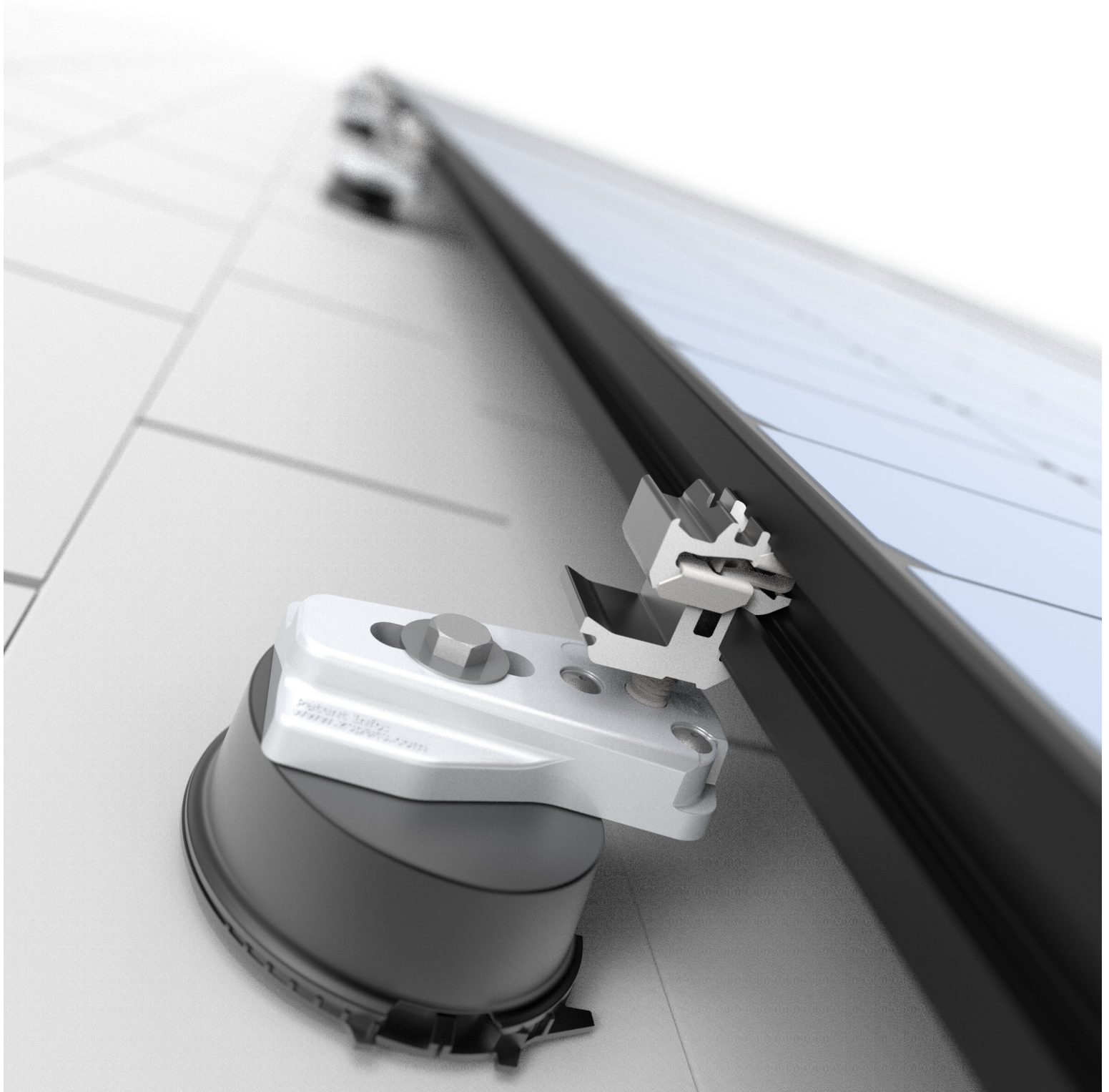


TESLA | ZS COMP

INSTALLATION MANUAL

FLASHING INSERT APPLICATIONS FOR COMPOSITION SHINGLE ROOFS



DISCLAIMER OF LIABILITY

Tesla Incorporated (“Tesla”) and its subsidiaries are not liable for any damages caused by failure to follow the instructions and guidelines found in this manual, or from inappropriate use or maintenance of PV modules. This includes, without limitation, any damages, losses, and expenses caused by non-observance of the instructions of this manual, as well as damages, losses, and expenses caused by, or in connection with, products of other manufacturers.

NOTICES

This manual contains safety, installation, configuration and troubleshooting instructions for Tesla Zep Compatible™ Systems (ZS) products. Tesla recommends that you save this manual in a readily accessible location, should any questions arise.

Tesla ZS Comp is UL 2703 Listed for Bonding.

Tesla ZS Comp has a IEC/UL 61730 Class “A” Fire Rating when installed on steep slope roofs using modules from any manufacturer certified as “Type 1” or “Type 2.”

Tesla ZS Comp is to be mounted over a fire resistant roof covering rated for the application.

This system should be periodically re-inspected by qualified service technicians. In the event any components or fasteners are found to be loose, they should be re-tightened to manufacturer’s specifications. Any components showing signs of corrosion that compromise safety or function shall be replaced immediately.

Tesla ZS Comp may only be used to ground and mount Zep Compatible™ PV modules.

All Tesla Zep Compatible™ modules comply with IEC/UL 61730 and have been evaluated for grounding and mounting in compliance with the included instructions. Zep Compatible™ modules are identified by the Zep Solar logo on their label.

Tesla Zep Compatible™ components are only suitable for PV modules with a series fuse rating of 20 Amps or less.

CONTACT INFORMATION

ENERGY TECHNICAL PUBLICATIONS

EnergyTechPubs@tesla.com

TESLA, INC

3500 Deer Creek Road

Palo Alto, CA 94304 U.S.A.

TABLE OF CONTENTS

Important Safety Information	6
Introduction to ZS Comp	7
Tesla ZS Mounting Solutions	
Rockit: Key and Tongue	
Module Drop-In	
Core Components	9
ZS Comp Components	
Grounding and Bonding Components	
Array Skirt Components	
Wire Management Components	
Array-Building Overview	13
Required Tools	
Installation Overview	
Standard Standoff Layout	
Staggered Standoff Layout	
STEP 1: Array Layout	15
1. Layout the Array	
2. Drill Pilot Holes for Comp Mount	
STEP 2: Install Comp Mount	16
1. Assemble Comp Mount	
2. Position and Seal Comp Mount on roof	
3. Fasten Comp Mount to roof	
4. Inject Moisture Curable Sealant into Comp Mount	

STEP 3: Install Leveling Feet 19

1. Install Outer Leveling Feet
2. Anchor a String Line to Outer Leveling Feet
3. Align Inner Leveling Feet using String Line

STEP 4: Install Array Skirt 22

1. Rock in Array Skirt
2. Install Interlock
3. Install Support Grips
4. Install End Caps

STEP 5: Install PV Modules (SKIMBL) 25

1. Set Module
2. Kickstand
3. Interlock
4. Manage Wires
5. Bolt Leveling Foot
6. Level
7. Repeat SKIMBL

STEP 5: Install Side Skirts 29

1. Install Double Key Zeps
2. Install Side Skirts

STEP 6: Install Corner Caps 30

1. Push the Outside Corner Cap onto the Skirt corner
2. Fold tab
3. Press tab using Offset Tool
4. Fasten if needed

APPENDIX

Appendix: Allowable Mounting System Loading	33
Appendix: Wire Management Recommendations	34
Appendix: Grounding and Bonding	35
1. Interlock	
2. Rockit	
3. Ground Zep	
Appendix: Thermal Expansion	40
Appendix: Module Servicing	44

IMPORTANT SAFETY INSTRUCTIONS

WARNING: Read and understand all instructions before you install, wire, operate, or maintain a PV system.

Failure to read and comply with any of the limitations noted herein can result in property damage, serious bodily injury, or death. The installer assumes the risk of all injury that might occur during installation, including, without limitation, the risk of electric shock.

- Always use qualified personnel for installation.
- Always follow PV module manufacturer safety precautions, installation instructions, and operating guidelines..
- Always abide by local, regional, and national statutory regulations when installing the system, and obtain a building permit if necessary.
- Always use equipment, connectors, and wiring suitable for solar electric systems.
- Always use fall protection when working from heights of 6 feet (183 cm) or above. Follow Occupational Safety and Health Act (OSHA) or local governing safety regulations regarding Fall Protection.
- Always use insulated tools that are approved for working on electrical installations.
- Always wear suitable personal protection equipment (PPE) to prevent the risk of personal injury, such as fall hazards or electrical hazards.
- Always exercise caution when transporting and installing PV modules.
- Always wear non-slip gloves when carrying PV modules.
- DO NOT wear metallic rings, watchbands, earrings, nose rings, lip rings, or other metallic objects while installing or troubleshooting PV systems.
- DO NOT contact or touch electrically charged, accessible live parts of PV modules, such as terminals.
- DO NOT touch the PV module unnecessarily during installation.
- DO NOT attempt to make an electrical connection with wet, soiled, or otherwise faulty connectors.
- DO NOT use a PV Module with broken glass or torn backsheet.
- DO NOT open electrical connections or unplug connectors while the circuit is under load.
- DO NOT allow children or unauthorized persons near the installation.

INTRODUCTION TO ZS COMP

The Tesla Zep Systems (ZS) Comp for composition shingle roofs is an integrated solution for installing PV arrays on composition shingle roofs.

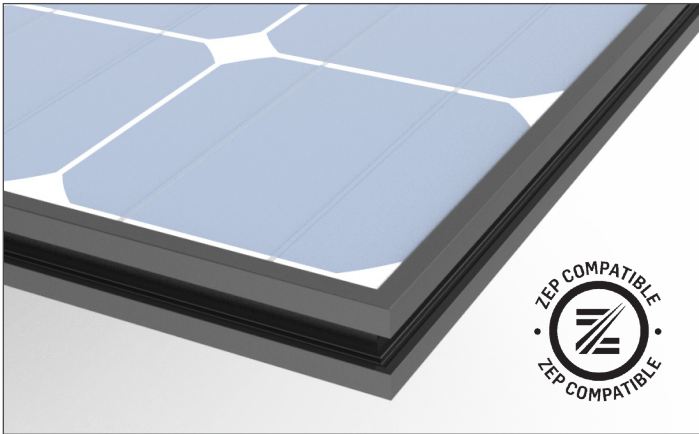
The Tesla ZS Comp mounting system offers the following benefits: rapid installation, reduced roof penetrations, reduced parts count, low system weight, elimination of lengthy and cumbersome mounting rails and clip hardware, precision alignment, enhanced aesthetics, resistance to theft, redundant auto-bonding hardware, and portrait and landscape options.



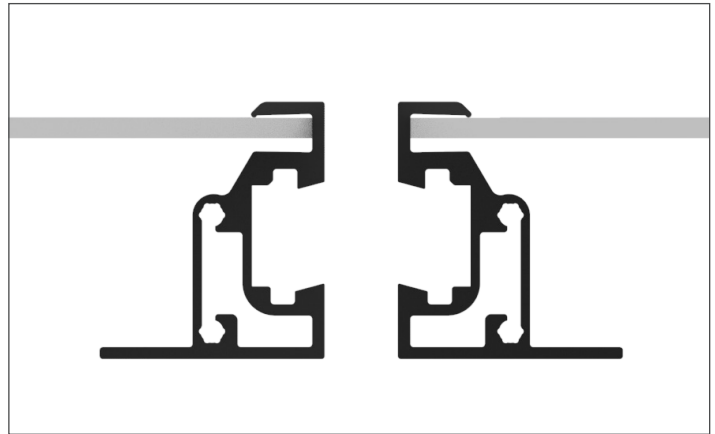
TESLA ZS MOUNTING SOLUTIONS

Tesla ZS mounting solutions are based on the Zep Groove, a patented module frame profile designed to mate easily and precisely with Tesla ZS components, creating a simultaneous structural and electrical bond with simple drop-in and precision quarter-turn connections. Zep Compatible™ PV modules are certified by Tesla to work exclusively with ZS mounting hardware.

Zep Compatible PV Module

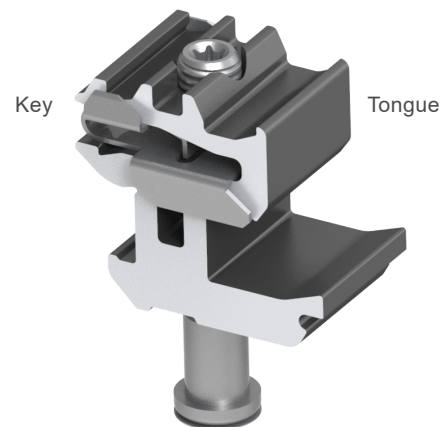


Zep Groove



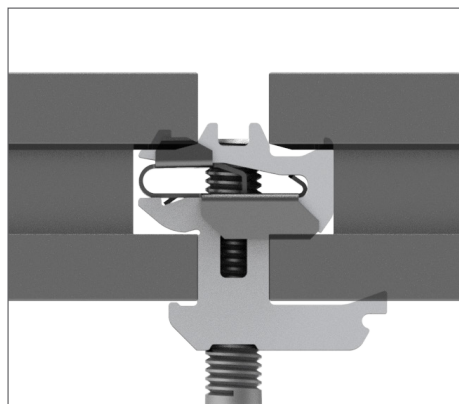
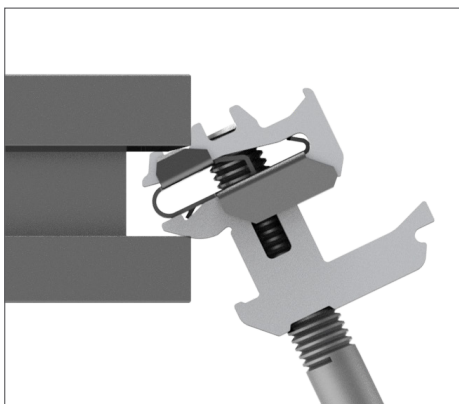
ROCKIT: KEY AND TONGUE

The Rockit is a feature common to many Zep Compatible™ hardware designs. The Key and Tongue refers to the “front” and “back” side of the Rockit. The Key side inserts into the Zep Groove, similar to inserting a key into a lock. On the other side, the Zep Groove allows PV modules to “drop in” easily onto the Tongue of the Rockit.

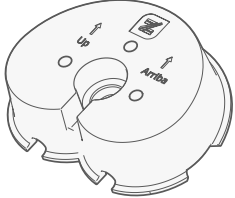
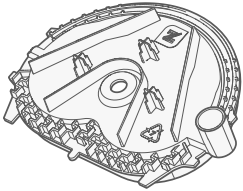


MODULE DROP-IN

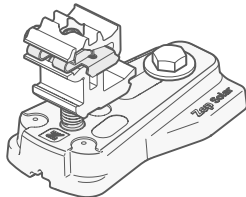
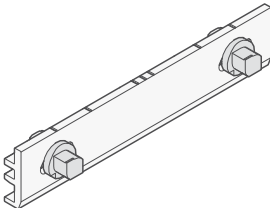
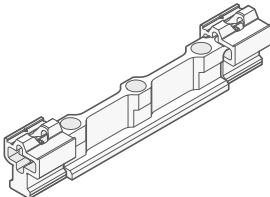
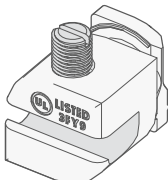
Tesla Zep Compatible™ modules are typically dropped in with a downward rotation, as shown. The module's downward rotation creates forced interference with the Zep Groove of the module frame, cutting through the anodized frame to create an electrical bond.



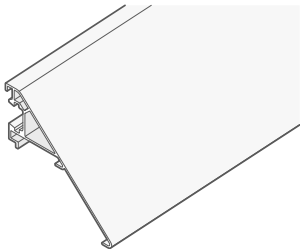
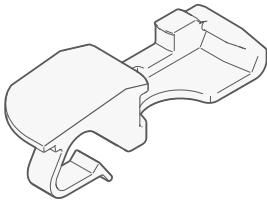
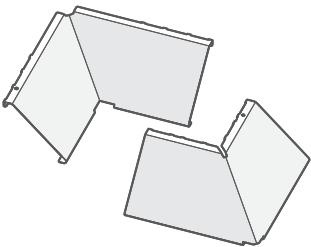
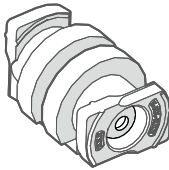
CORE COMPONENTS

PART	DESCRIPTION	PART #
COMP MOUNT COMPONENTS		
Mounting Block 	Provides a roof mounting attachment point for the array. Listed to UL 2703 and UL 2582	Part #850-1633
Flashing Insert 	Provides waterproofing for Mounting Block. Listed to UL 2703 and UL 2582	Part #850-1628* *Where required, use Flashing Accessory 850-1634, Listed to UL 2703 and UL 2582.
Captured Washer Lag 	Positively attaches Mounting Block to roof surface.	Part #850-1631-002 (4.75") Part #850-1631-004 (5.5")** **5.5-inch lag must be used for roofs with skip sheathing

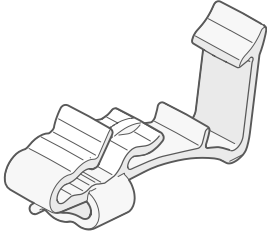
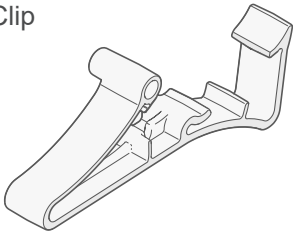
CORE COMPONENTS

PART	DESCRIPTION	PART #
GROUNDING AND BONDING COMPONENTS		
Leveling Foot 	Secures PV Modules to the Comp Mount and enables fine-tuned leveling. Listed to UL 2703	Part #850-1397
Interlock 	Provides structural and electrical bonding between PV modules within each sub-array. Listed to UL 2703	Part #850-1388 or Part #850-1613
Hybrid Interlock 	Provides structural and electrical bonding. Listed to UL 2703	Part #850-1281
Ground Zep 	Provides a single point for grounding a PV array. Listed to UL 467 and UL 2703	Part #850-1511

CORE COMPONENTS

PART		DESCRIPTION	PART #
ARRAY SKIRT COMPONENTS			
Array Skirt		The Array Skirt serves as an aesthetic feature for the front of the PV array. Listed to UL 2703	Part #850-1608
Grip		The Grip provides structural support to the Array Skirt. Listed to UL 2703	Part #850-1606
Corner Cap		The Corner Cap conceals hardware for an aesthetic appearance on the corners of the array.	(Outside) Part #850-1642 (Inside) Part #850-1641
Double Key Zep Assembly		The Double Key Zep assembly is used to install the array skirt to the side of the array. Listed to UL 2703	Part #850-1639

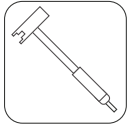
CORE COMPONENTS

PART		DESCRIPTION	PART #
WIRE MANAGEMENT COMPONENTS			
DC Wire Clip		Secures up to 3 conductors underneath a Tesla Zep Compatible™ PV array. Listed to UL 1565	Part #850-1509
Home Run Wire Clip		Secures up to 5 conductors underneath a Tesla Zep Compatible™ PV array. Listed to UL 1565	Part #850-1510

ARRAY-BUILDING OVERVIEW

REQUIRED TOOLS

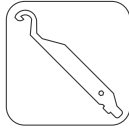
In addition to standard roofing tools (Drill and Impact Driver; Stringline and Chalkline; Measuring Tape) Tesla Zep Systems require a #30 Torx bit and two proprietary tools - the Zep Tool and Flat Tool.



Zep Tool



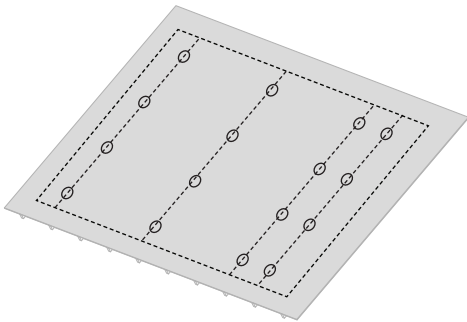
Torx bit



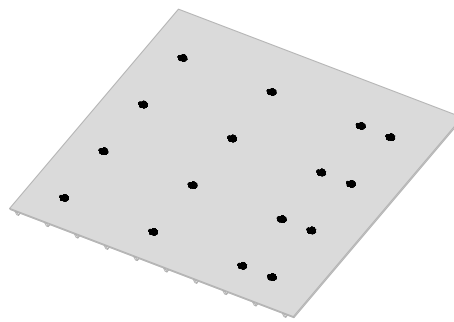
Flat tool

INSTALLATION OVERVIEW

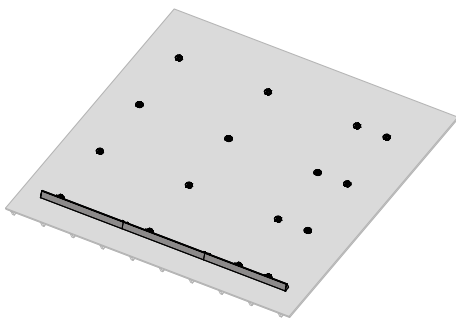
① Layout Array



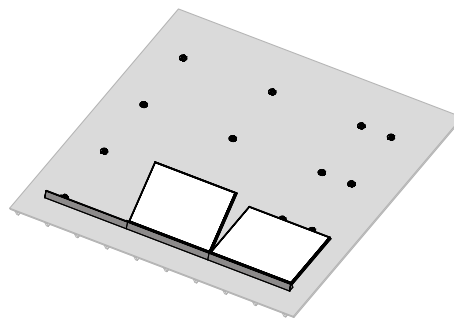
② Install Comp Mounts



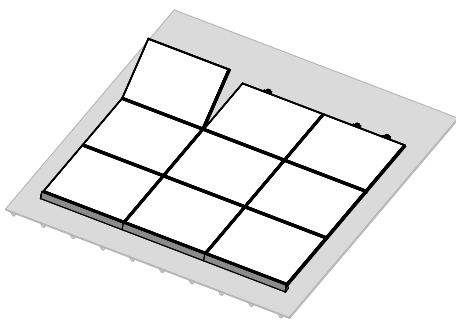
③ Install Array Skirt



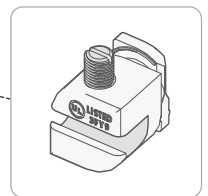
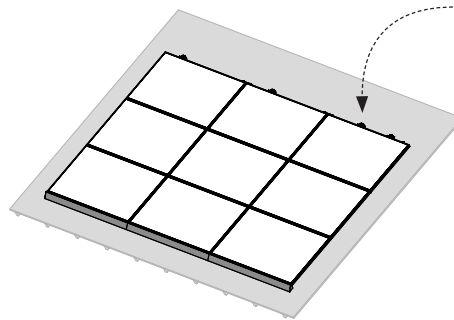
④ Install First Module Row - SKIMBL



⑤ Complete Module Rows



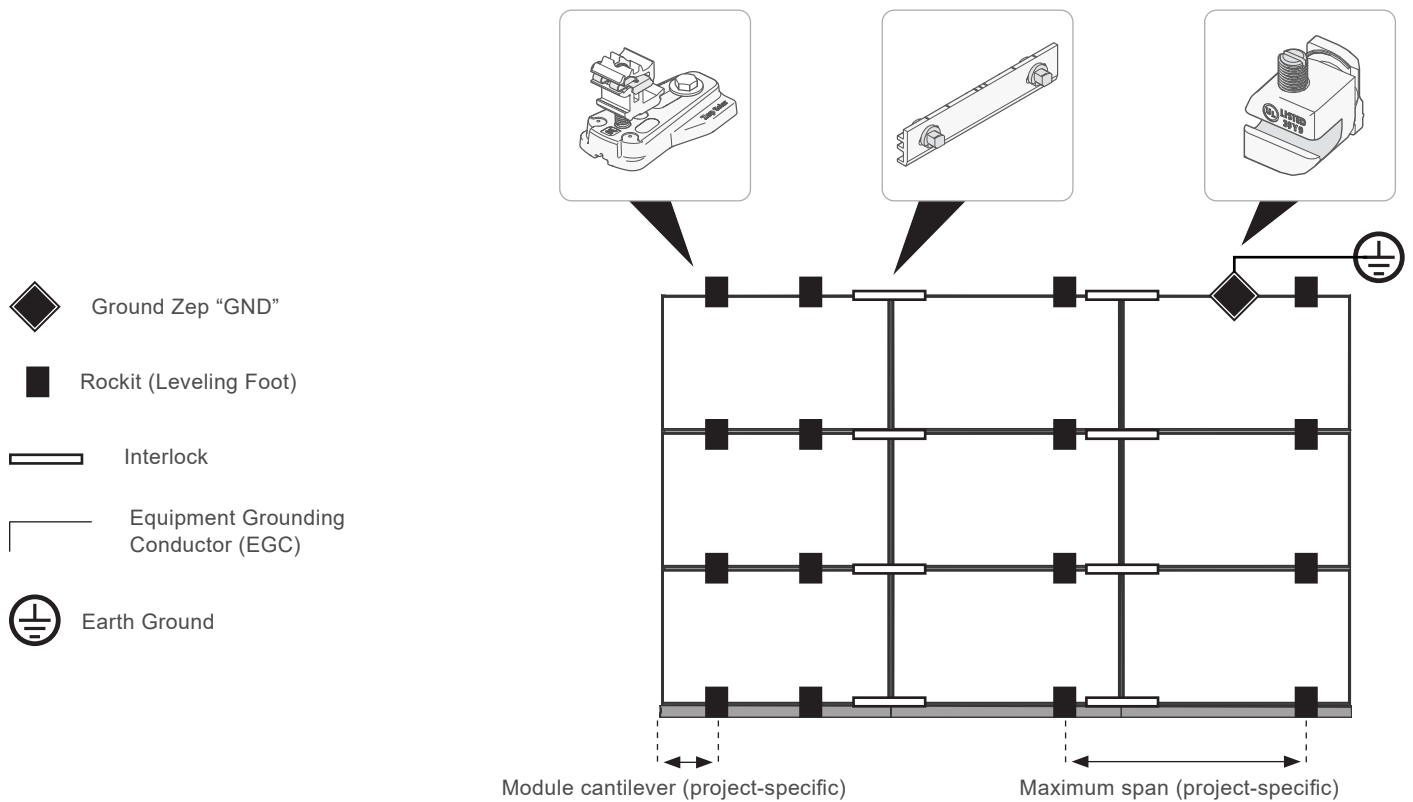
⑥ Ground Zep



STANDARD STANDOFF LAYOUT

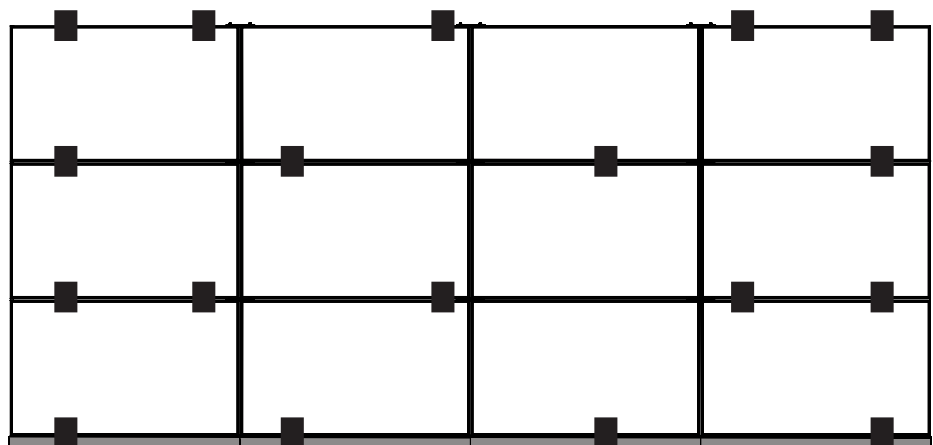
Maximum cantilever and span is shown on the project plan set.

Maximum cantilever is 1/3 of the maximum span and never exceeds 24 inches.



STAGGERED STANDOFF LAYOUT

Staggered standoff layouts may be necessary to avoid roof obstructions and fulfill required cantilevers.



STEP 1: ARRAY LAYOUT

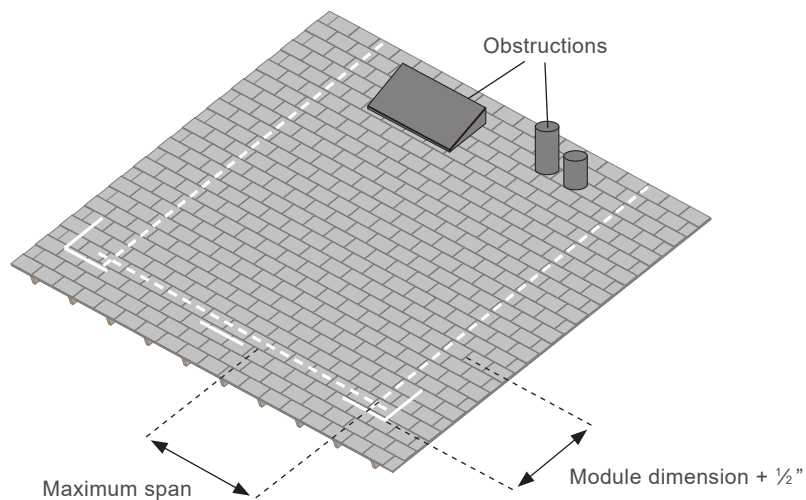
1. LAYOUT THE ARRAY

Check roof for obstructions and mark out the perimeter of the array.

Obstructions may include vents, vent pipes, skylights and chimneys. Be aware of roof hips and valleys.

Adjust front row marks for optimal placement.

Do not install on the first course of shingles.

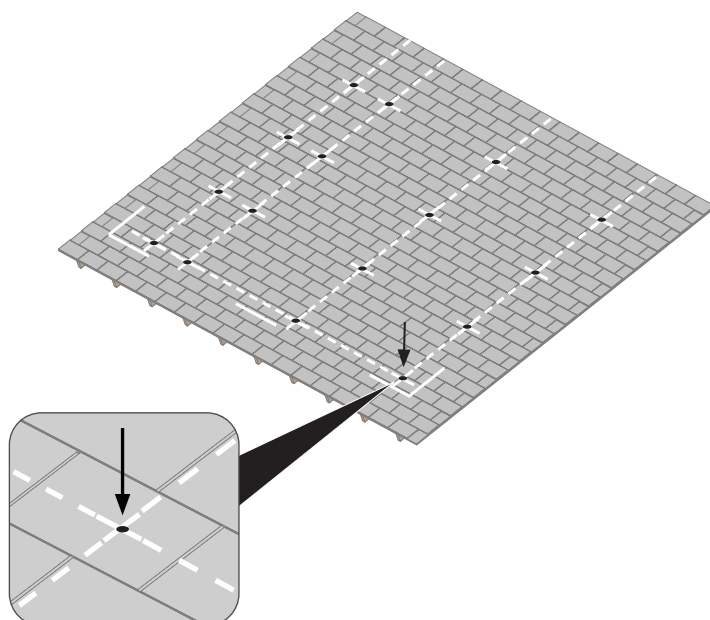


2. DRILL PILOT HOLES FOR COMP MOUNT

Use a 3/16" or 7/32" drill bit to drill pilot holes for Comp Mount based on array layout.

Do not drill pilot holes 1/2" above or below the shingle drip edge.

3 or more missed pilot holes REQUIRE card flashing.



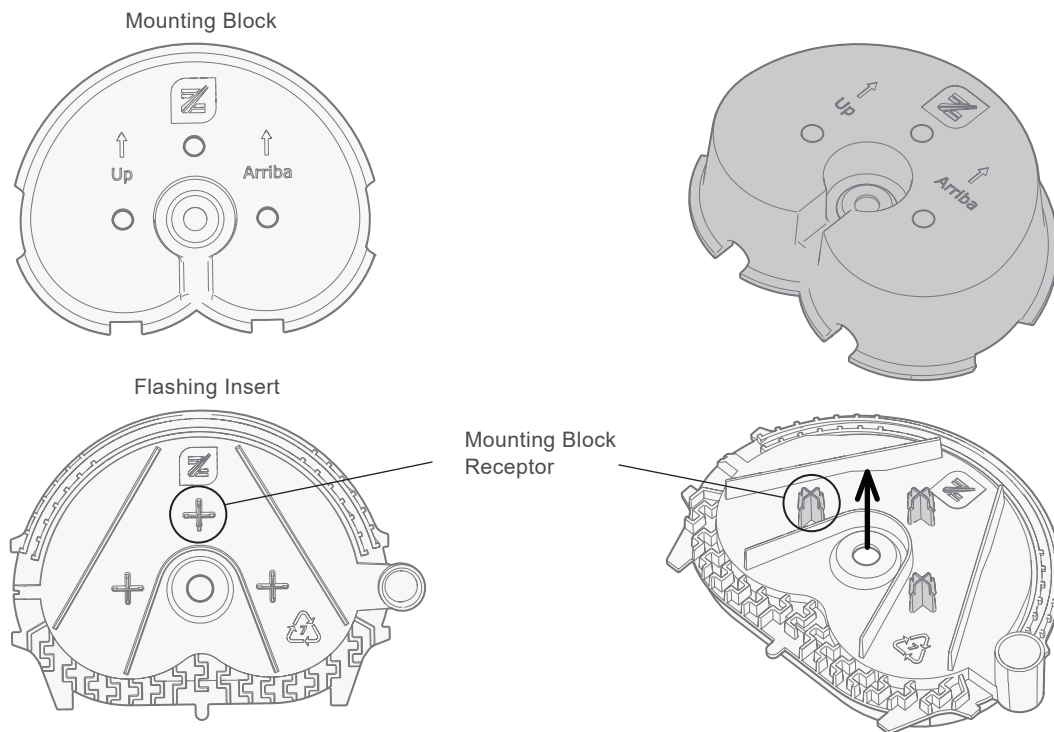
Composition Shingle Courses

1/2"	NO DRILL ZONE
1/2"	
	NO DRILL ZONE
	NO DRILL ZONE

STEP 2: INSTALL COMP MOUNT

1. ASSEMBLE COMP MOUNT

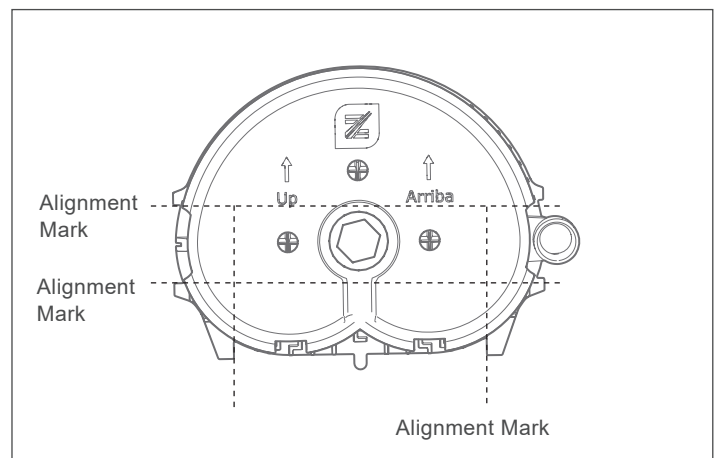
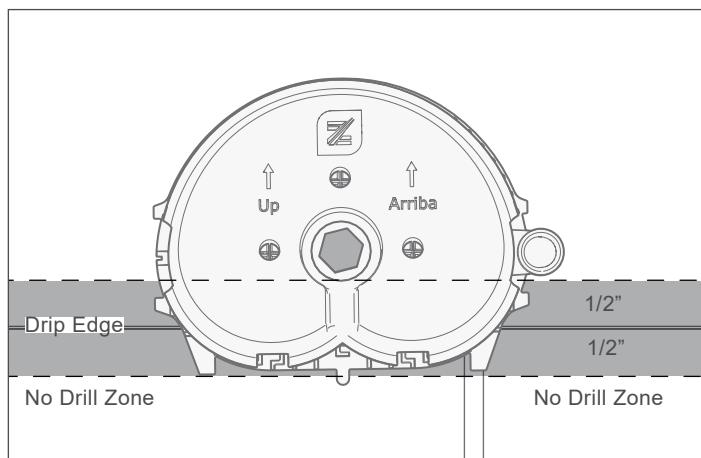
Install Flashing Insert onto Mounting Block. The shape of the Mounting Block corresponds exactly with the shape of the Flashing Insert. Apply pressure on all sides of the Flashing Insert to ensure complete installation.



2. POSITION COMP MOUNT ON ROOF

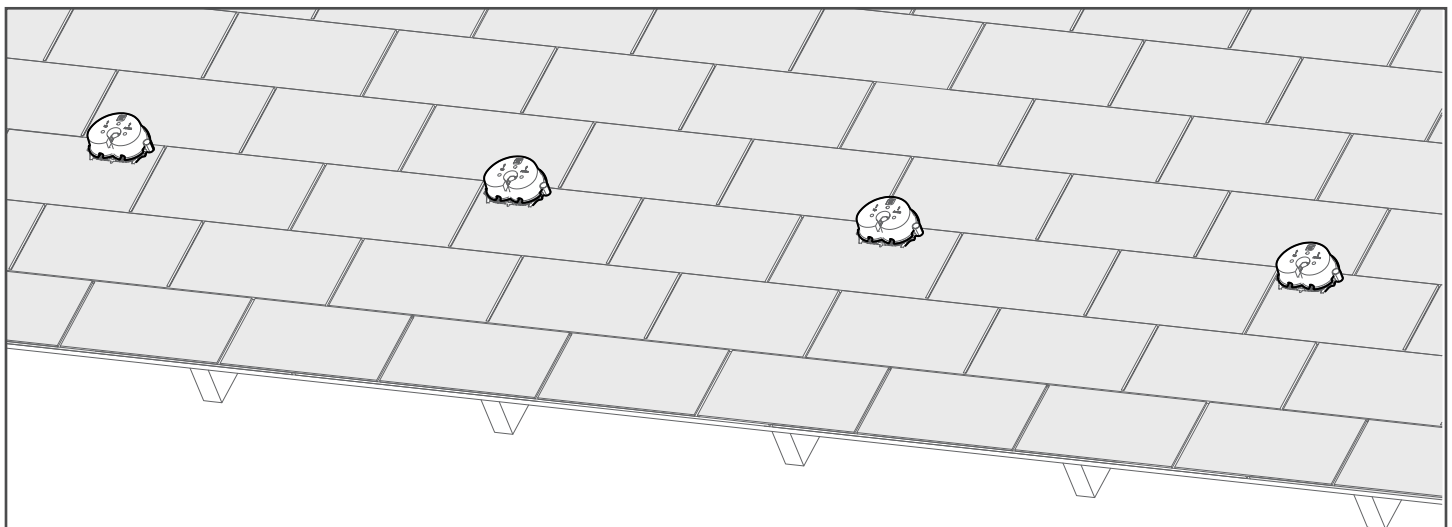
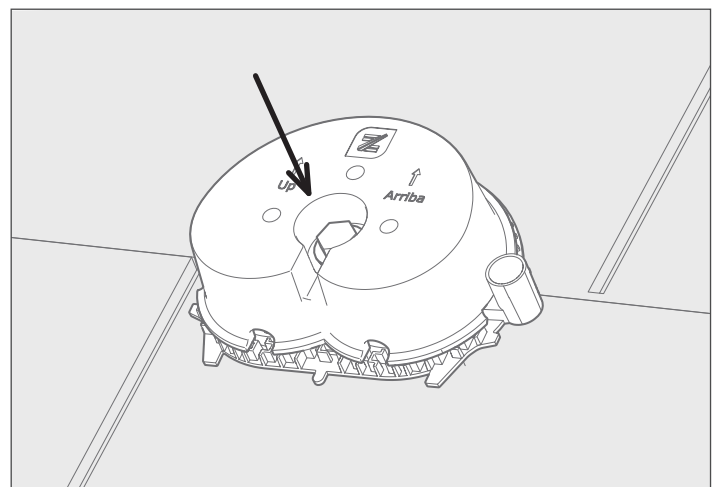
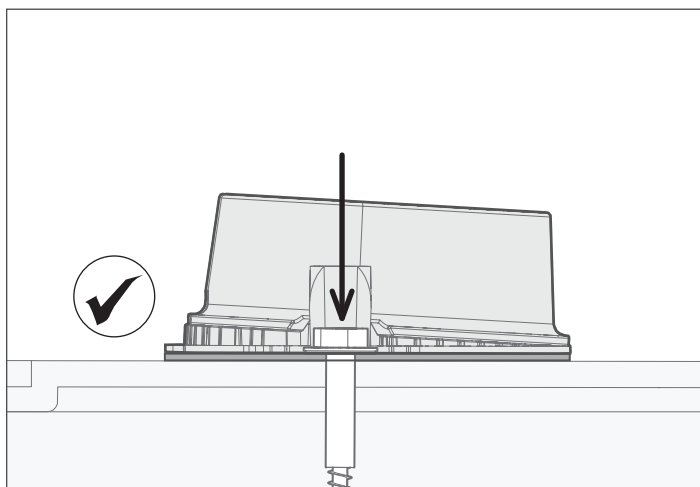
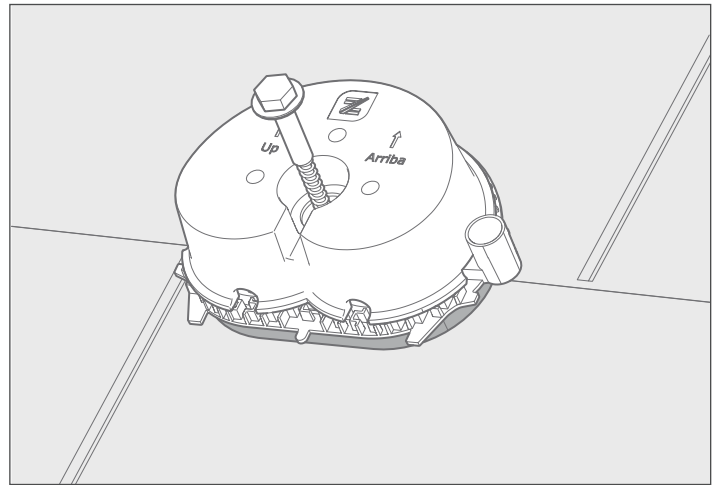
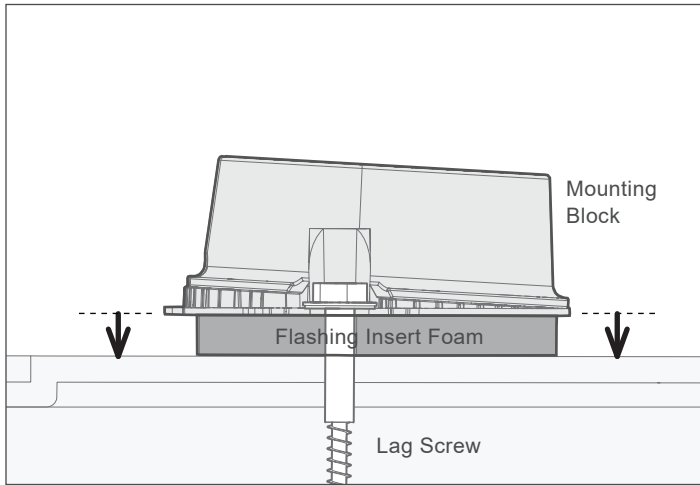
The Comp Mount can be installed anywhere along the drip edge, as long as the Captured Washer Lag placement is outside of the 1" No Drill Zone. If Comp Mount falls over drip edge, apply bead of sealant onto the bottom of the Flashing Insert Foam to ensure a complete seal. Penetrations located **COMPLETELY WITHIN** Alignment Marks have sealant coverage. Lags outside area of complete sealant coverage require card flashing.

1" No Drill Zone at Shingle Drip Edge



3. FASTEN COMP MOUNT TO ROOF

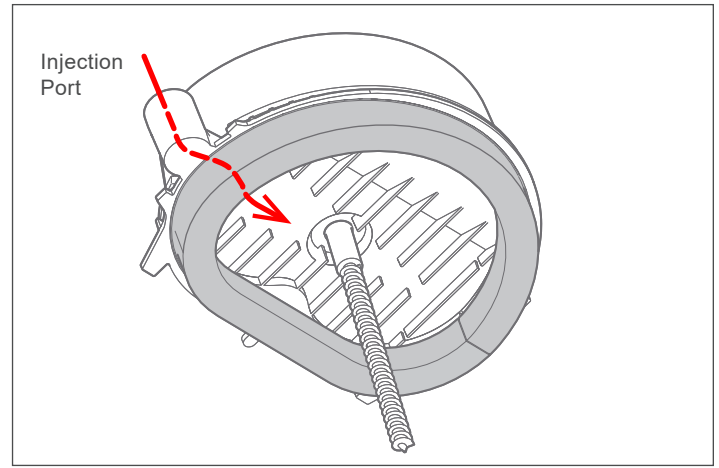
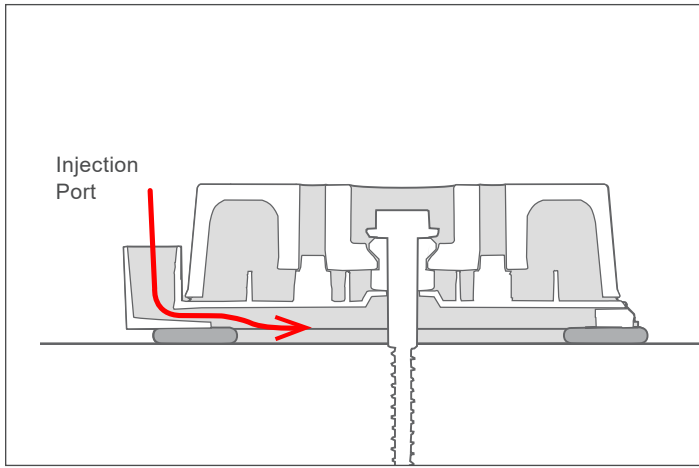
Insert the Captured Washer Lag into the Lag Slot in the Comp Mount. Point the Comp Mount uproof as indicated by markers. Lags without sufficient purchase, i.e. “spinners” REQUIRE removal, card flashing, and re-installation. Fasten the Comp Mount, compressing the foam all the way to ensure a complete seal. Flashing Insert Foam is used during installation to contain sealant and is NOT the principal barrier to water ingress.



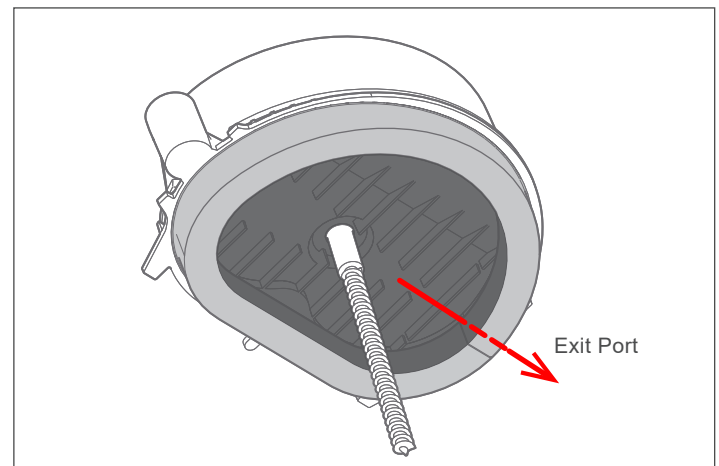
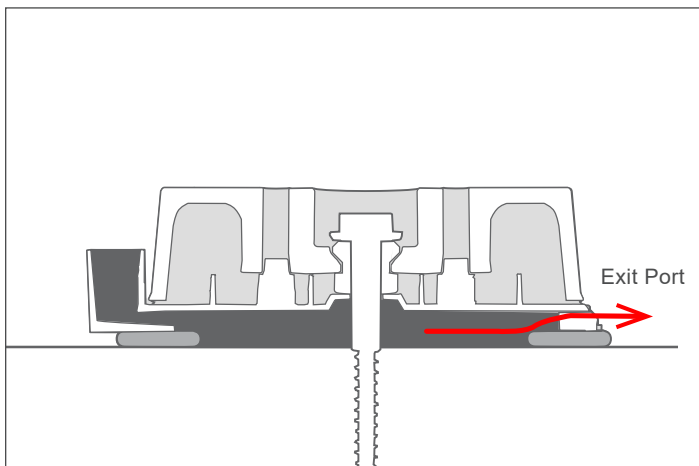
4. INJECT MOISTURE CURABLE SEALANT INTO COMP MOUNT

Inject moisture curable sealant through the Flashing Insert Injection Port. Once the sealant completely fills the Flashing Insert, it will exit out of the Exit Port. If more than 7 full pumps are required, remove Comp Mount and seal manually. Sealant should be filled above edge of Injector Port to prevent pooling.

Inject sealant through the Injection Port.



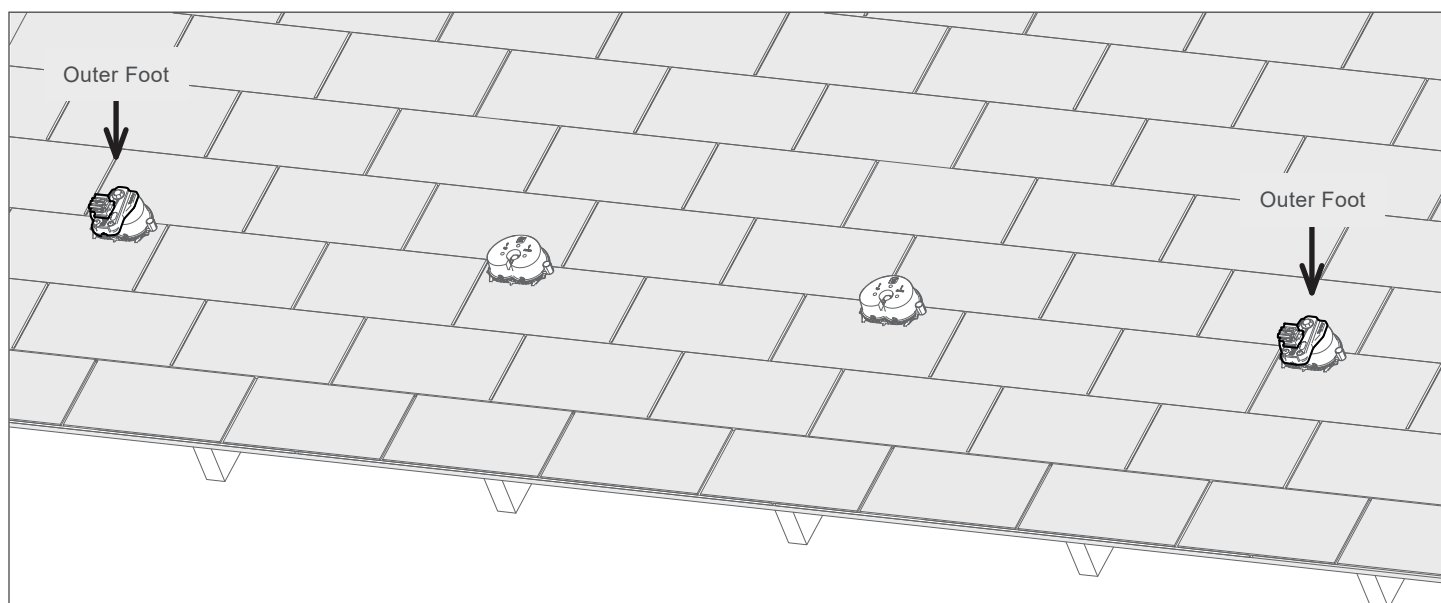
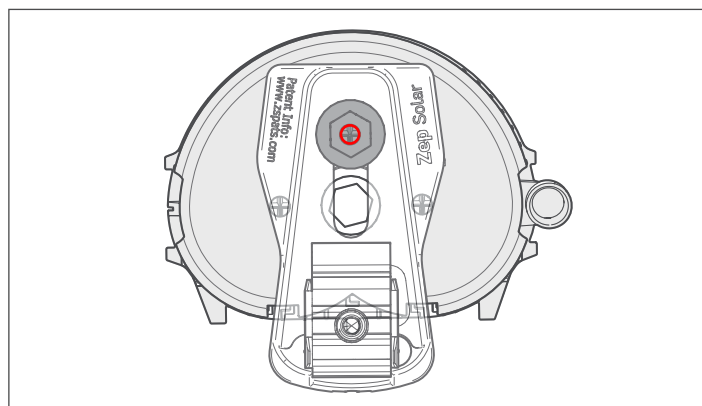
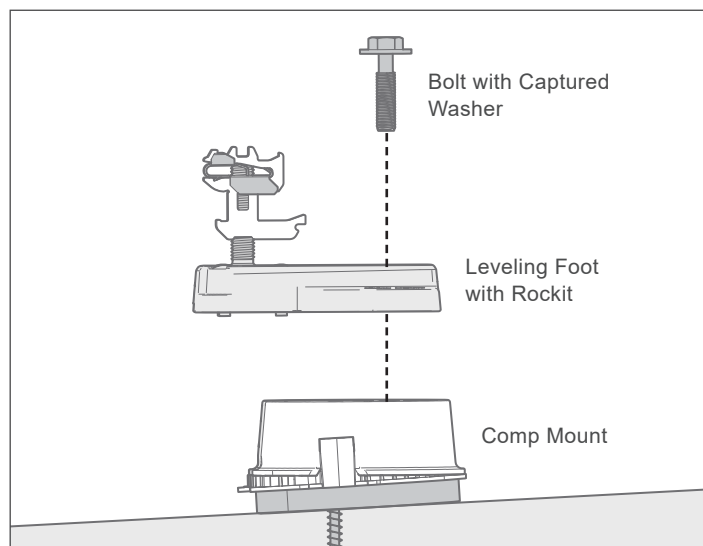
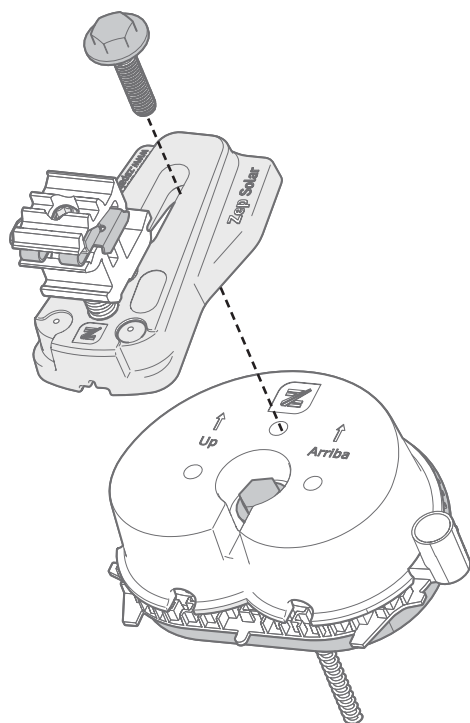
Sealant will exit out of the Exit Port.



STEP 3: INSTALL LEVELING FEET

1. INSTALL OUTER LEVELING FEET

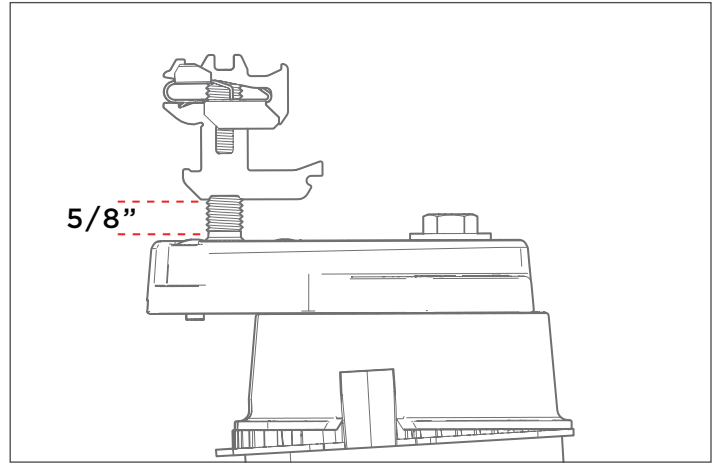
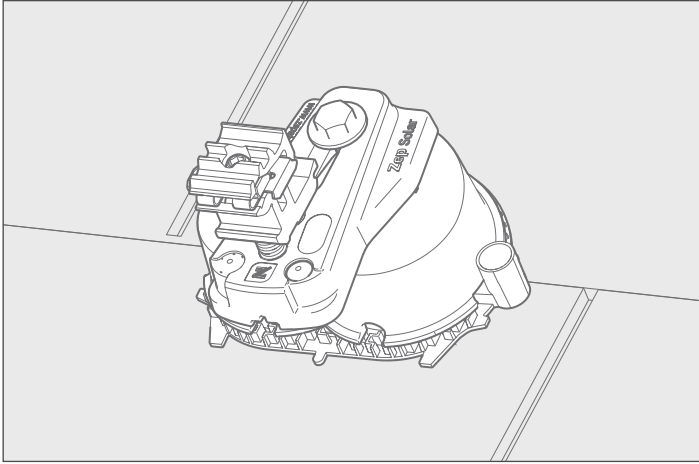
Secure Leveling Feet to the outer first row of Comp Mounts using the Bolt with Captured Washer. **Torque: 13ft-lbs.** Center the Leveling Feet on the middle hole of the Comp Mount to provide maximum flexibility for consecutive rows.



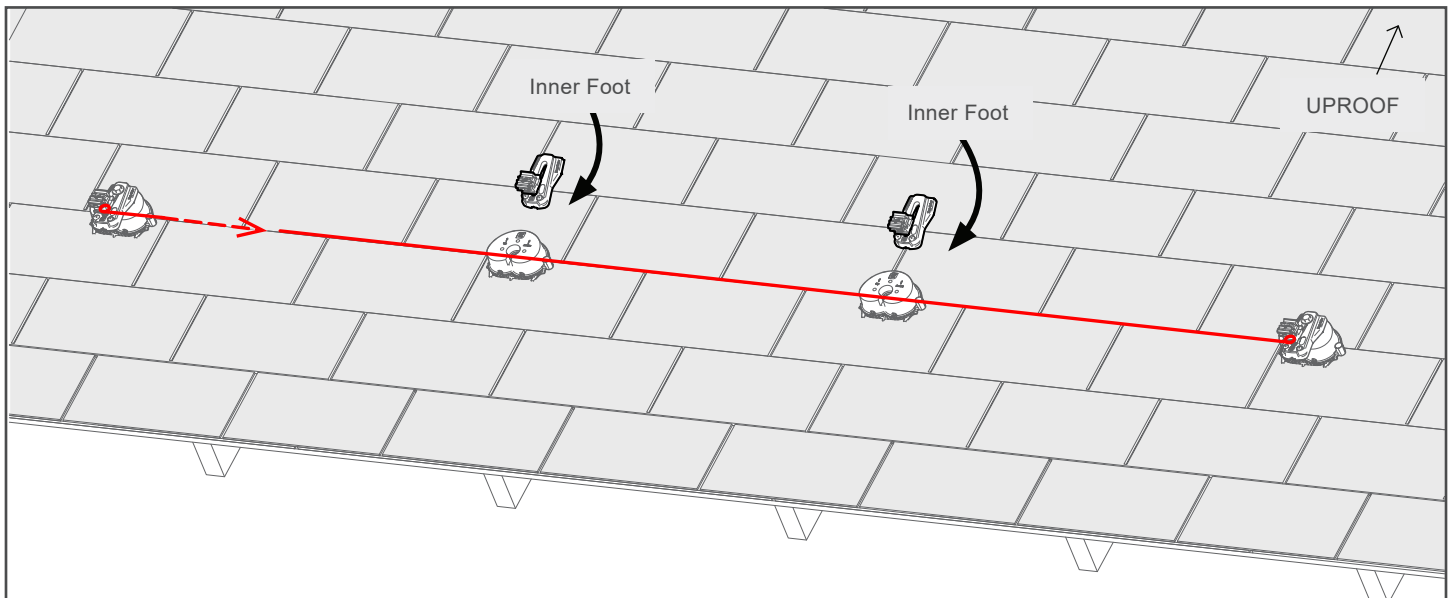
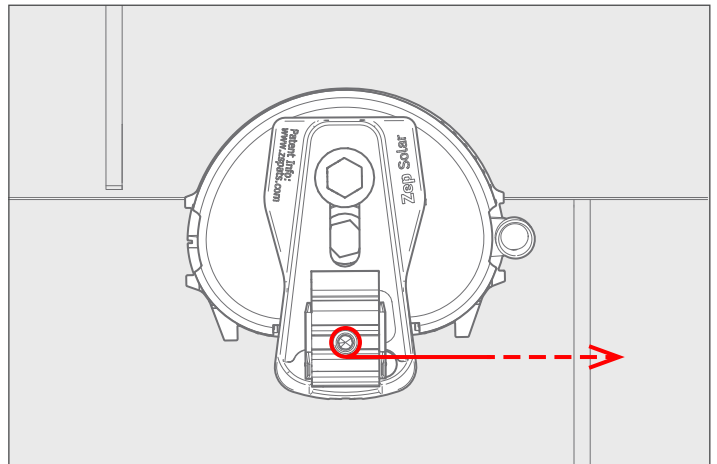
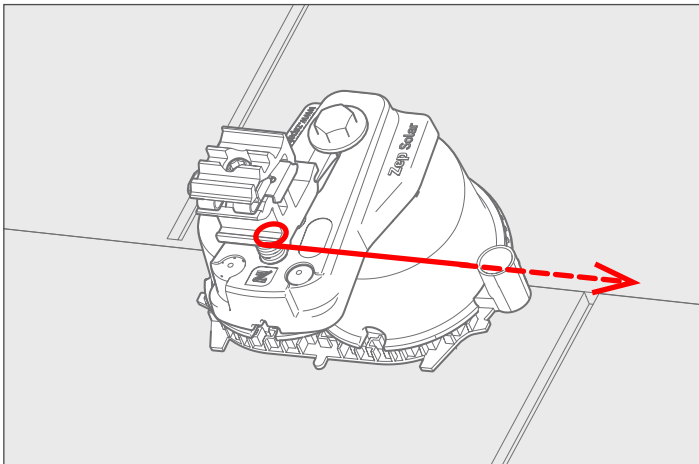
2. ANCHOR A STRING LINE TO OUTER LEVELING FEET

Center the Rockit on its stud (approximately 5/8 inch from base of Rockit) to provide maximum flexibility on consecutive rows. Run a String Line from the base of the Rockits on the outer Leveling Feet. String Line should be pulled across the **front** of the stud. String Line should be 1/16 inch away from the Rockit stud.

Center the Rockit on its stud.

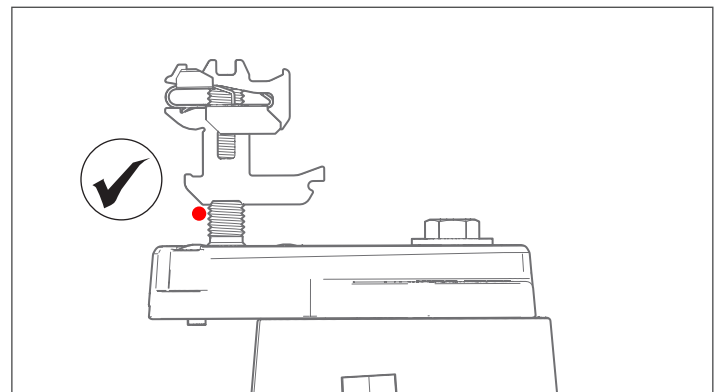
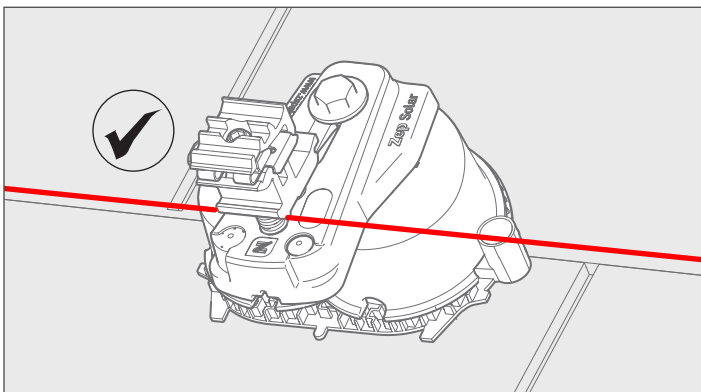
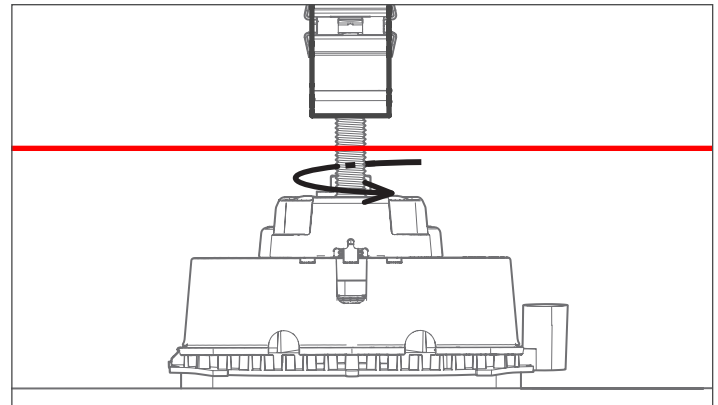
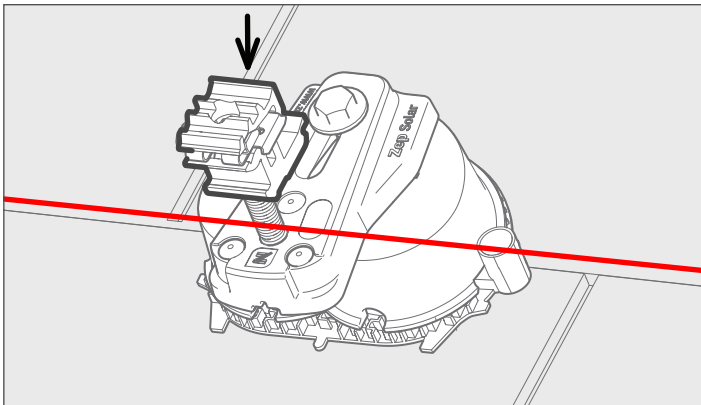
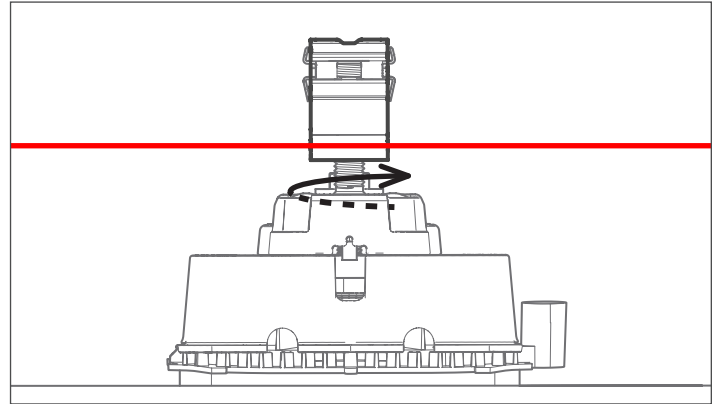
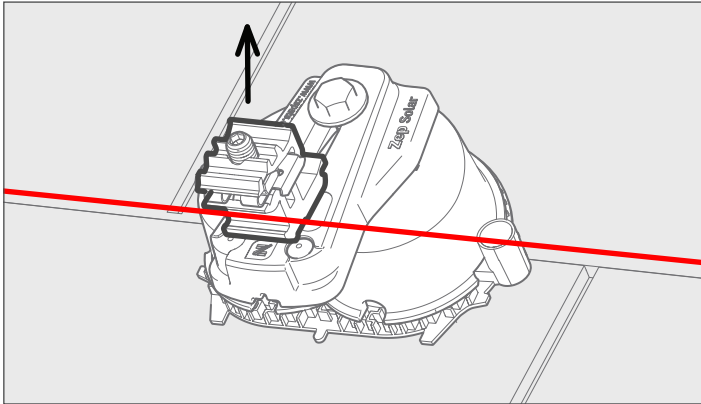
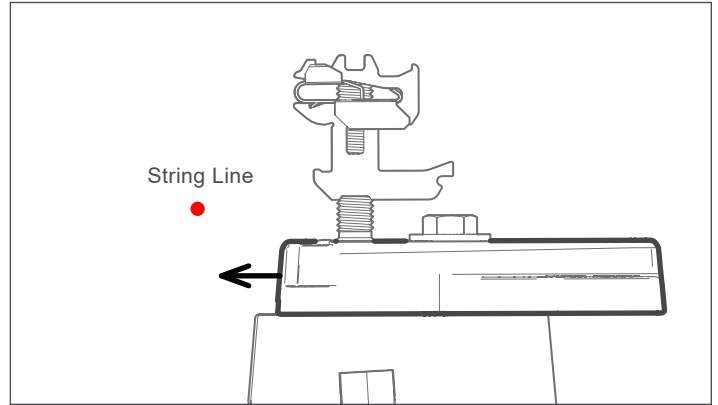
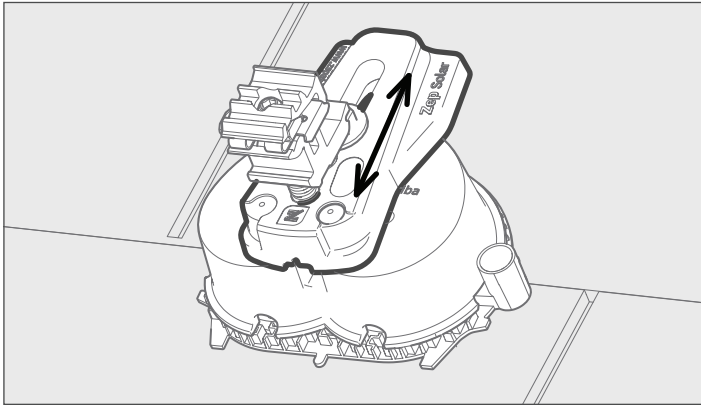


Run a String Line across the front of the stud.



3. ALIGN INNER LEVELING FEET USING STRING LINE

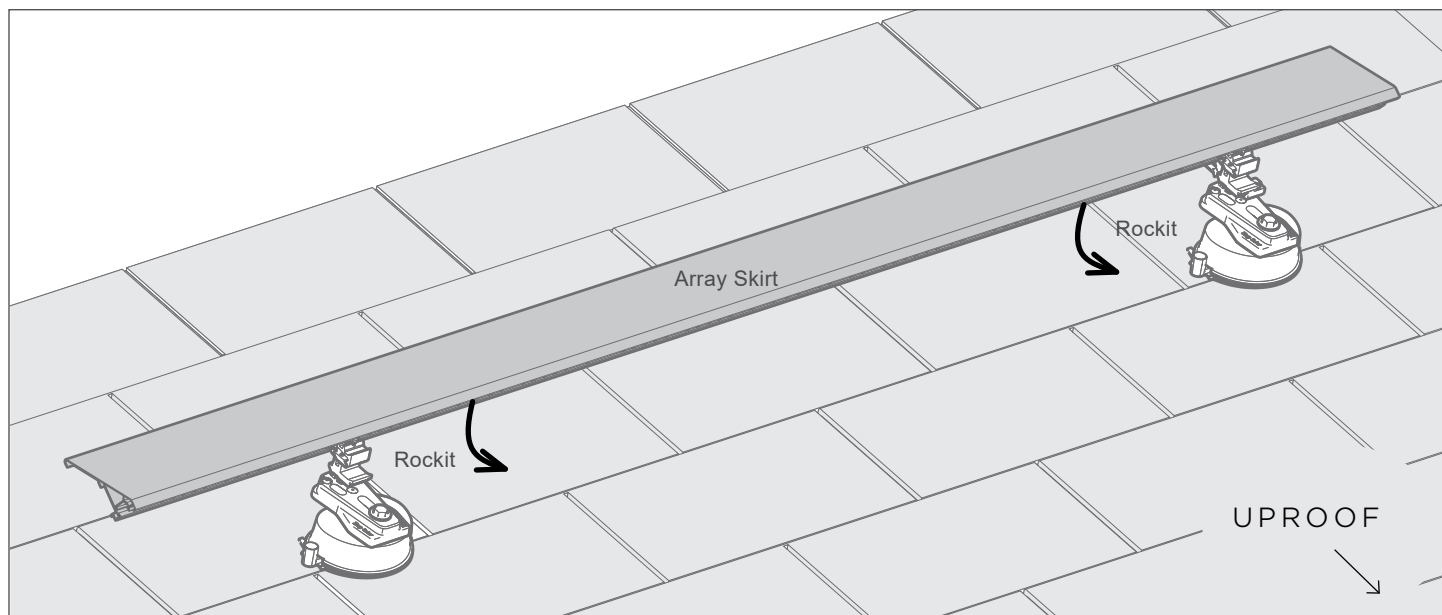
Adjust the Leveling Feet so that the Rockit stud is as close to the String Line as possible without touching it. Rotate and level all first row Rockits to just above the String Line. All Rockits should be parallel with the framing in which they are attached.



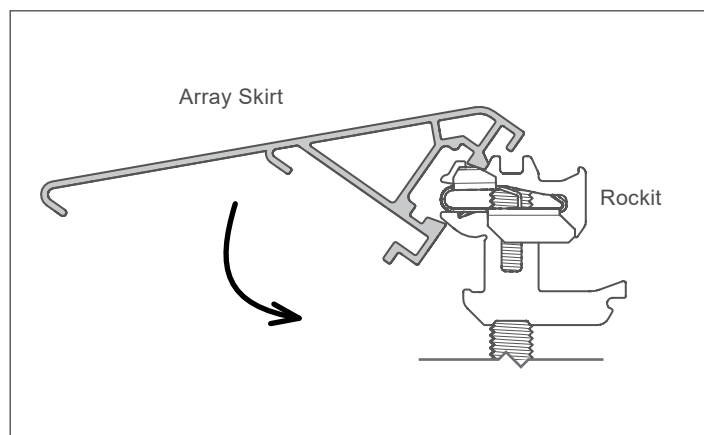
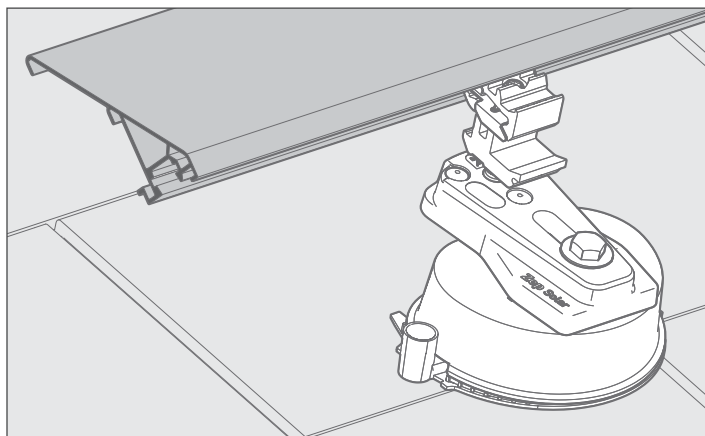
STEP 4: INSTALL ARRAY SKIRT

1. ROCK IN ARRAY SKIRT

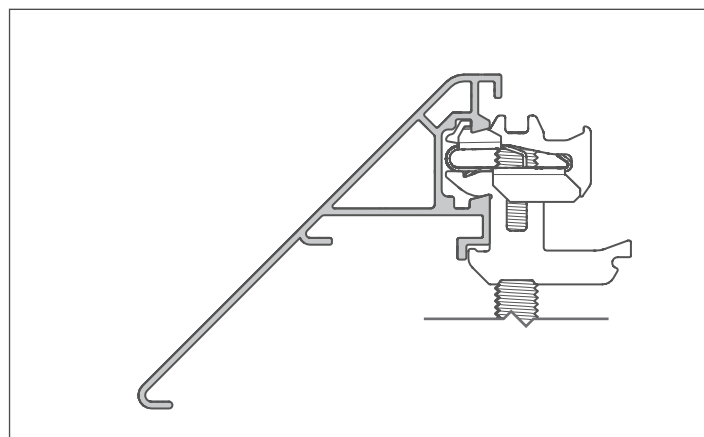
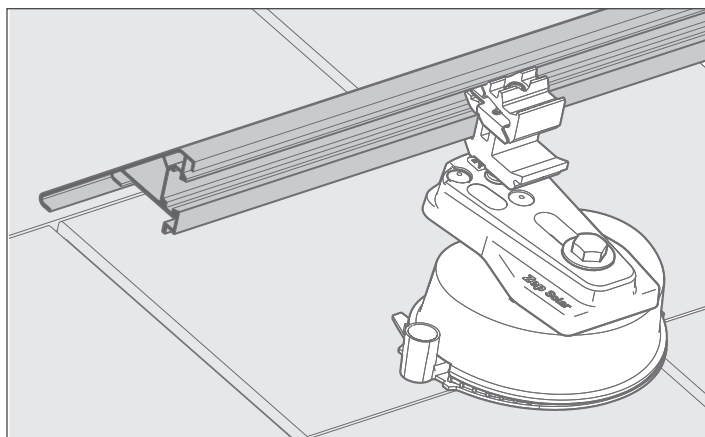
The first Array Skirt should be installed at the front of the system, starting with the Rockits that are closest together. Set the Array Skirt on the Rockit and rock down, making sure to fully engage with the Key side of the Rockit. The Array Skirt should press flush against the Rockit. Rock in the second Array Skirt, aligning it to be flush against the first Array Skirt.



Set the Array Skirt on the Rockit and rock down



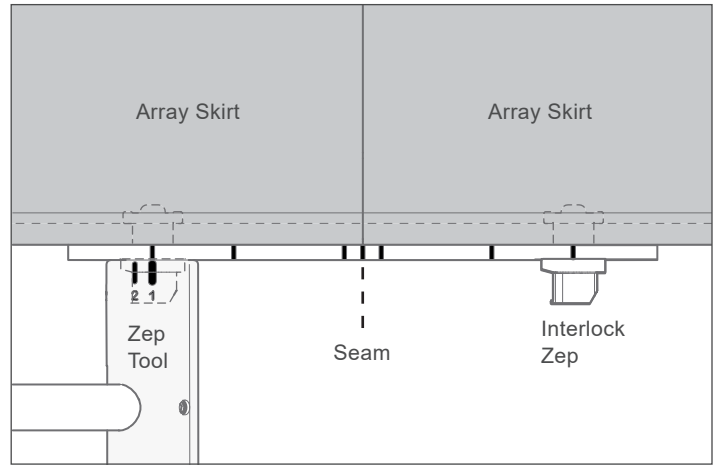
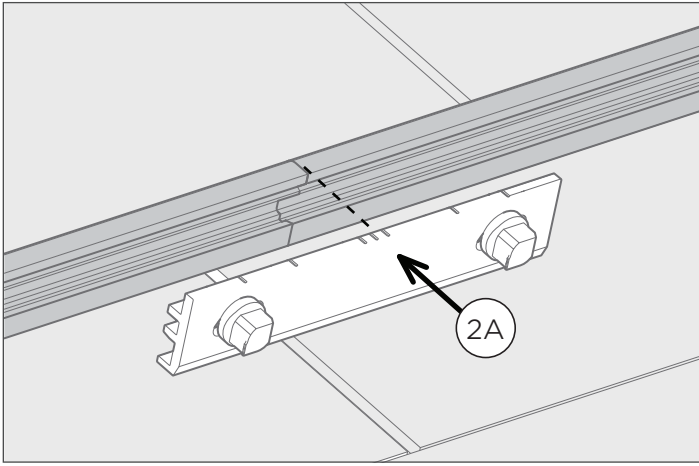
Fully engage with the Key side of the Rockit



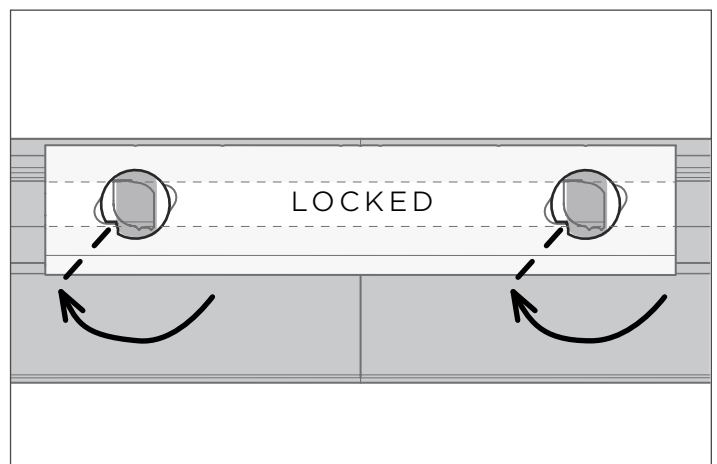
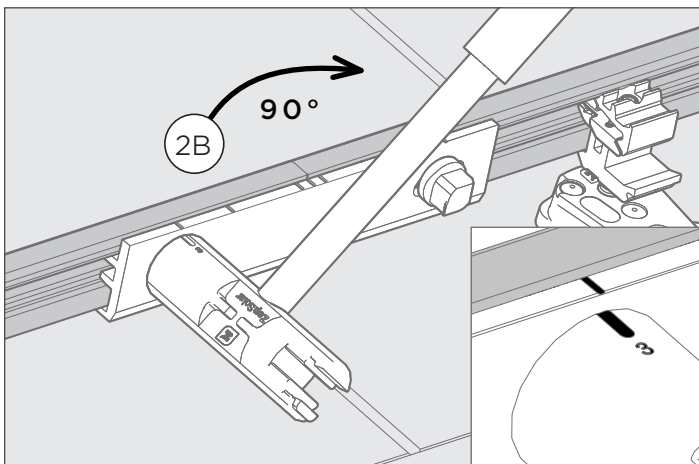
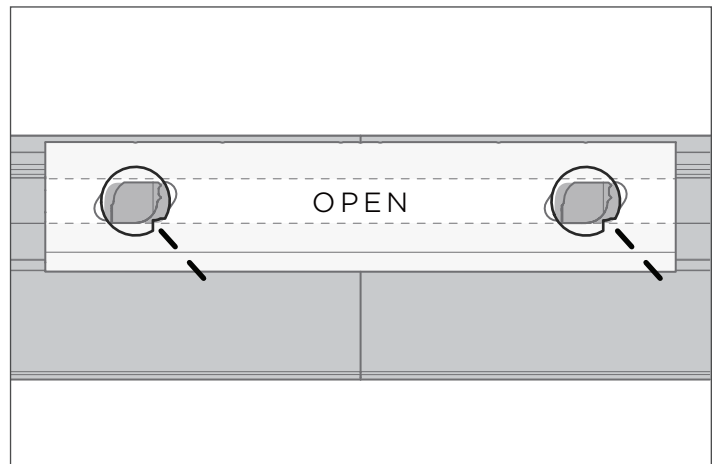
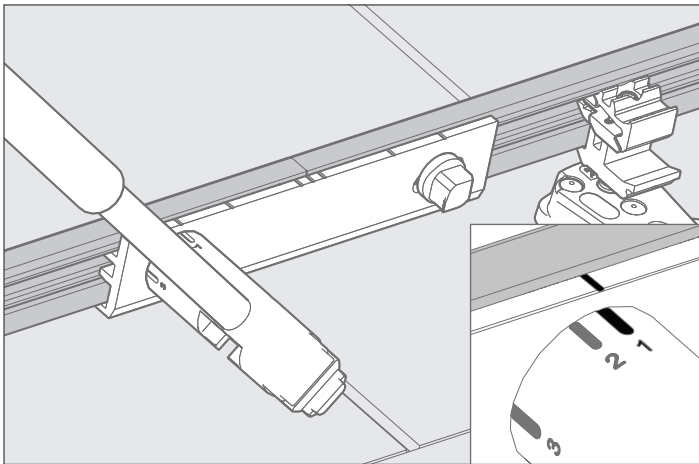
2. INSTALL INTERLOCK

Place and center an Interlock over the seam of the two Array Skirts, using timing marks as shown (2A). Use the Zep Tool to rotate Interlock Zeps from Position 1 to Position 3 (2B). The outside edge of the Array Skirt should line up with the array perimeter. Complete the Skirt by installing additional Array Skirts with Interlocks.

Center the Interlock at the Array Skirt seam, using timing marks.



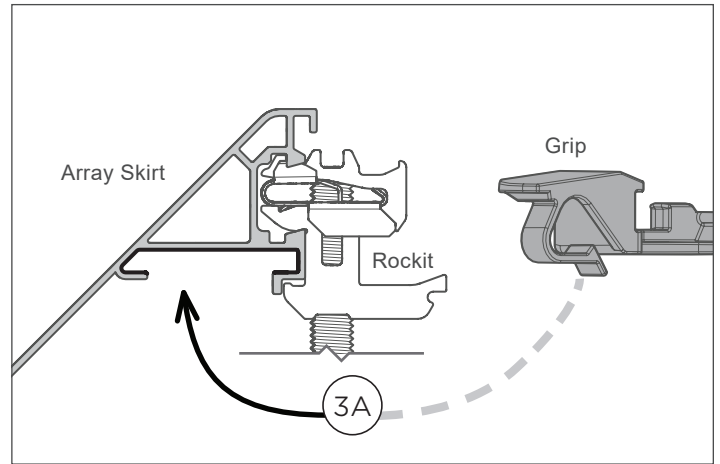
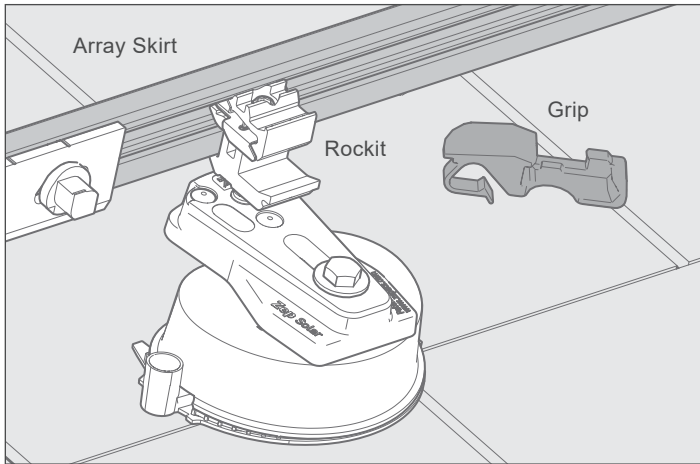
Rotate Interlock Zeps from Position 1 to Position 3.



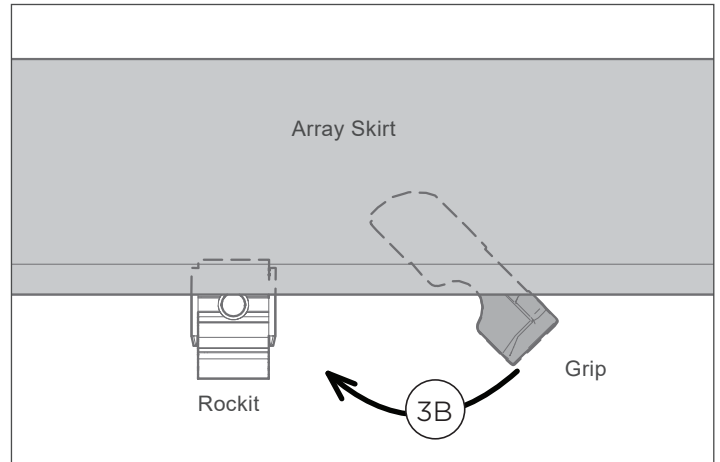
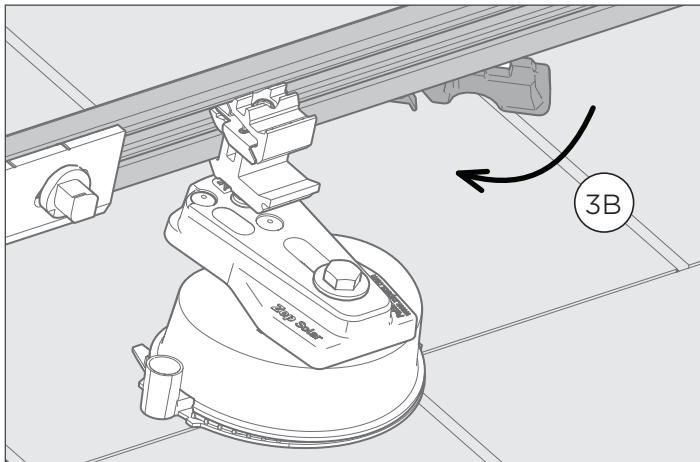
3. INSTALL SUPPORT GRIPS

Insert Grip into Grip Slot on underside of Array Skirt. Grips are installed to the RIGHT of the Rockit (3A). Rotate Grip parallel with the Rockit until it clicks into place (3B). Slide the Grip over the Rockit until it clicks into place (3C).

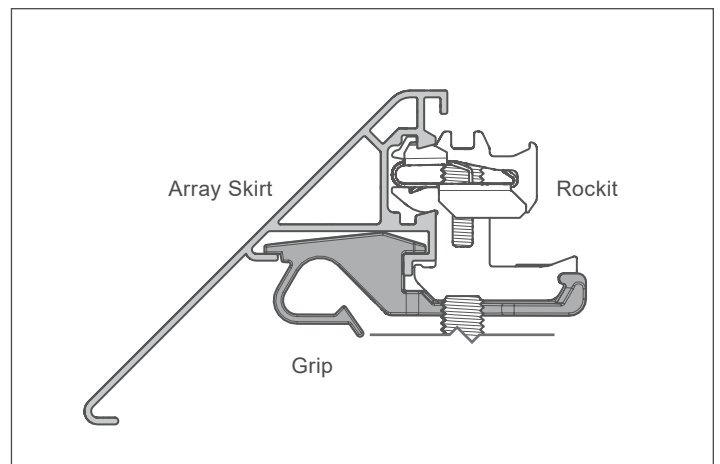
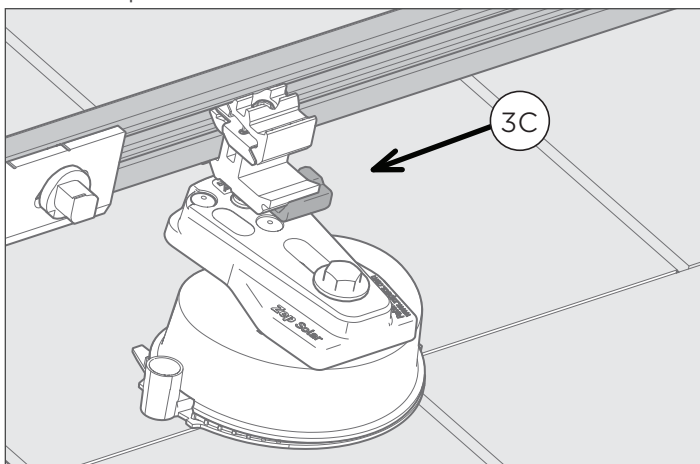
Insert Grip on underside of Array Skirt



Rotate Grip until it clicks into place



Slide the Grip until it clicks into the Rockit



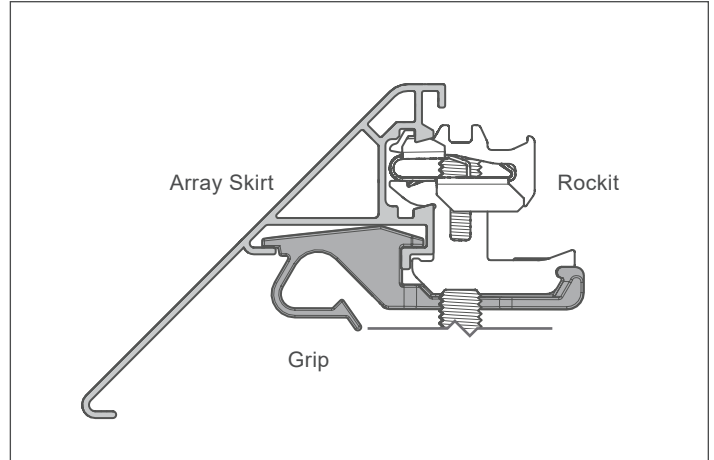
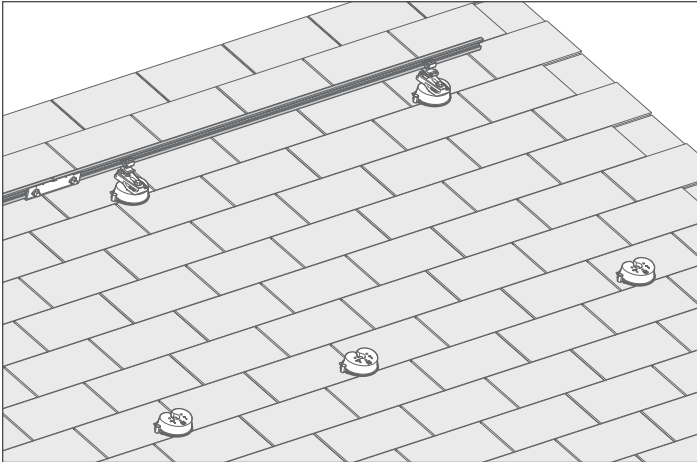
STEP 5: INSTALL PV MODULES (SKIMBL)

Module drop-in is the same for Portrait orientation as for Landscape. To remember the installation order, think “SKIMBL”: Set Module, Kickstand, Interlock, Manage Wires, Bolt Foot, Level.

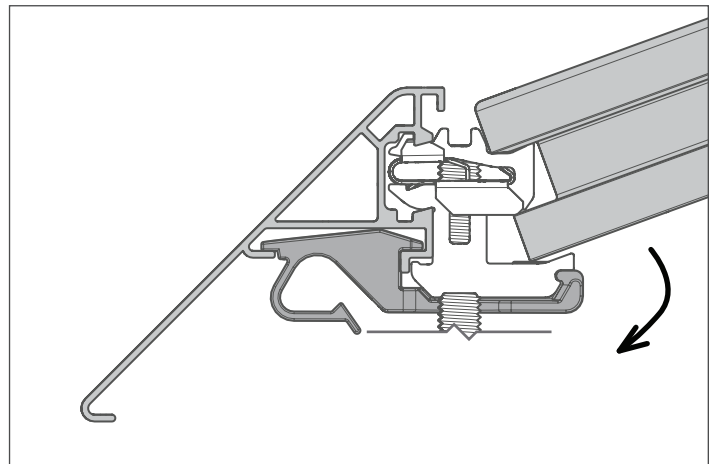
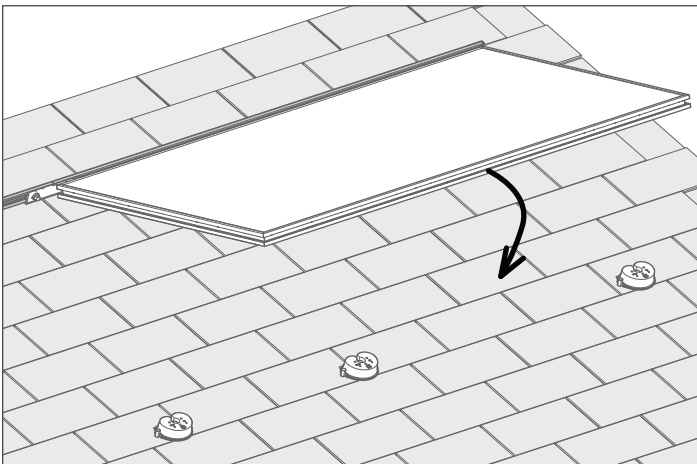
1. SET MODULE (SKIMBL)

Position the first module on the tongue side of the front row Leveling Feet. Rock the module down. Forced interference between the Zep Groove of the module frame and the Rockit creates a structural and electrical bond without the need for additional fasteners.

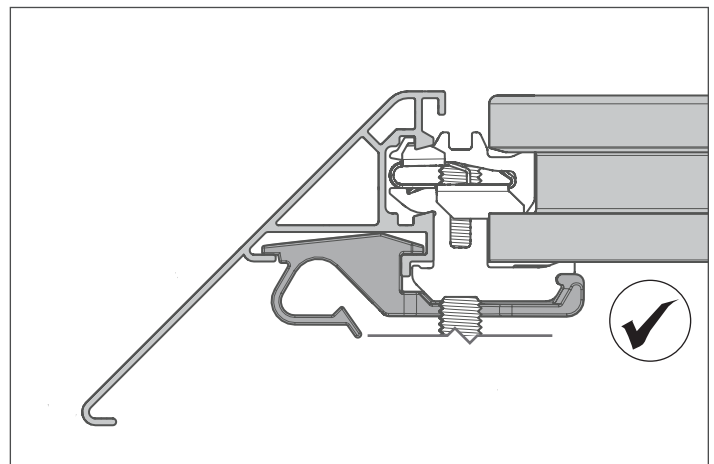
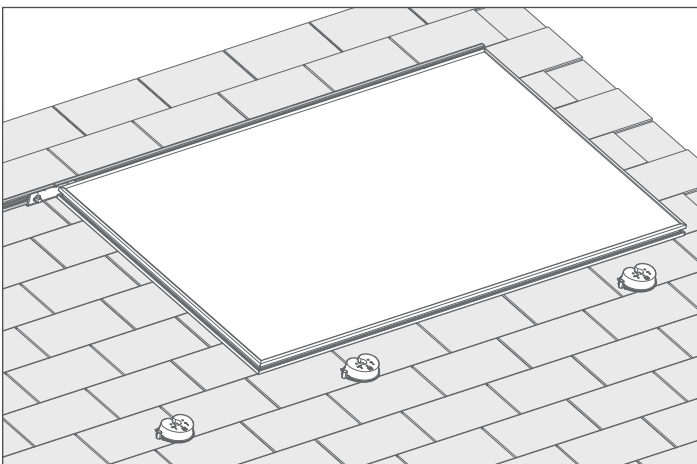
Installation is complete at the Array Skirt.



Position module on the tongue side of the front row.



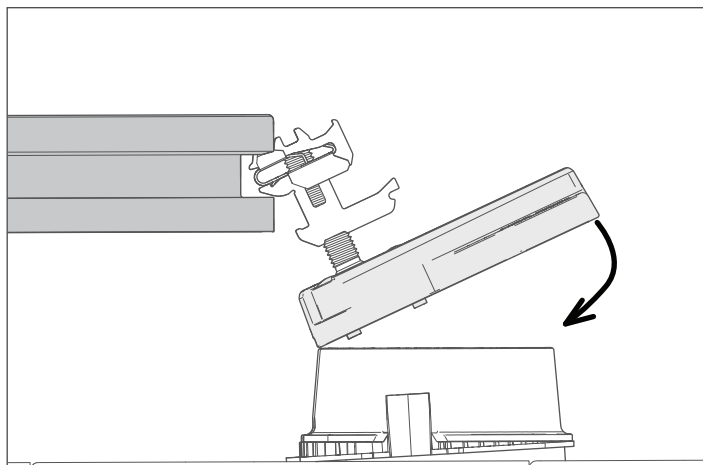
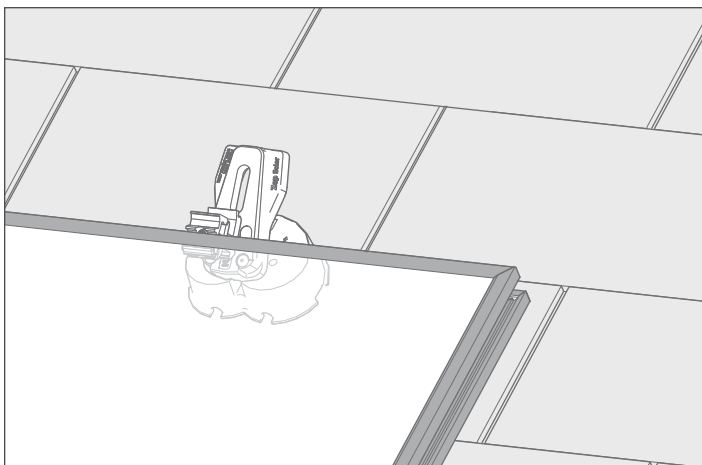
Rock the module down for forced interference.



2. KICKSTAND (SKIMBL)

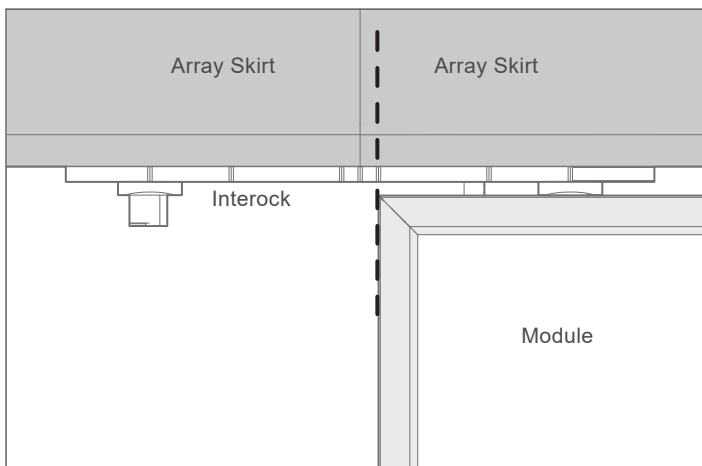
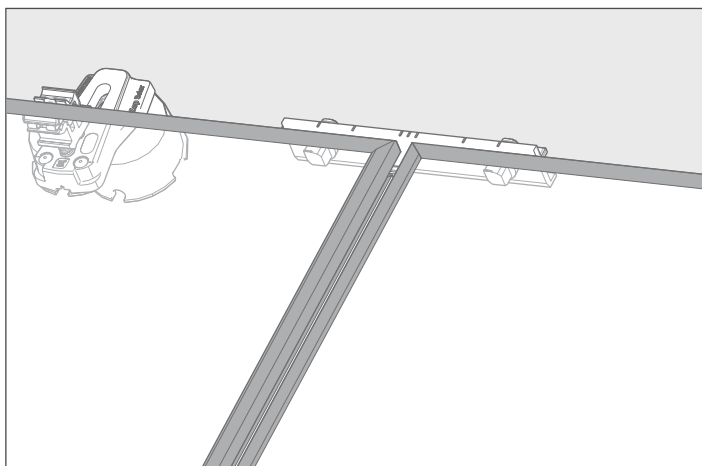
At the rear edge of the module, install Key side of the Rockit into the Zep Groove of the module frame.

Use the Foot as a “kickstand” to support the module, but **do not secure it**.



3. INTERLOCK (SKIMBL)

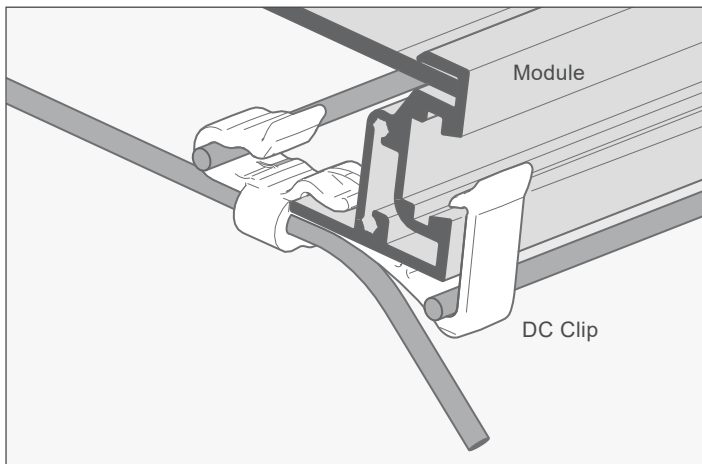
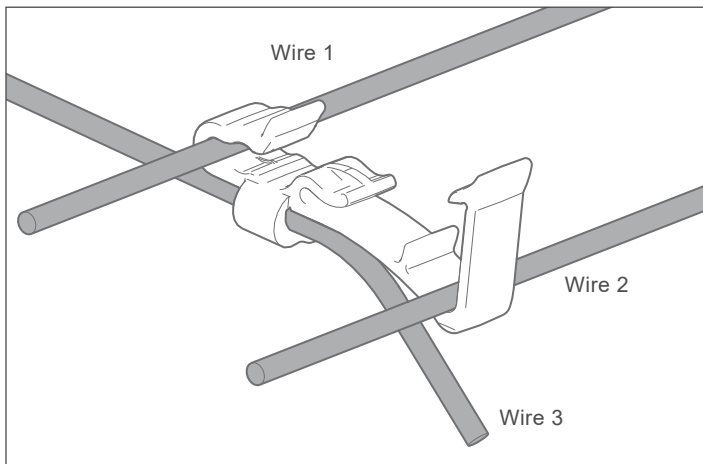
Install Interlocks between modules. Ensure that the module corner is within the allowable range.



4. MANAGE WIRES (SKIMBL)

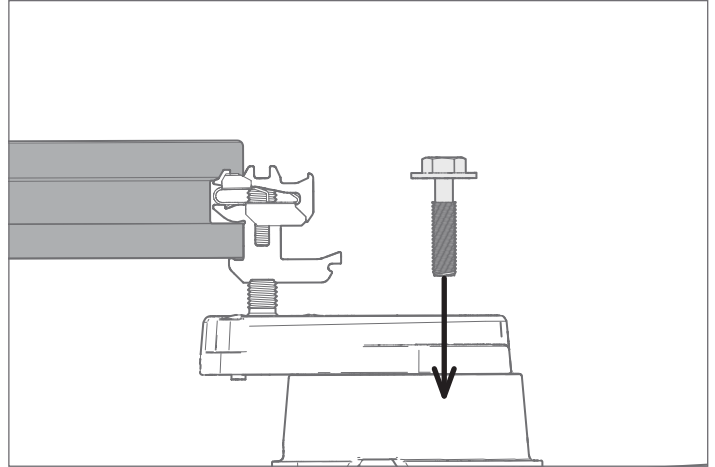
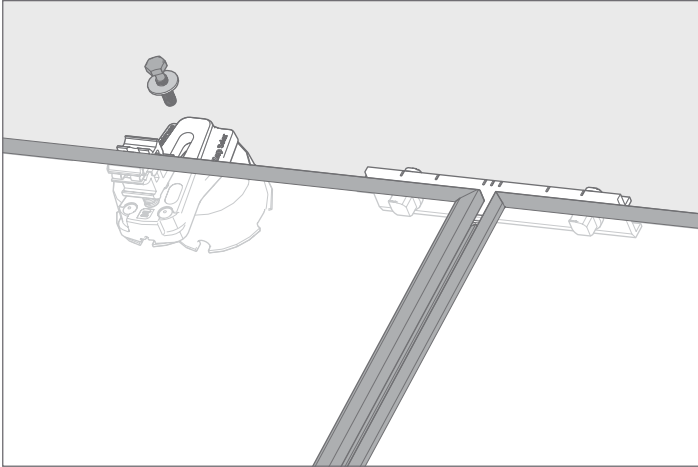
The DC Wire Clip (Part No. 850-1509) is UL listed to UL 1565 as a Wire Positioning Device.

DC Wire Clip accommodates up to three wires. Refer to Wire Management Recommendations for array wire management.



5. BOLT FOOT (SKIMBL)

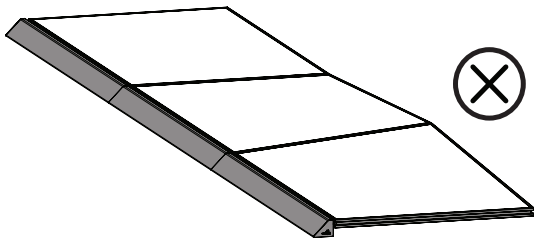
Secure the rear Leveling Feet.



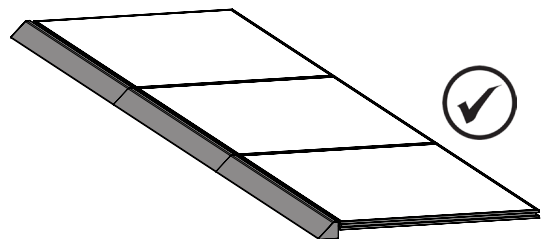
6. LEVEL (SKIMBL)

Uneven leveling is visually apparent, and aesthetically undesirable. Level all the modules so that the array appears to be perfectly flat regardless of roof irregularities underneath. Ensure that first module row is level.

Uneven leveling.

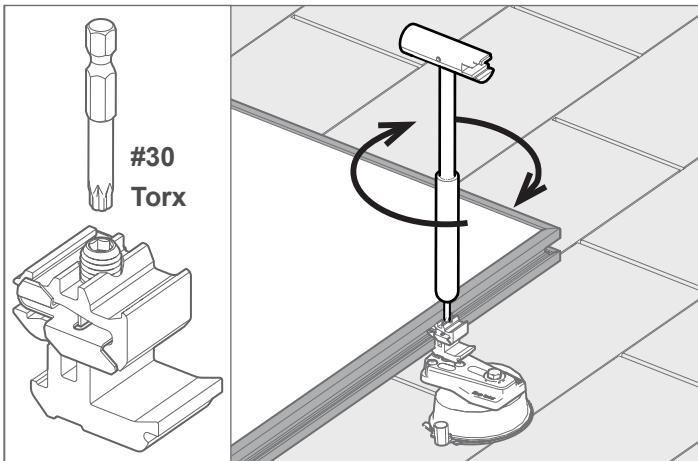


Even leveling.

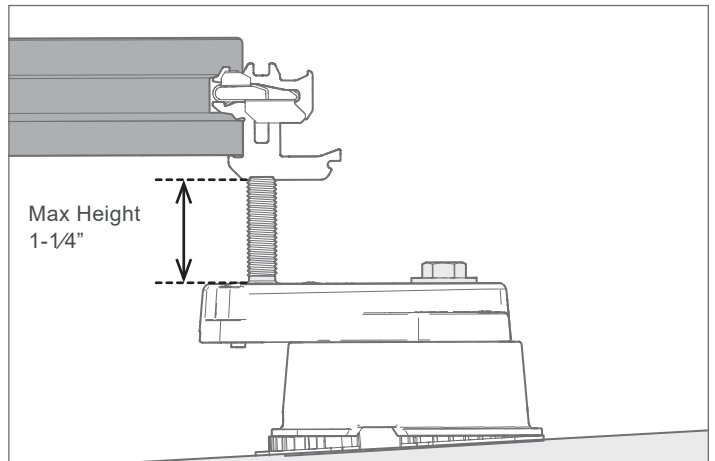


Rotate the threaded stud using a **#30 Torx bit or Zep Tool** to raise or lower module attachment points.
Do not level Rockit beyond 1 1/4 inches above the Leveling Foot Base.

Use a Torx bit to raise or lower module attachment points.



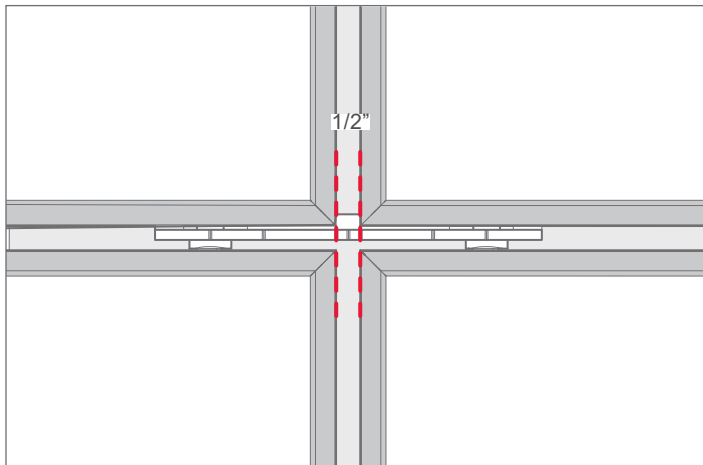
Do not level Rockit beyond 1 1/4 inches above the Leveling Foot Base.



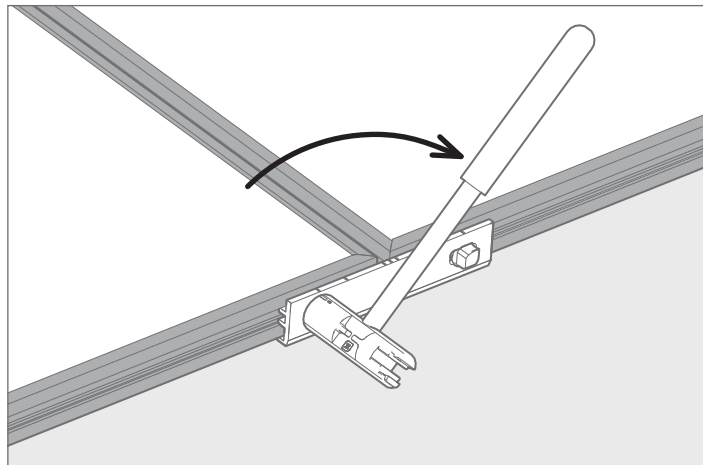
7. REPEAT SKIMBL

For the second module, align and center the Interlock on module edges. The standard gap between modules is 1/2" with a total range of 3" (in case of interference with the Leveling Foot). Use the Zep Tool to turn Interlock Zeps from position 1 to position 3. Tongue side of Interlock allows flexibility for small variations in module sizes. Allowable gap is still structurally electrically bonded. The farthest allowable position to align with module edge when shifting Interlock is shown below. Continue to install Modules, Leveling Feet and Interlocks until the array is complete. Be sure to "SKIMBL" every row.

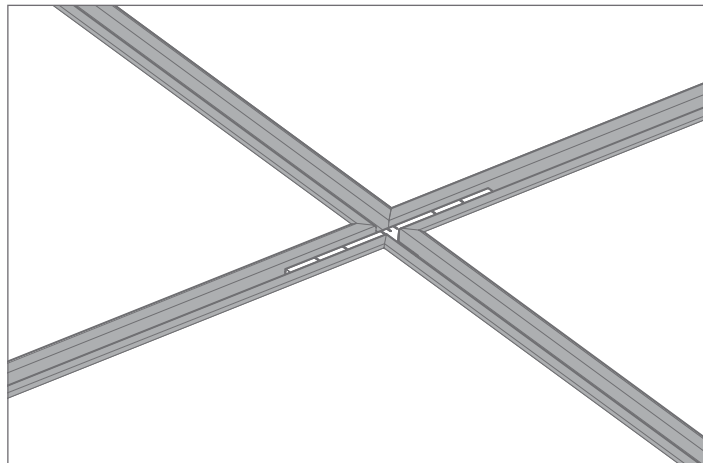
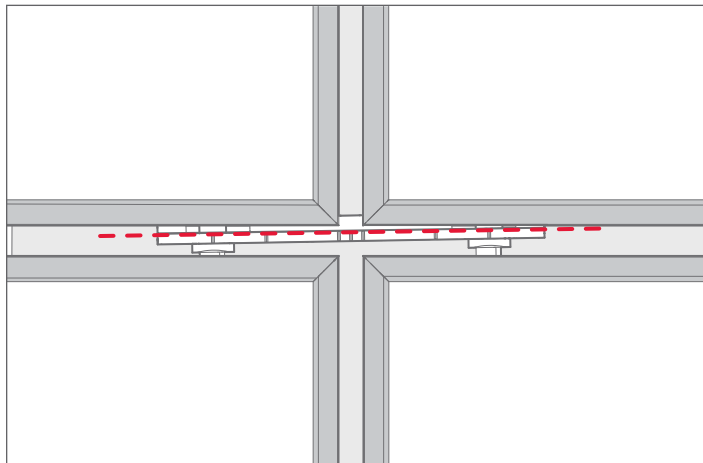
The standard gap between modules is 1/2".



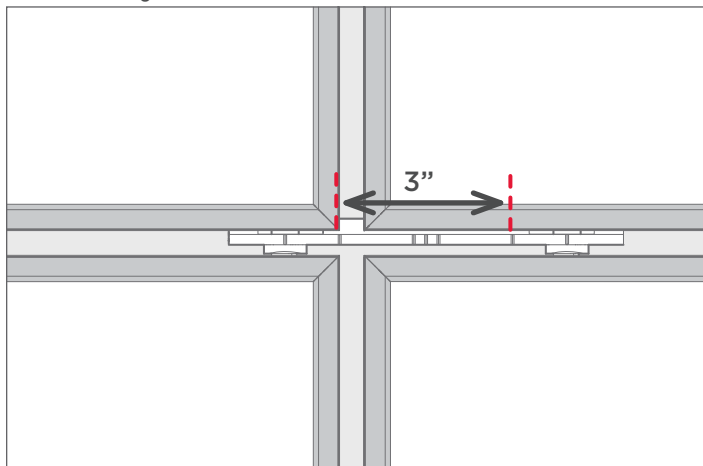
Use the Zep Tool to turn Interlock Zeps from position 1 to position 3.



Tongue of Interlock allows for some flexibility.



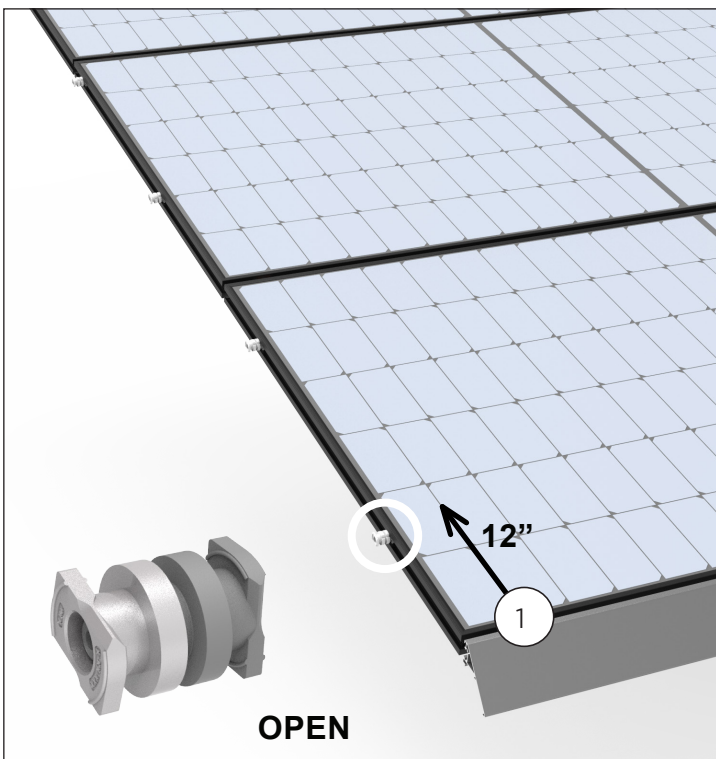
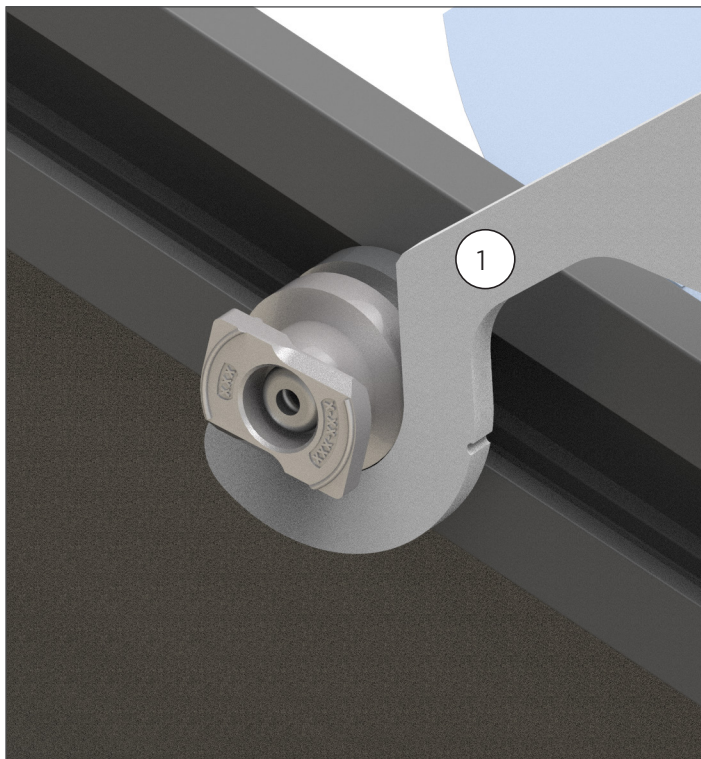
Maximum range is indicated on Interlock.



STEP 6: INSTALL SIDE SKIRTS

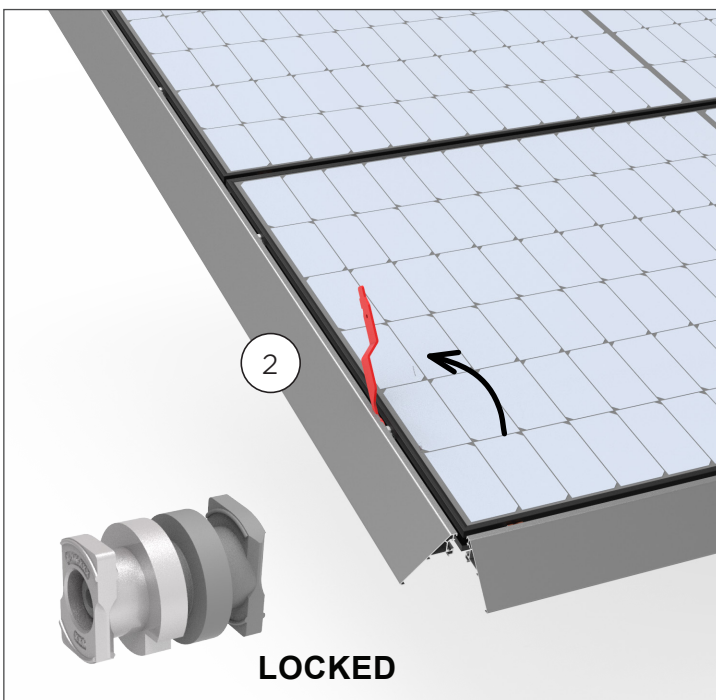
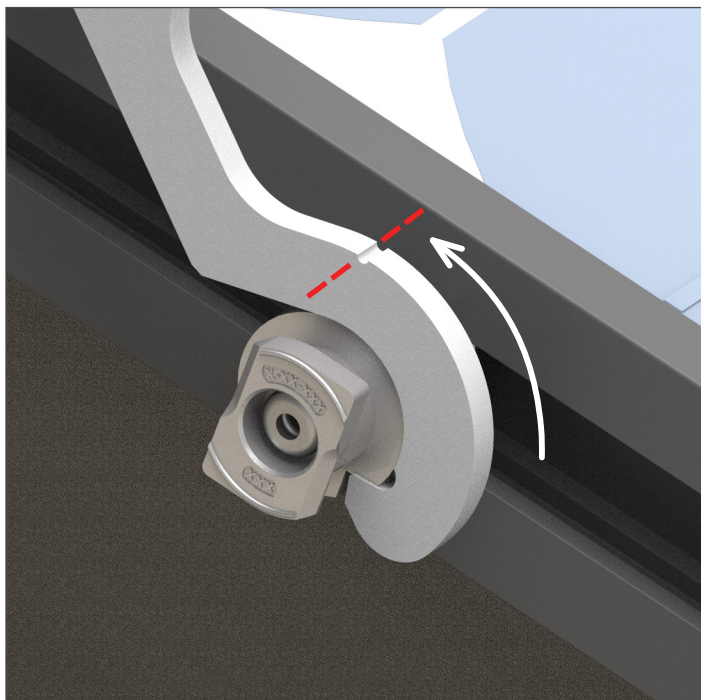
1. INSTALL DOUBLE KEY ZEPS

Install a Double Key Zep 12" from each end of the Array Skirt. Each Array Skirt should have two Double Key Zeps installed on it. Only install interlocks between multiple side skirts if panels cannot be aligned correctly and feature a **visible gap**.



2. INSTALL SIDE SKIRT

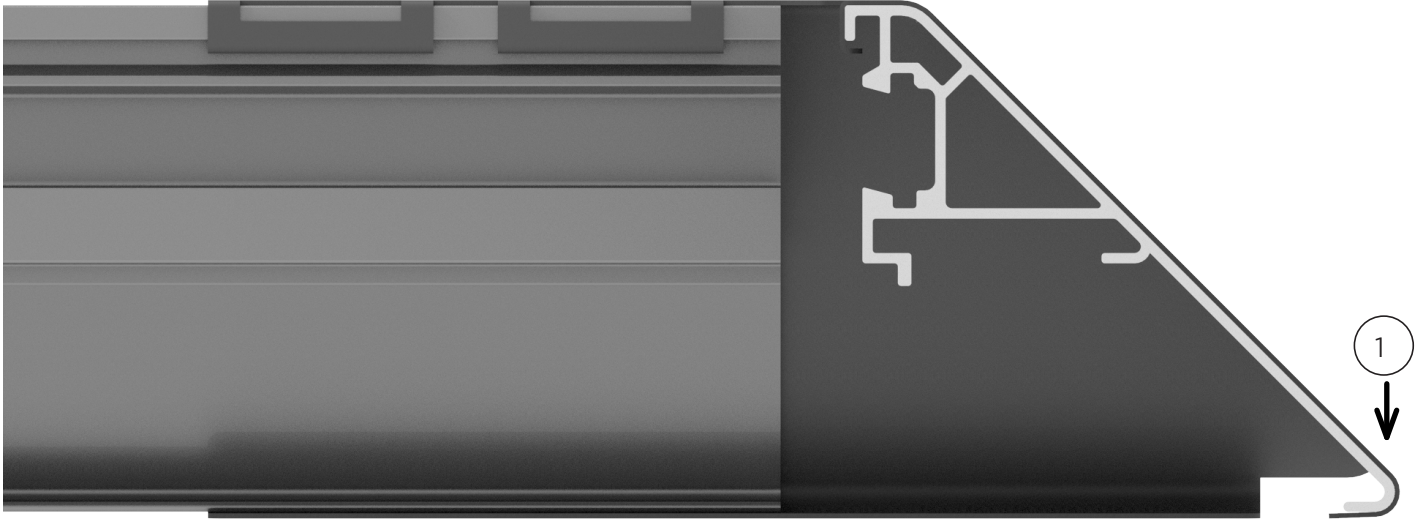
Using the Zep Offset Tool, install the skirt to the side of the array. The notch in the Zep Offset Tool indicates Position 3.



STEP 7: INSTALL CORNER CAPS

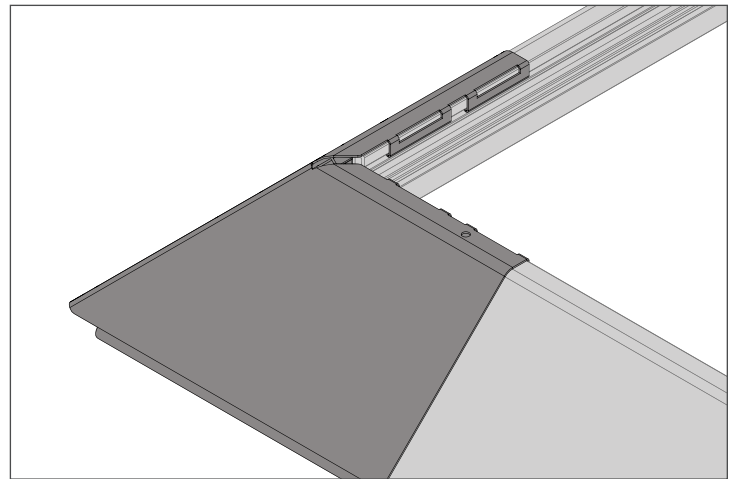
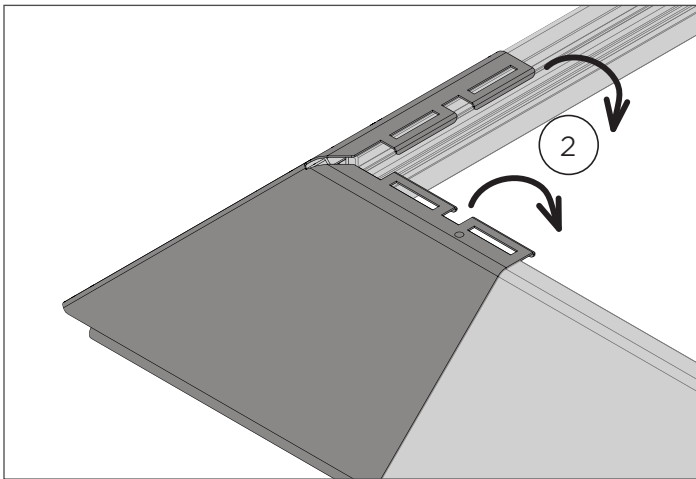
1. PUSH THE OUTSIDE CORNER CAP ONTO THE SKIRT CORNER

Ensure the Corner Cap is fully seated so that the bottom end of the tab is aligned with the top edge of the Array Skirt.



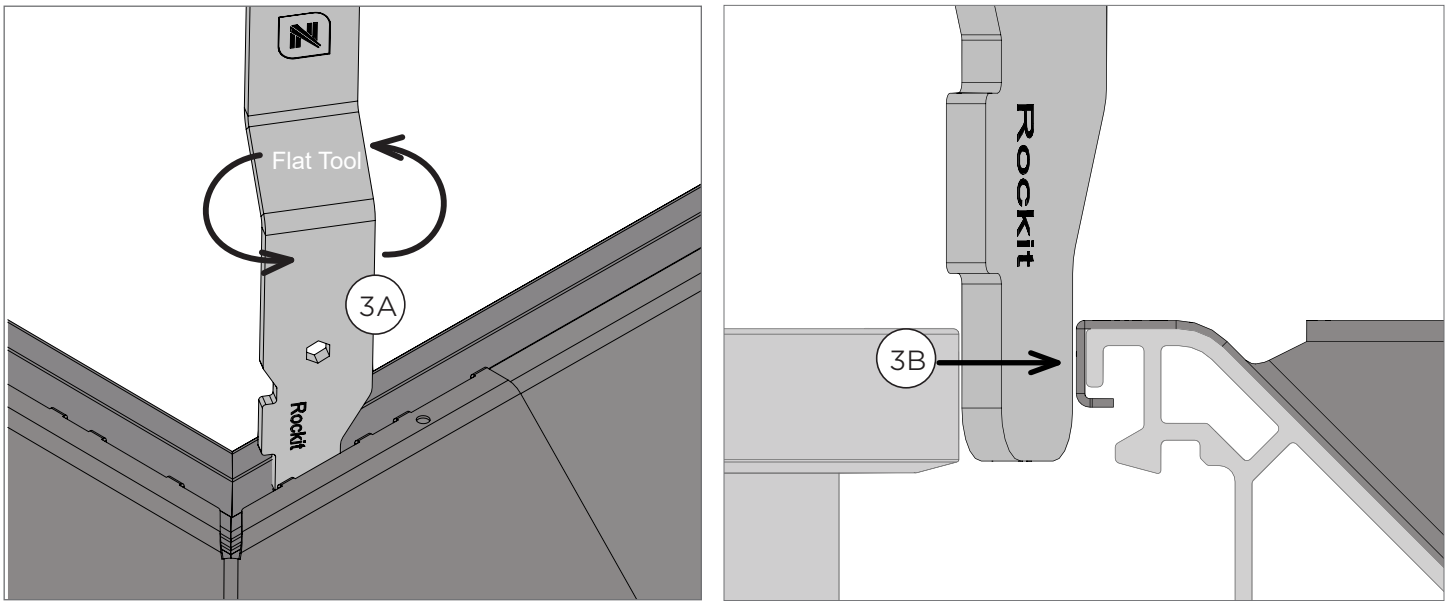
2. FOLD TAB

Fold the Outside Corner Cap tabs down around the back of the Array Skirt.



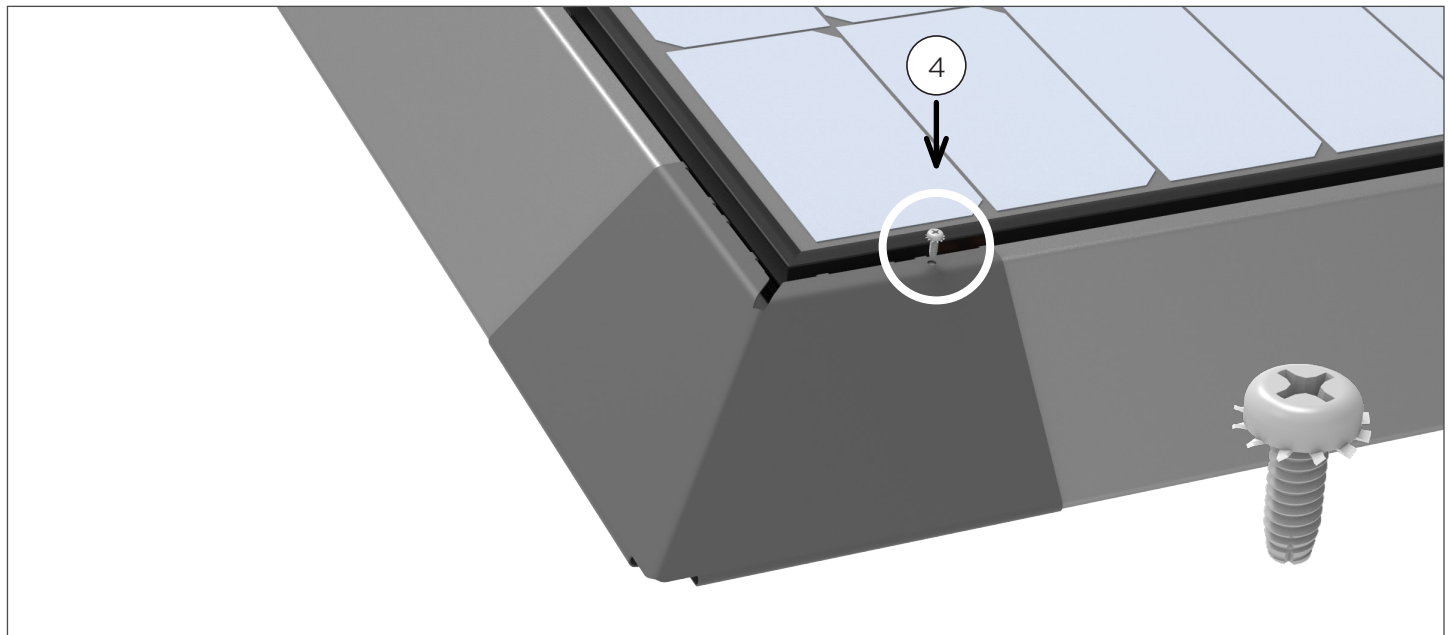
3. PRESS TAB USING OFFSET TOOL

Place the back end of the Offset Tool between the module frame and the Corner Cap (3A) and twist gently to fully engage the tab (3B).



4. FASTEN IF NEEDED

If required by the local AHJ, use a 7/64" (#34 or 2.8mm) drill bit to drill hole and install 6-32 x 3/8" 18-8 SS Thread-Cutting Screw and #8 Lock Washer.



APPENDIX: ALLOWABLE MOUNTING SYSTEM

LOADING

Tesla Compatible modules have been evaluated for design loads on the back surface (e.g., wind load) and on the front surface (e.g., wind and snow load).

UL 2703 REQUIREMENTS

PV Modules were evaluated at the following attachment spacings in order for Tesla Solar hardware to obtain load ratings using specified test procedures:

ZS COMP				
MODULE	LANDSCAPE		PORTRAIT	
	ATTACHMENT SPACING	LOAD (PSF)	ATTACHMENT SPACING	LOAD (PSF)
Tesla T420S, T425S, T430S and T395H, T400H, T405H	24"	100 - front side; 72 - rear side	24"	31.3 - front side; 37.5 - rear side
Q.Cells Q.Pro-G4 where ### = 250-265	24"	50 - front side; 72 - rear side	24"	50 - front side; 72 - rear side
Q.Pro-G4.1 where ### = 270-325				
Q.Peak Duo BLK G5 where ### = 310-320				
Q.Peak Duo BLK G6+ where ### = 330-345				
Q.Peak Duo BLK ML-G10+/TS where ### = 395-415	24"	100 - front side; 72 - rear side	24"	31.3 - front side; 37.5 - rear side

*all spacings are measured on center.

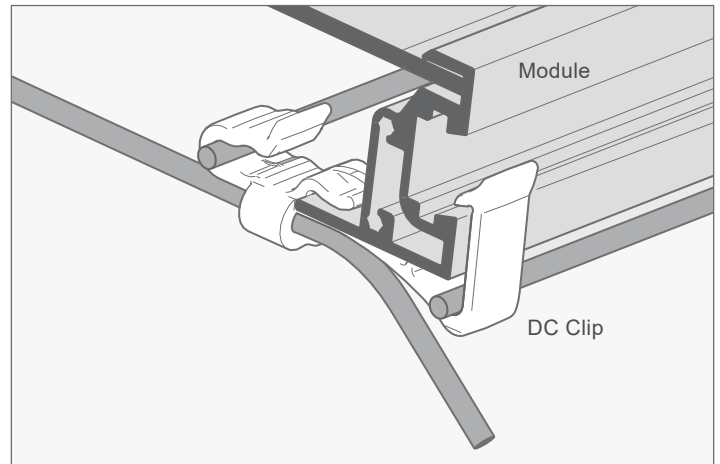
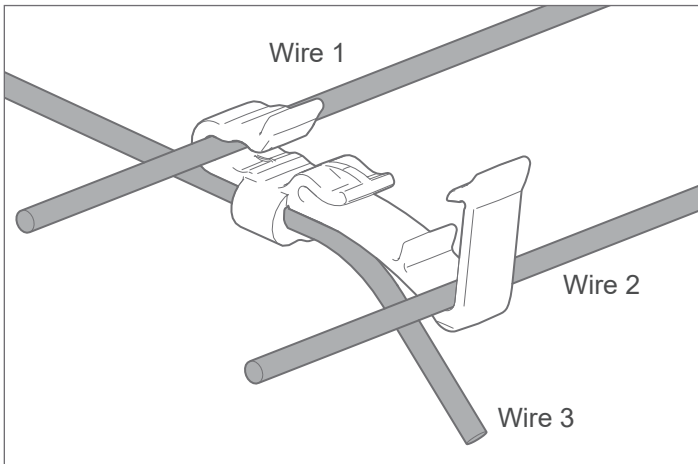
Tesla Solar Hardware must be installed following all applicable instructions.

Listed by UL to UL 2703 for a mechanical load rating up to 100 psf downforce and up to 72 psf uplift. This racking system is Listed for fire performance, grounding and mounting of Listed PV modules where the combination of Listed module and Listed racking system has been evaluated.

APPENDIX: WIRE MANAGEMENT

RECOMMENDATIONS

Perform wire management as appropriate for the array. Refer to the example below for a standard 3x3 module array. The DC Wire Clip (Part No. 850-1509) is UL listed to UL 1565 as a Wire Positioning Device. DC Wire Clip accommodates up to three wires.

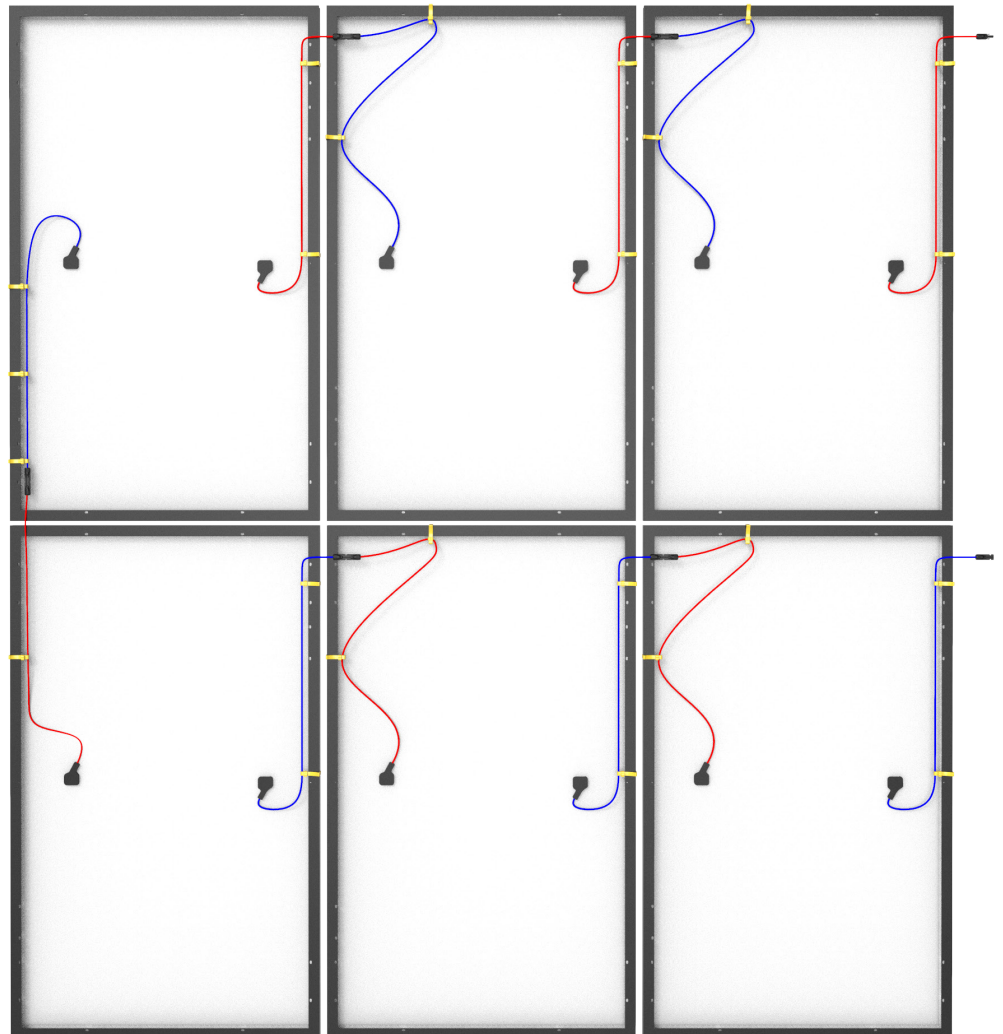
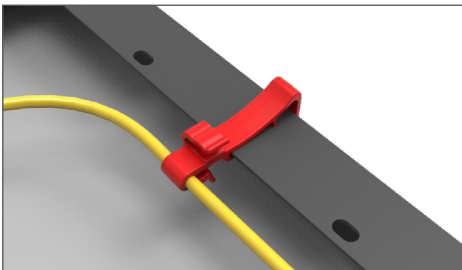


EXAMPLE ARRAY WIRING: PORTRAIT ORIENTATION

DANGER:

Ensure that the cabling is not under mechanical stress (Comply with bending radius of ≥ 2.36 in (60 mm)).

Ensure that the cables do not run between module and mounting rail or structure (danger of pinch).



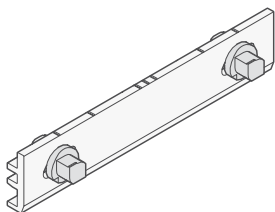
APPENDIX: GROUNDING AND BONDING

INTERLOCK ROCKIT GROUND ZEP

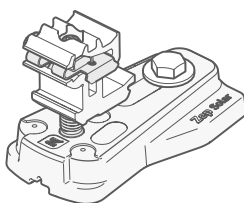
Tesla Zep Compatible™ systems do not require running copper conductors to each module. The act of physically installing each component simultaneously establishes an electrical bond.

Adjacent Tesla Zep Compatible™ module frames are bonded using two Tesla Solar products. The frame of every module is electrically bonded to adjacent modules and/or Array Skirts through the Interlock and Leveling Foot. The frame of every module is part of the EGC path. The EGC path leaves the array by means of the Ground Zep connected to a copper conductor, which acts as the fault current path to ground. The face of the Ground Zep is labeled “GND.”

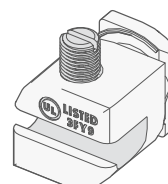
Interlock



Rockit (Leveling Foot)

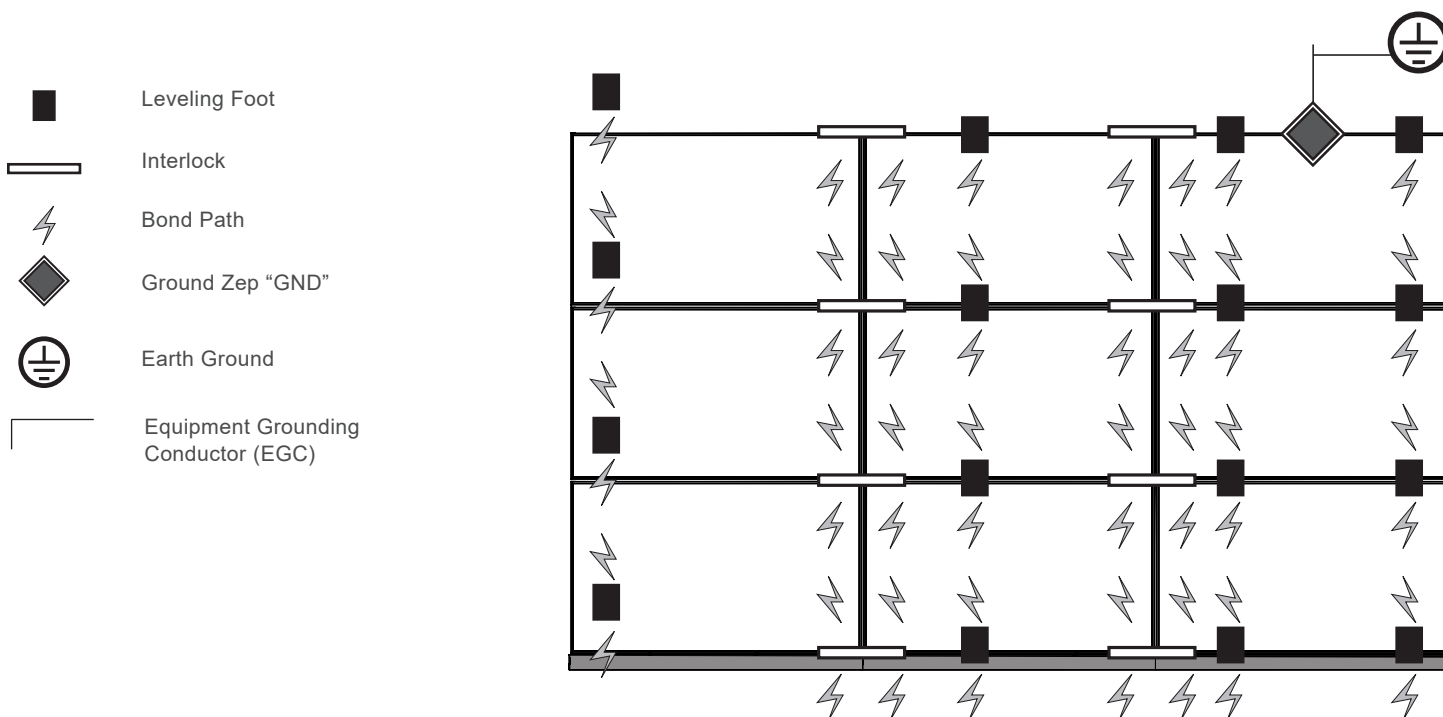


Ground Zep “GND”

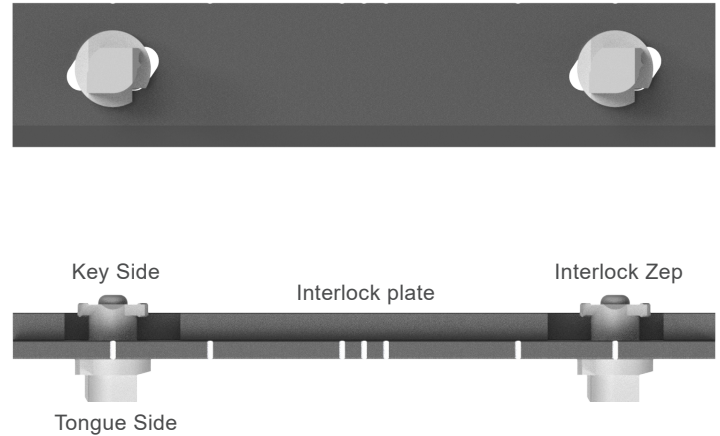
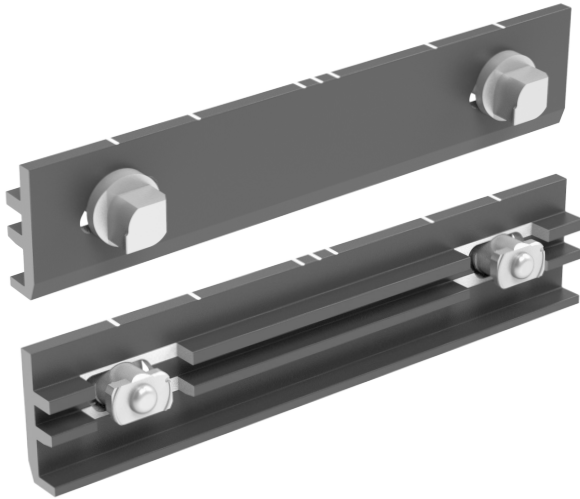


The following example shows a representative fault current ground path leaving a Tesla Zep Compatible™ array. Each Interlock and Leveling Foot creates a bond between the module(s) and Array Skirt(s) it touches. The EGC path is carried through each module frame and Array Skirt. The fault current ground path then leaves the array through the Ground Zep. Typical Tesla Zep Compatible™ arrays will have multiple EGC paths, represented by the bond symbol below.

In the event a module must be removed for servicing, use additional Ground Zeps as needed to ensure the ground bonding path is maintained.



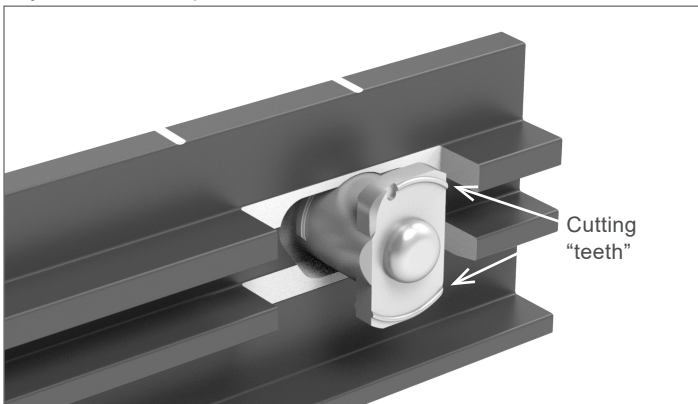
INTERLOCK



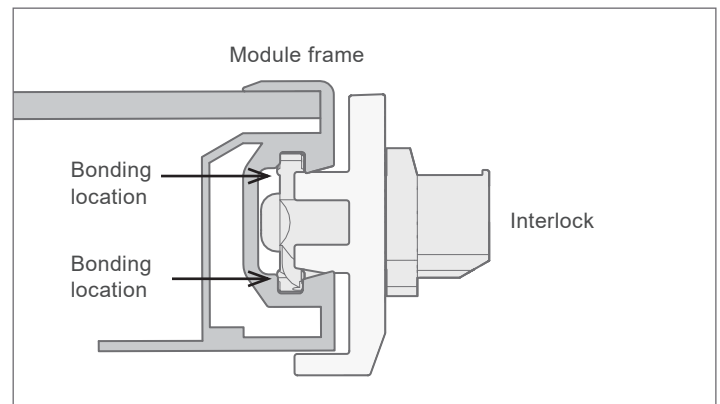
KEY SIDE BONDING TO MODULE FRAME

Forced interference during rotation of Interlock Zep causes teeth to cut through anodization on module frame, resulting in robust and UL certified bonding path.

Key Side in closed position



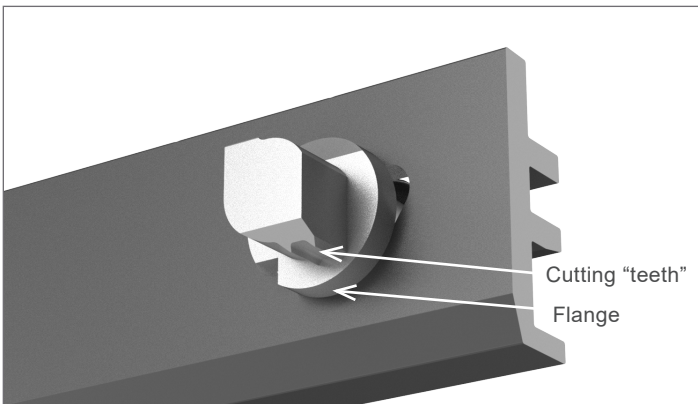
Side View



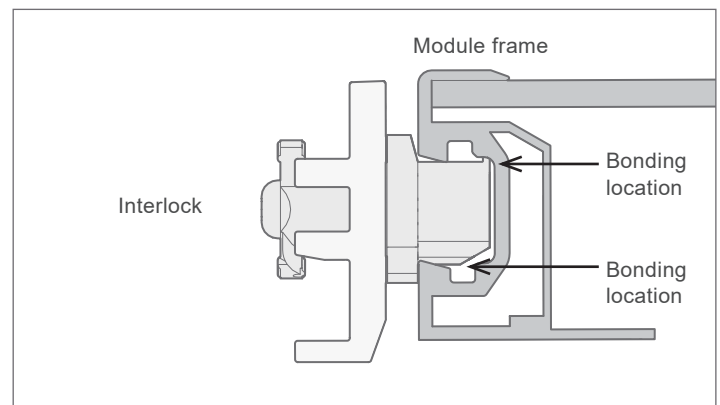
TONGUE SIDE BONDING TO MODULE FRAME

Forced interference between mating parts from module rock-in motion cuts into module frame for the range of allowable install positions, removing anodization and resulting in robust and UL certified bonding path.

Tongue Side in closed position



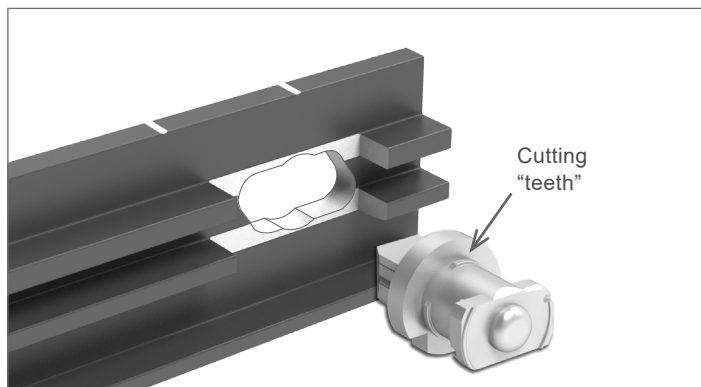
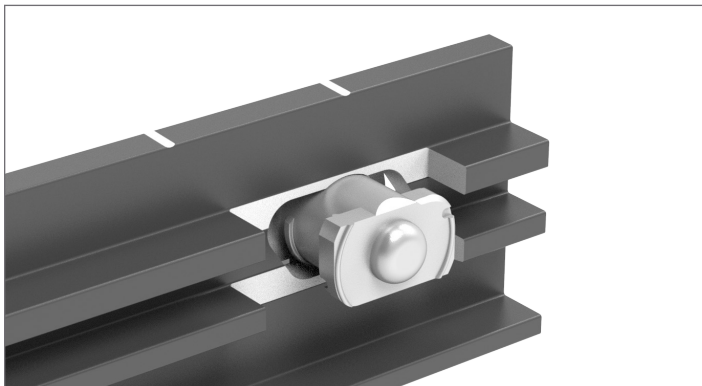
Side View



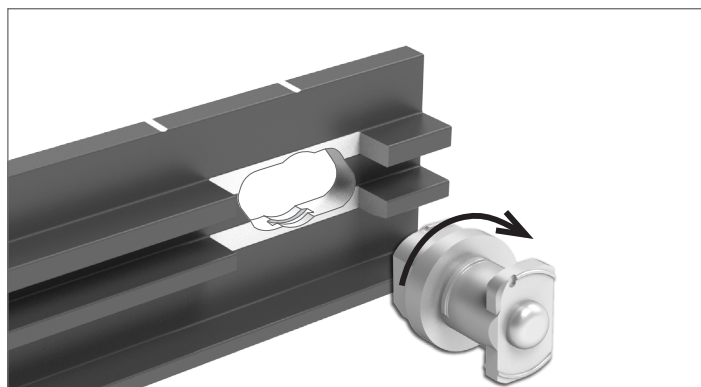
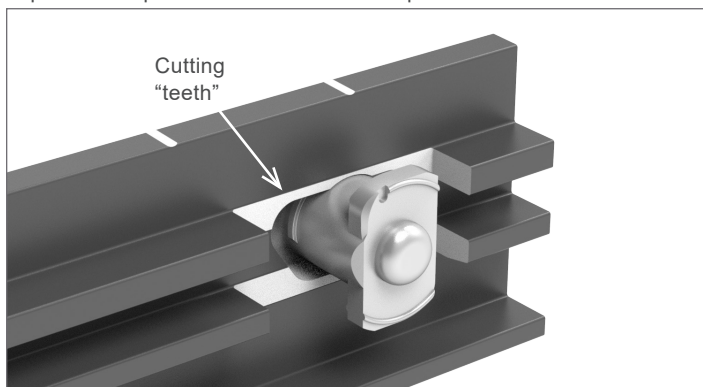
ZEP TO INTERLOCK BONDING

The rotating fastener attached to the Interlock plate, called the “Zep” or “Interlock Zep”, has two cutting teeth on the shaft that cut into the Interlock plate when the Zep is tightened during normal installation, resulting in robust and UL certified bonding path. The Interlock may be re-installed up to 15 times.

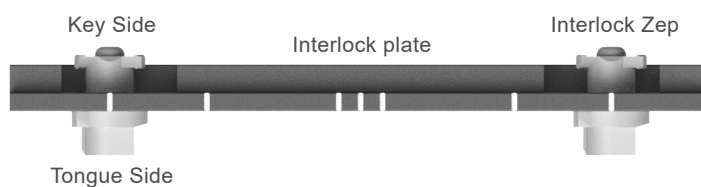
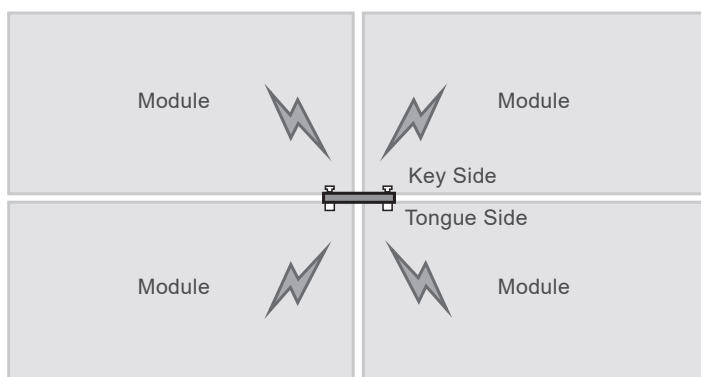
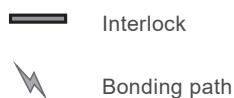
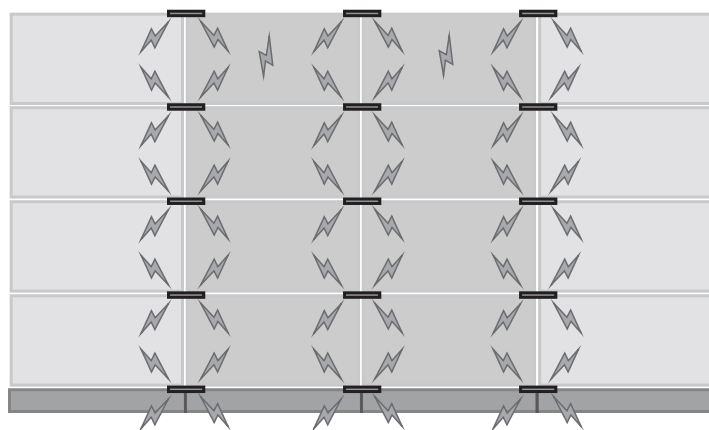
Zep in open position.



Zep in locked position cuts into Interlock plate.



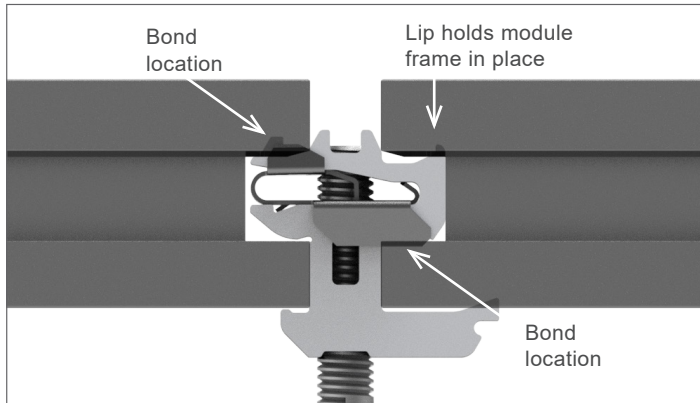
The Interlock bonds modules on all 4 sides and across the Interlock plate to create a hyper-bonded array where every module is structurally and electrically bonded to the surrounding modules.



ROCKIT

KEY & TONGUE SIDE BONDING

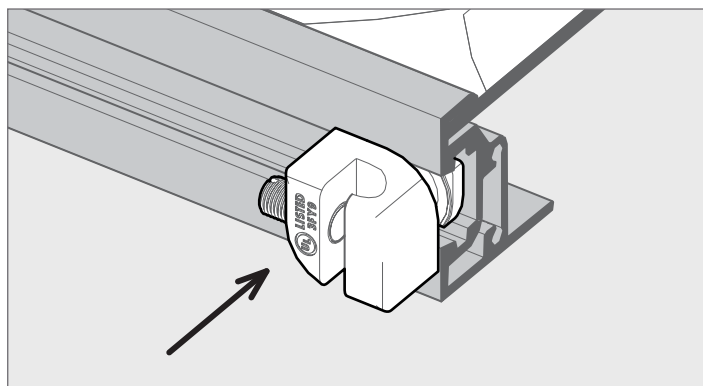
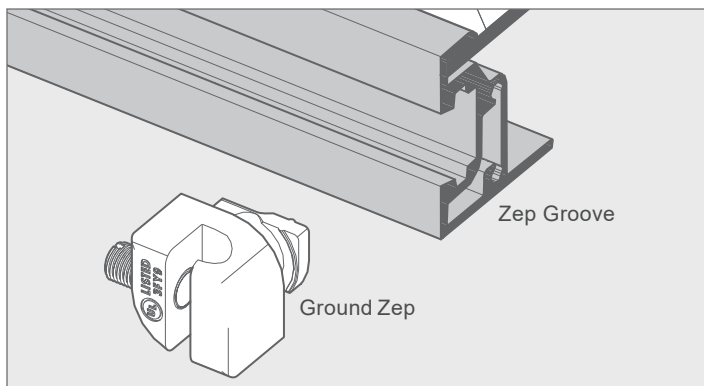
The Rockit has a stainless steel spring clip that bonds to the adjacent module frame on both Key and Tongue sides. A module can be pulled out to the edge of the lip and still be correctly installed, allowing for small variations in module sizes.



GROUND ZEP

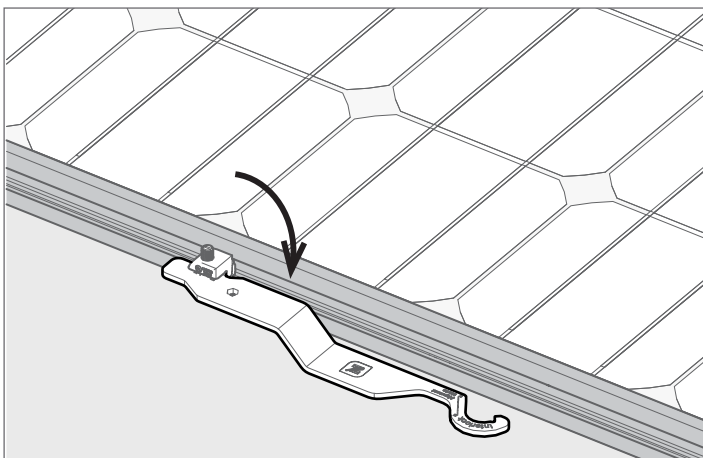
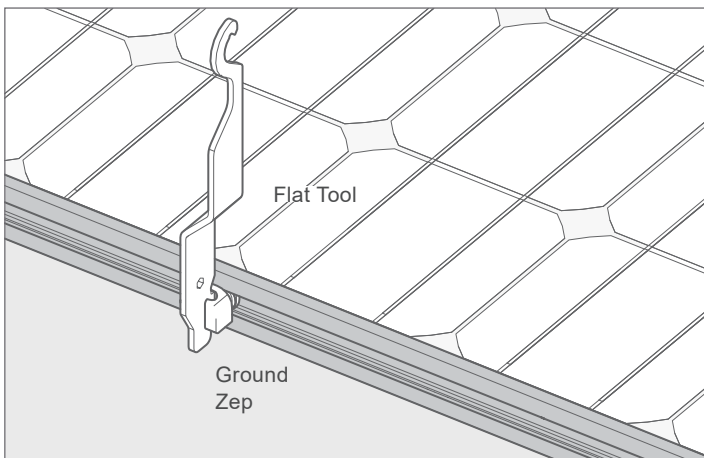
1. INSERT GROUND ZEP

The Ground Zep provides a single point of connection for the Equipment Grounding Conductor (EGC) from the array to a building ground. Insert a Ground Zep into the Zep Groove with the Set Screw pointing left.



2. LOCK GROUND ZEP

Using either a Zep Tool or the Flat Tool (shown), lock the Ground Zep into place with a 90 degree clockwise turn. The Set Screw should be pointing straight up.



3. INSERT GROUND WIRE

Insert solid copper ground wire into ground wire retention slot.

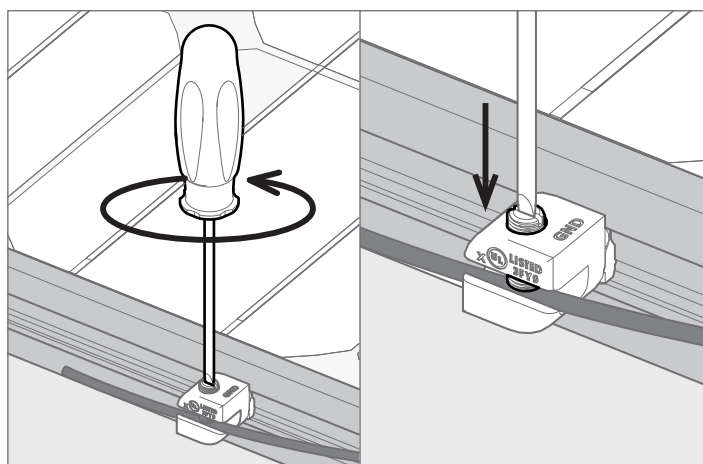
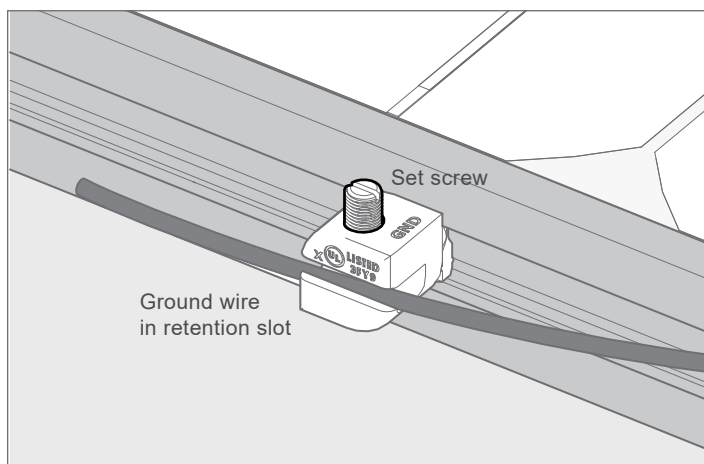
To fully secure the ground wire, torque the set screw as follows:

14-10 AWG: 40 INCH-LBS

8 AWG: 45 INCH-LBS

6 AWG: 50 INCH-LBS

4 AWG: 55 INCH-LBS



APPENDIX: THERMAL EXPANSION

There are two methods to address thermal expansion and contraction within Tesla Zep Compatible™ arrays: Thermal Expansion Joints and physical gaps or breaks between sub-arrays.

Thermal Expansion Joints consist of Interlocks that are installed in a manner that allows modules to slide back and forth as they expand and contract in response to daily temperature swings on the roof. This allows the modules some added flexibility to expand in the direction that the Interlocks are running. In the other direction (North-South in the case of ZS Span), a physical gap is required to allow for thermal expansion of the modules. Generally, a gap of at least 12" between sub-arrays is recommended, both for thermal expansion and to allow access by work crews for module servicing.

WHEN ARE THERMAL EXPANSION JOINTS NEEDED?

Thermal expansion must be addressed under the following conditions:

- Array sizes larger than 10 meters or approximately 33 feet in either direction.
- After two consecutive Thermal Expansion Joints, a physical gap is required.

NOTE: For example, a typical 60-cell polycrystalline module would require thermal expansion every 6 module lengths or 10 module widths, or approximately every 60 modules assuming a square array.

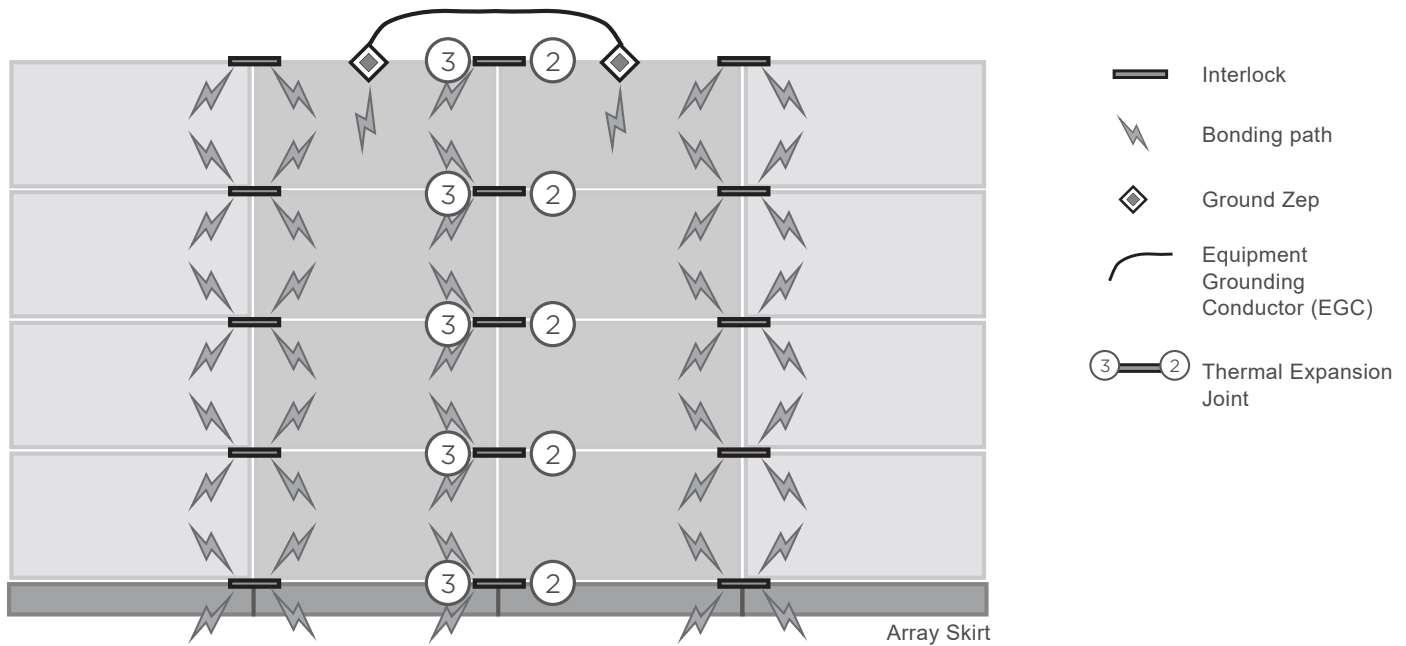
INSTALLING THERMAL EXPANSION JOINTS

Thermal Expansion Joints use the Interlock component, which is used to connect and bond two modules together. To create a Thermal Expansion Joint between two modules, rotate the Interlock Zep on one side to Position 3 (locked position) using the Zep Tool. Rotate the Interlock Zep on the other side to Position 2. Position 2 provides a structural connection, but does not establish an electrical bond. This allows the module on the side of Position 2 to slide back and forth as the modules expand and contract in changing temperatures.

NOTE: Thermal Expansion Joints require that a Ground Zep be installed on both sides of the break.

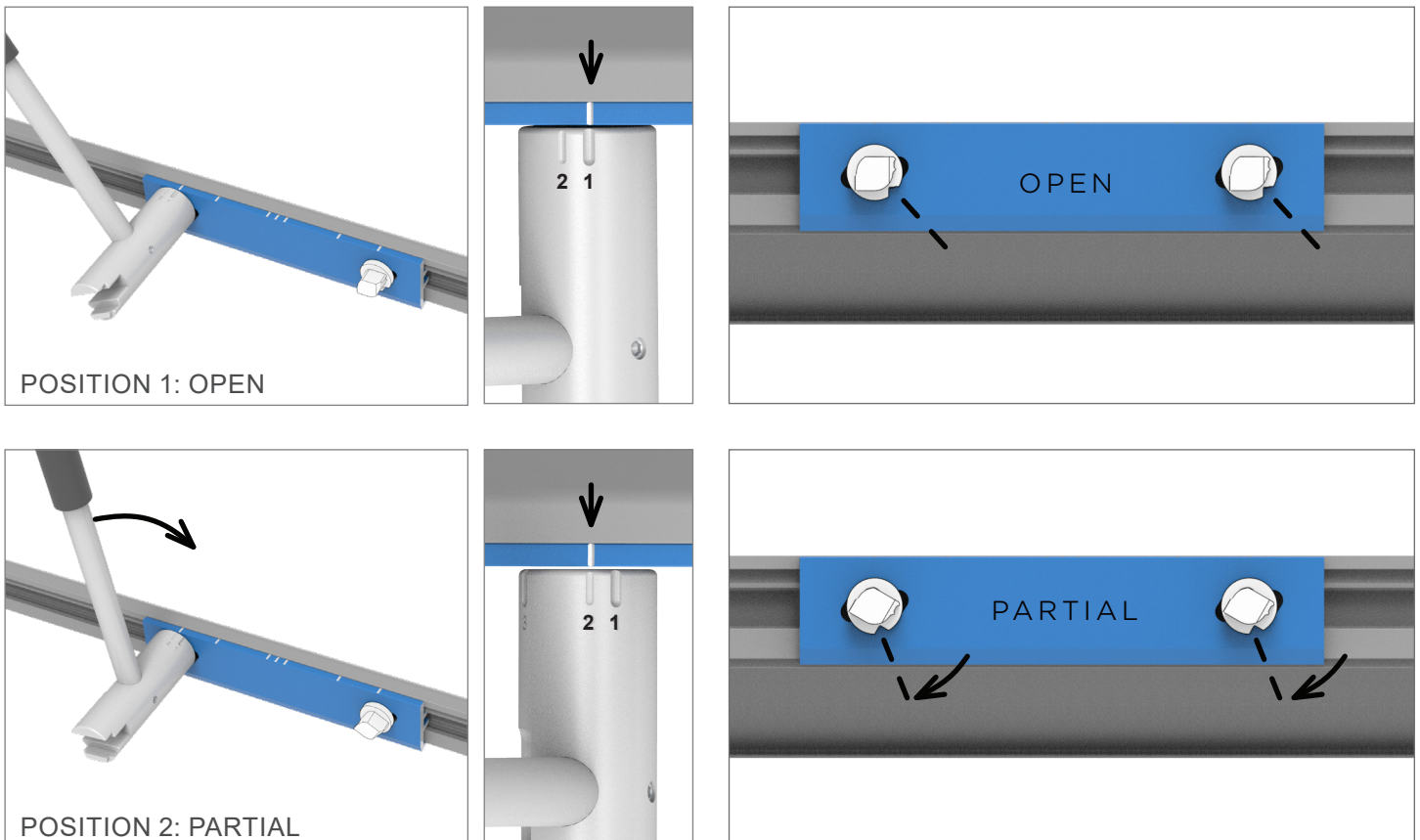
THERMAL EXPANSION JOINTS AND MODULE COLUMNS

When there is a continuous column of Interlocks all serving as a thermal expansion joint, all Interlocks must be tightened consistently going up the column. In most cases, one side is turned to **Position 3**, and the other side to **Position 2**, the exception being a staggered array. For example, a North-South drop-in with thermal expansions that run East-West could be installed as follows:



Thermal Expansion Joint: Interlock Tightening Positions, North-South Drop-In

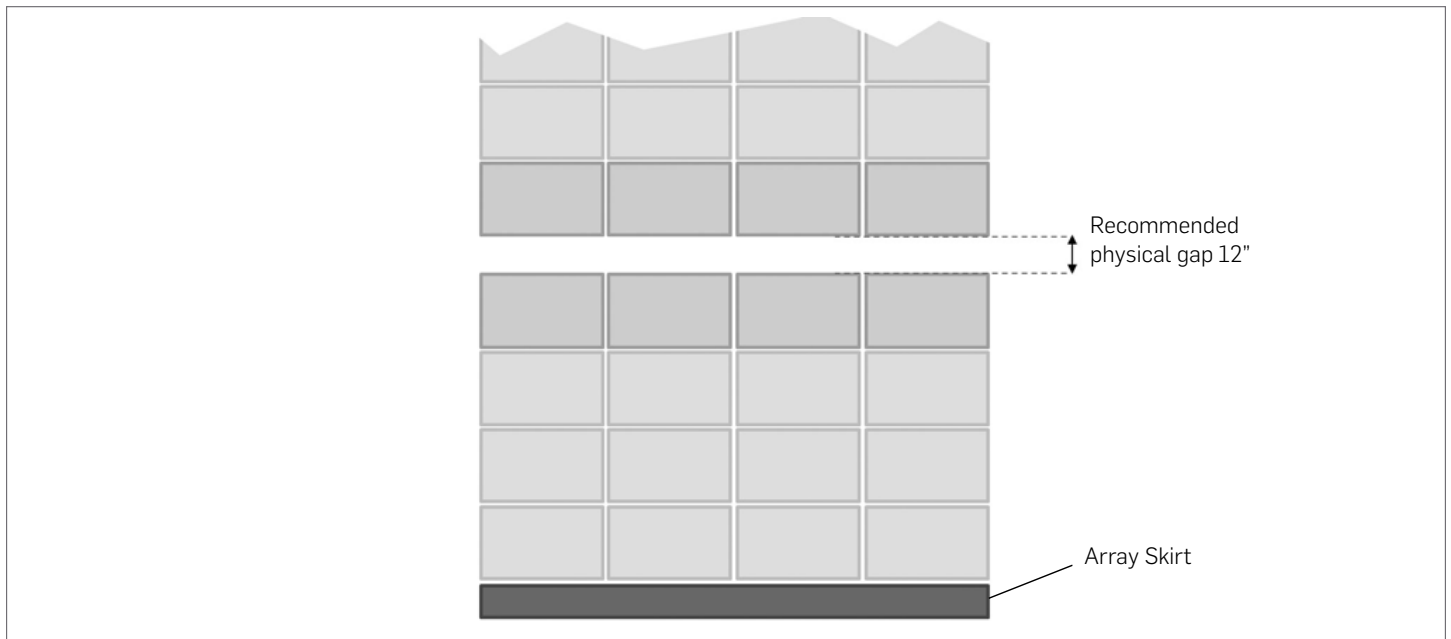
Note that the Interlock **Position 3** also locks in the Tongue side modules (up-roof side) as well.



PHYSICAL GAPS BETWEEN SUB-ARRAYS

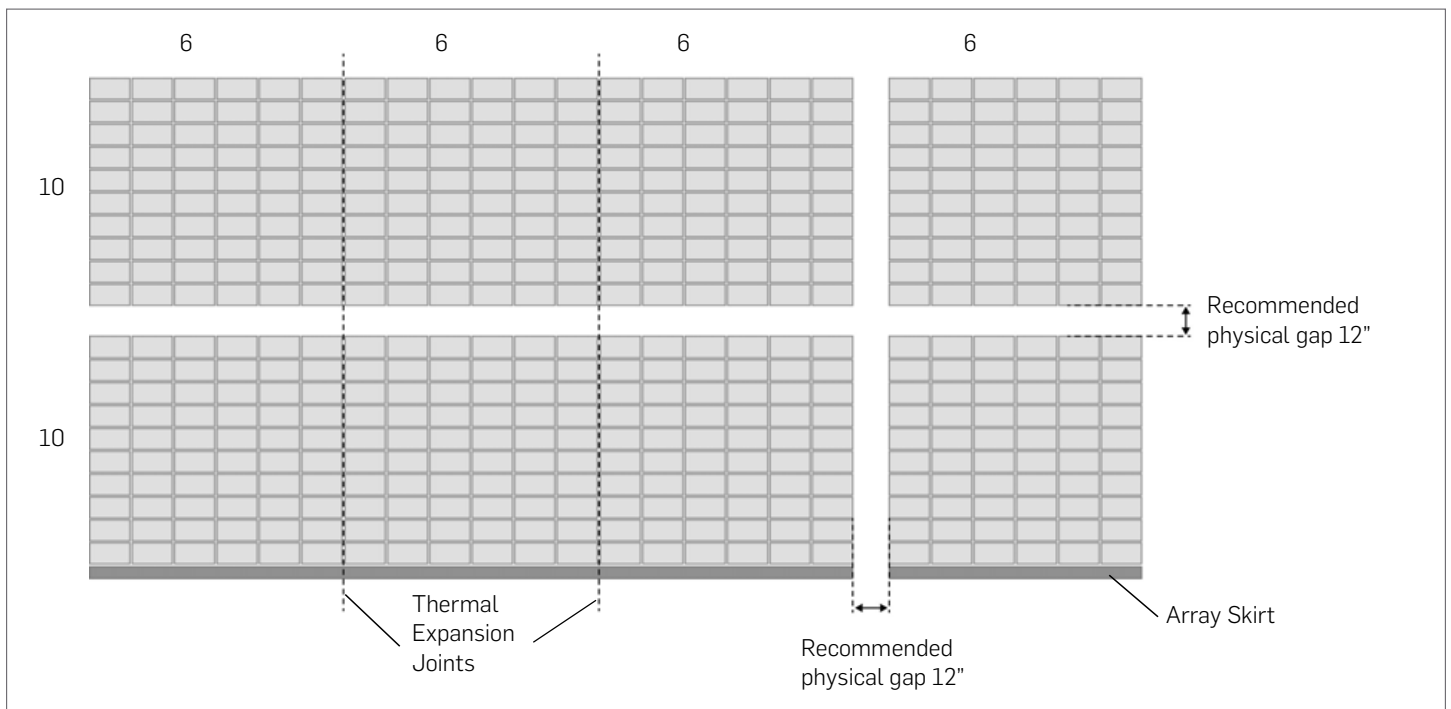
Thermal Expansion Joints only work along the axis of the Interlock. Thermal expansions running along the other axis (parallel to the module drop-in direction) require a physical break between the sub-arrays. For example, a vertical North-South drop-in may require physical breaks between rows.

At a minimum, the gap should be at least 4 inches or 100 mm. However, a gap of 12 inches or 300 mm is recommended for ease of servicing.



North-South Drop-In, North-South Thermal Expansion Gap

Along the axis of the Interlock, large arrays also need a physical gap after two Thermal Expansion Joints. For example, a North-South drop-in, Landscape orientation, might require a physical gap approximately every 30 meters or 100 feet. This would be approximately every 18 module lengths, depending on the module.



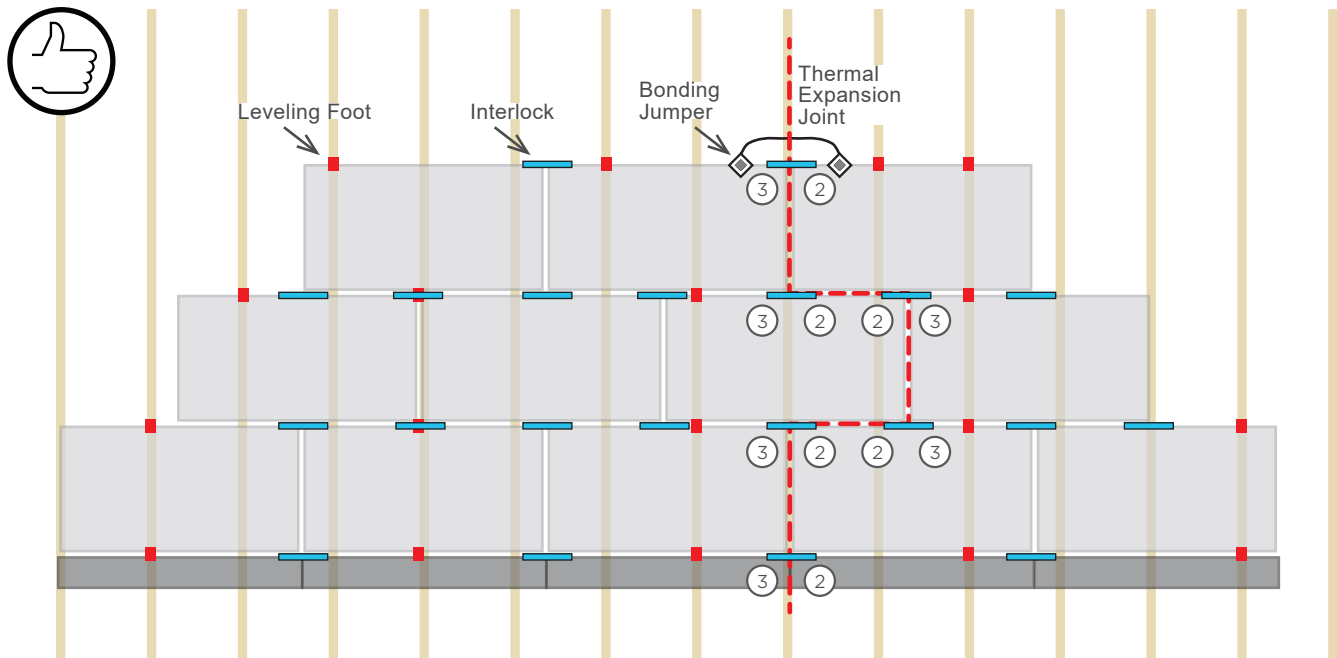
North-South Drop-In, North-South Thermal Expansion East-West

THERMAL EXPANSION JOINTS IN STAGGERED ARRAYS

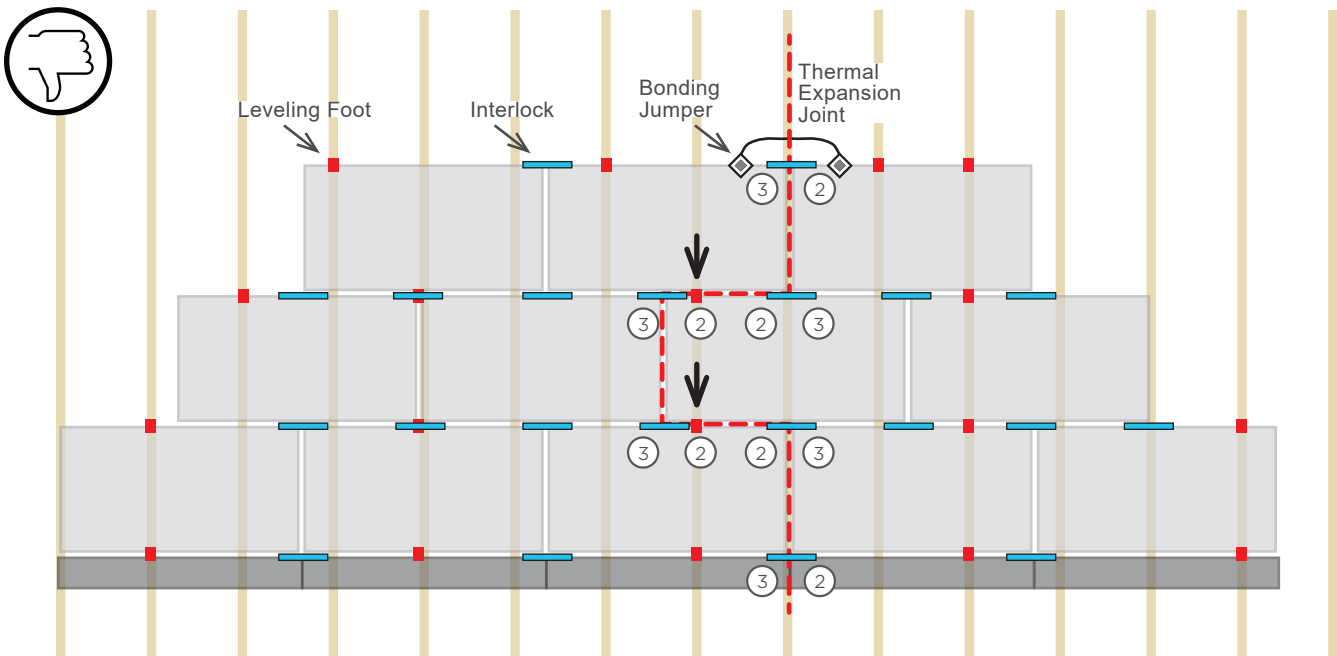
When module rows are offset from one another, creating a Thermal Expansion Joint is more complex, requiring additional Interlocks and a continuous path between them **with no intervening Feet**.

Thermal Expansion Joints on staggered arrays require Interlocks at each juncture where the array is intended to split apart. Each Interlock Zep is turned to Position 2 on one side (allows thermal expansion) and Position 3 (fully locked in place) on the other such that there is an unbroken line between the Zeps that are at Position 2. The installer must not place any Leveling Feet or Cam Feet between these points.

Thermal Expansion Joint for Staggered Arrays: correct layout with no intervening feet between Interlocks.



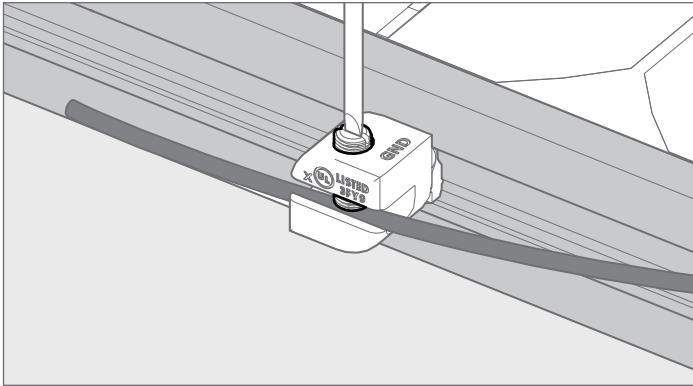
Thermal Expansion Joint for Staggered Arrays: incorrect layout with intervening feet between Interlocks.



APPENDIX: MODULE SERVICING

1. MAINTAIN GROUND PATH

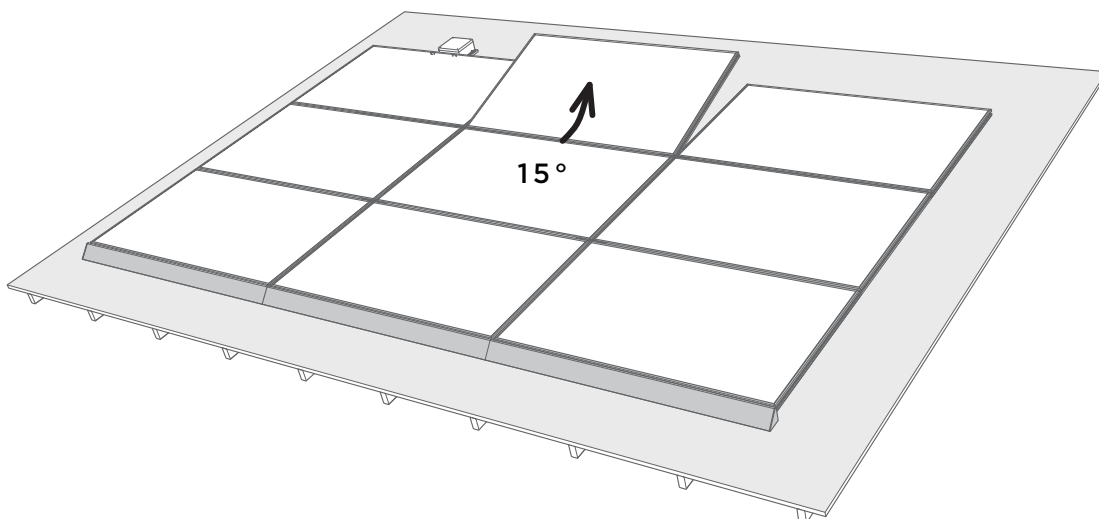
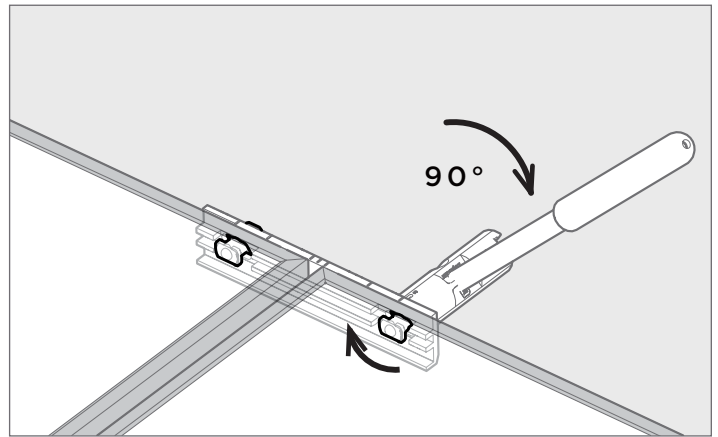
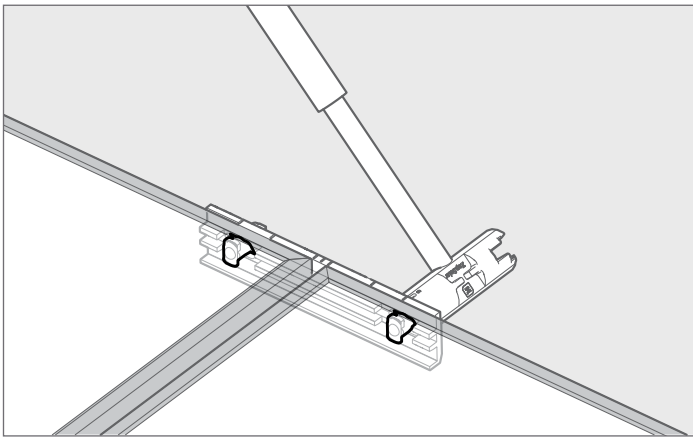
In the event a module must be removed for servicing, use additional Ground Zeps as needed to ensure the ground path is maintained.



2. DISCONNECT MODULE WIRES AND JUMPERS

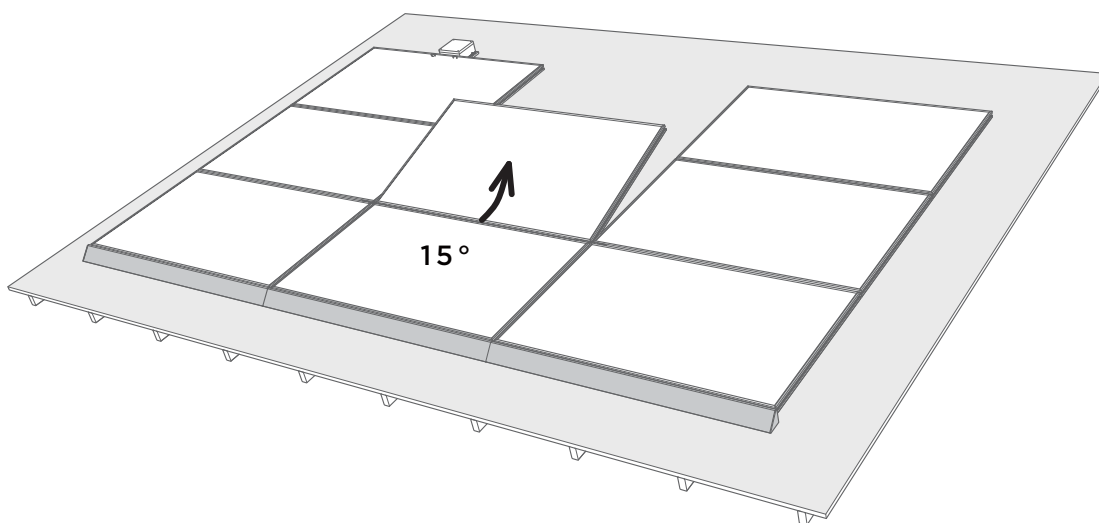
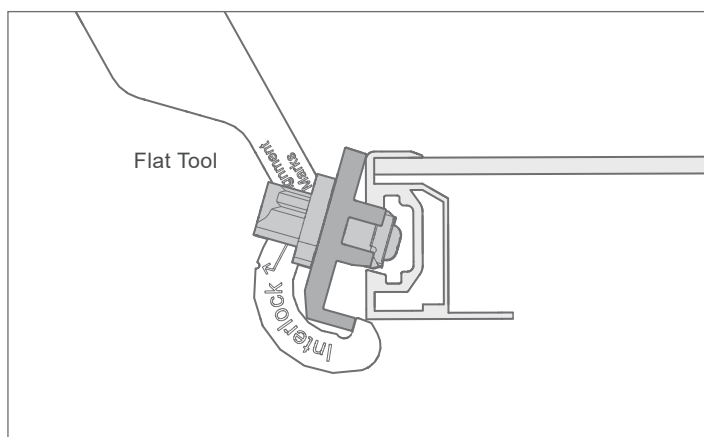
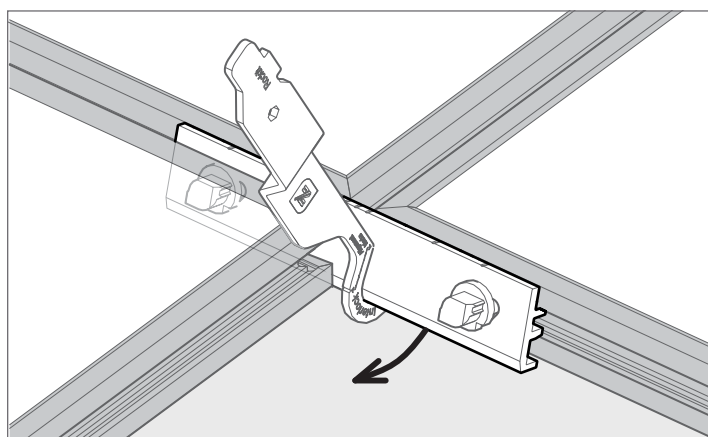
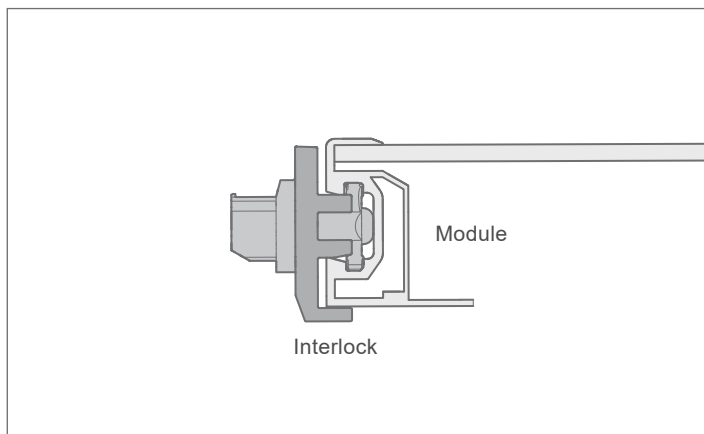
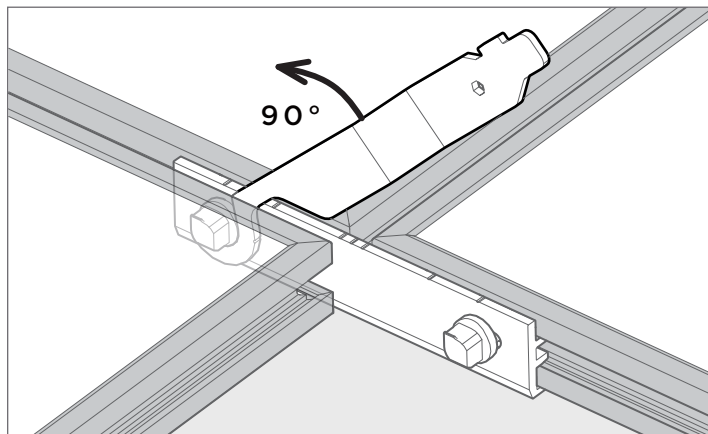
3. RELEASE OUTER MODULES

Remove all Interlocks at the top of the column containing the target module, or module needing replacement. Remove the first module by lifting it up at a 15 degree angle and pulling it off the front Leveling Feet and Interlocks.4.



4. RELEASE MID-ARRAY MODULES

Use the Flat Tool to unlock the mid-array Interlocks and release the modules.



5. RE-ASSEMBLE ARRAY

Replace modules, Leveling Feet, and Interlocks until the array is complete. Use the Flat Tool to fasten mid-array Interlocks.