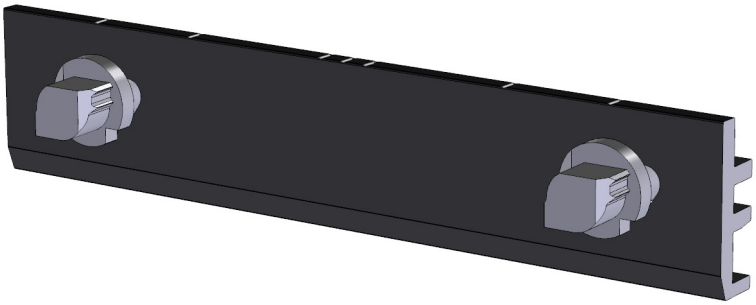
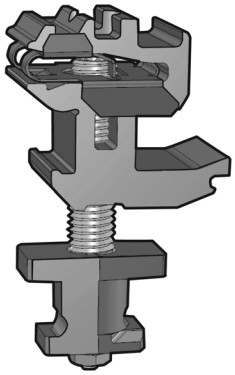
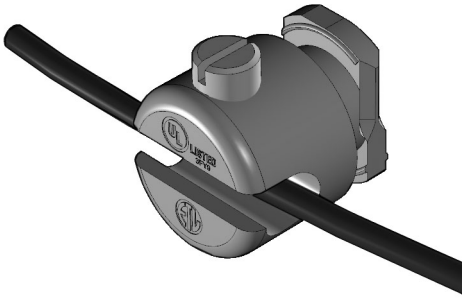
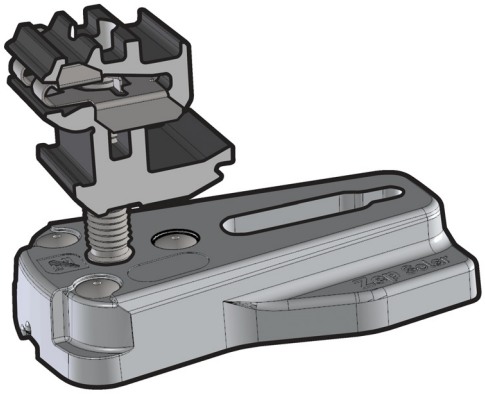








YGE-Z 60 Cell Series PV Modules

Installation Supplement

Yingli Solar

Based on Zep Solar Document No.
800-1444-001 Rev F

File Generated April 9, 2014

Notices

This manual contains important installation instructions for the core hardware components required for mounting Zep Compatible™ PV arrays.

WARRANTY VOID IF NON-ZEP-CERTIFIED HARDWARE IS ATTACHED TO GROOVE IN MODULE FRAME.

This supplement applies to YGE-Z 60 Cell Series PV Modules photovoltaic modules manufactured by Yingli Green Energy Holding Co., Ltd. ("Yingli Solar") and is explicitly written for qualified professionals ("Installer" or "Installers"), including without limitation licensed electricians and NABCEP-Certified PV Installers. This document is intended to serve as a supplement to the *Installation and User Manual* from Yingli Solar. **All of the information in the *Installation and User Manual* also applies to YGE-Z Series PV modules.** YGE-Z 60 Cell Series PV Modules modules feature a Zep compatible groove in the aluminum frame to which hardware manufactured by Zep Solar, Inc. is directly connected.

For detailed instructions about the design and assembly of Zep Compatible systems, refer to the Zep Solar installation support tools available online at **www.zepsolar.com**.

Contents

1 Zep System Layout Dimensions

Zep Compatible™ PV modules have been evaluated for design loads of 50 psf (2400 Pa) on the back surface (e.g., wind load) and on the front surface (e.g., wind and snow load) with the following Zep Solar solutions when installed with the Interlock and Leveling Foot or Cam Foot mounting hardware:

- ZS Comp
- ZS Tile
- ZS Span
- ZS Wave
- ZS Trap
- ZS Seam

The array layouts on the following pages show the maximum allowable spans and range of cantilevers that were evaluated with Zep Solar hardware in order for Zep Compatible modules to obtain the following load ratings:

- 50 psf (2400 Pa) front-side and rear-side load rating, per UL 1703 requirements
- 112 psf (5400 Pa) front-side and 50 psf (2400 Pa) rear-side load rating, per IEC 61215 requirements

Zep Solar hardware must be installed following all applicable instructions. The maximum allowable spans for each Zep Solar solution based on project and site conditions can be obtained as follows:

- Use the Zepulator online design tool at **www.zepulator.com**
- Refer to the Engineering Certification Letters and Span Tables on the “Support” page at **www.zepsolar.com**

1.1 Array Layouts, 50 psf (2400 Pa) Design Load

Figure 1.1 Layout With Leveling Feet, Landscape Example, 50 psf (2400 Pa) Design Load

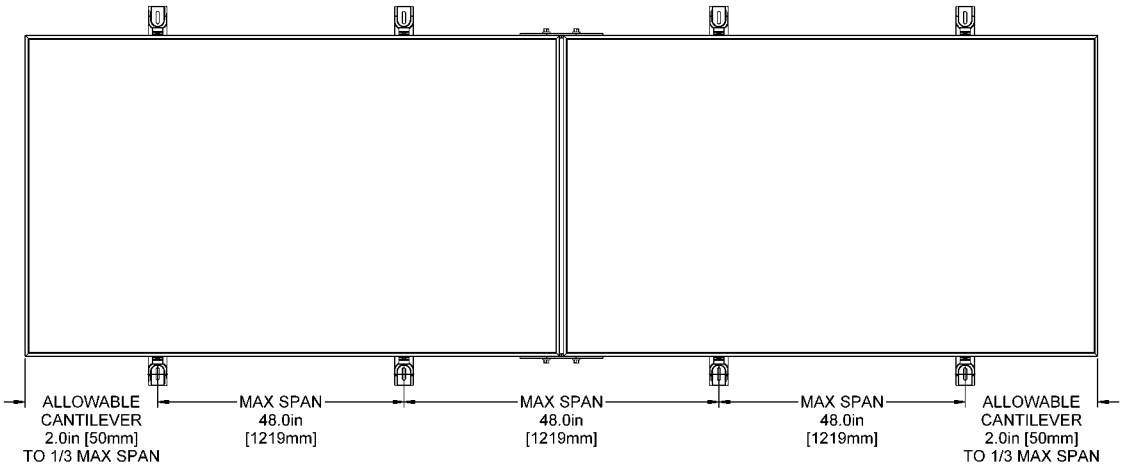


Figure 1.2 Layout With Leveling Feet, Portrait Example, 50 psf (2400 Pa) Design Load

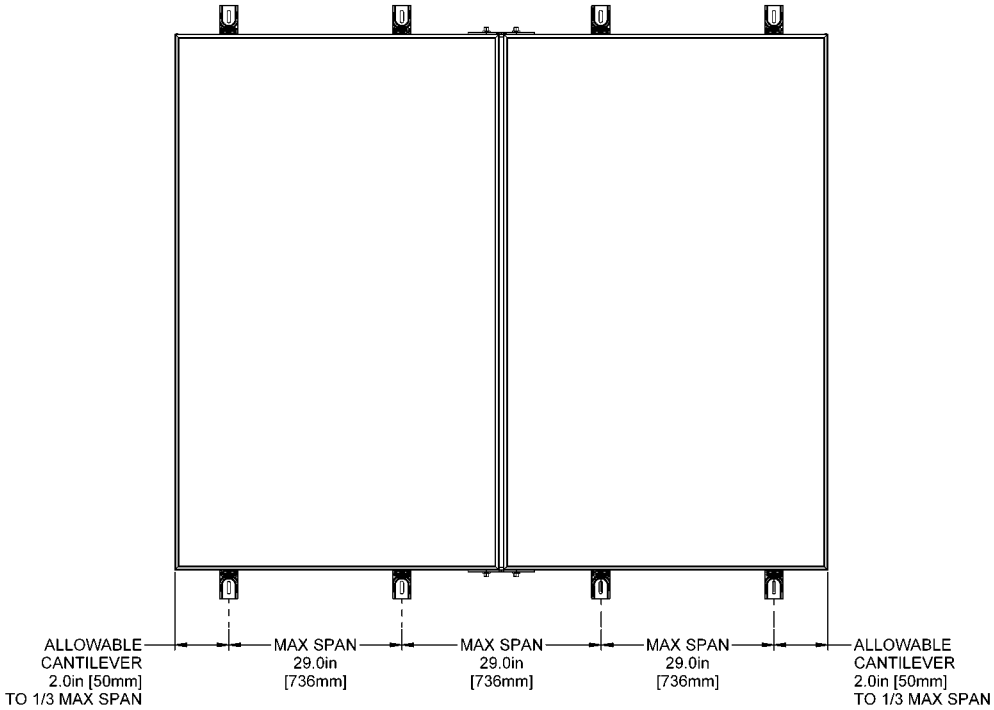


Figure 1.3 Layout With Cam Feet, Landscape Example, 50 psf (2400 Pa) Design Load

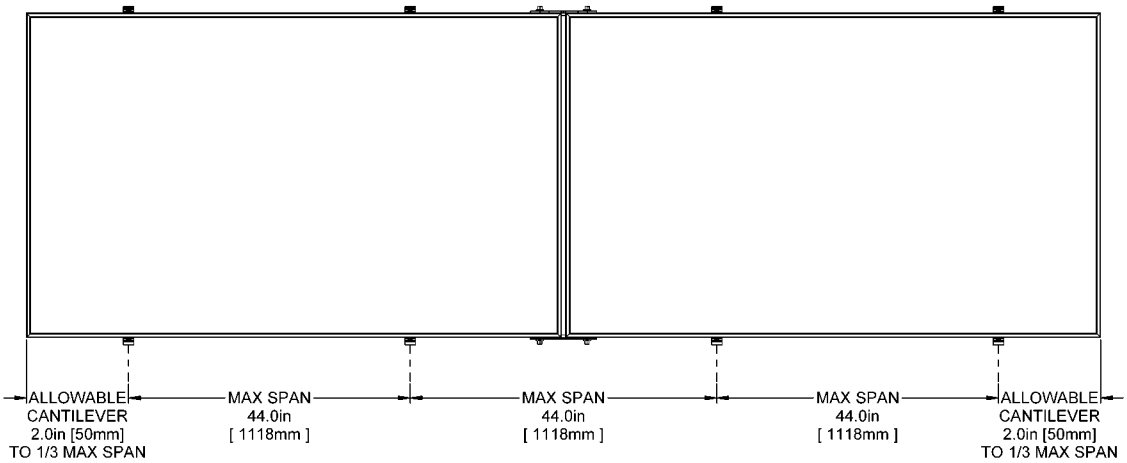
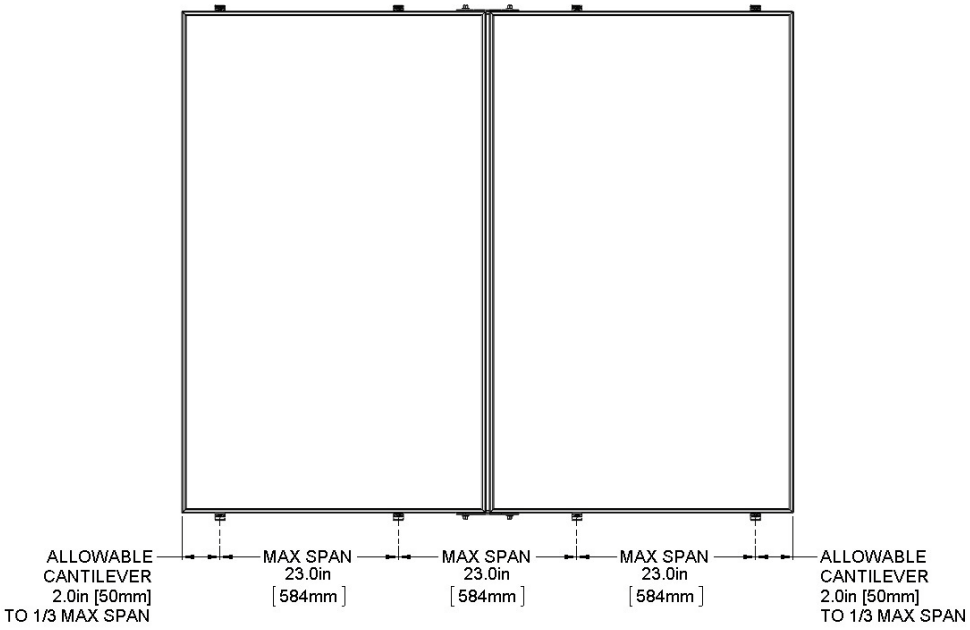


Figure 1.4 Layout With Cam Feet, Portrait Example, 50 psf (2400 Pa) Design Load



1.2 Array Layouts, 112 psf (5400 Pa) Design Load

Figure 1.5 Layout With Cam Feet, Landscape Example, 112 psf (5400 Pa) Design Load

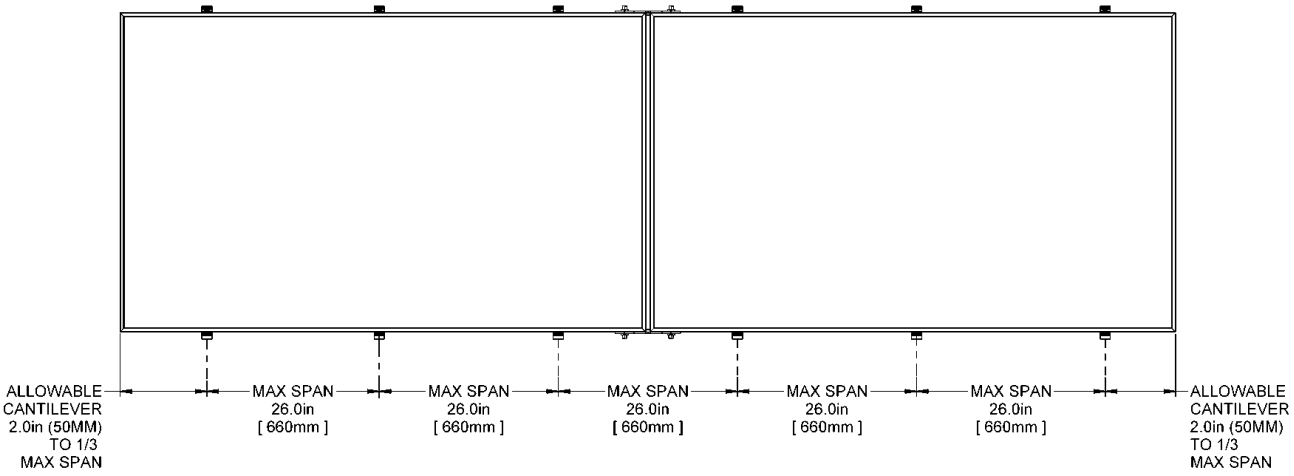
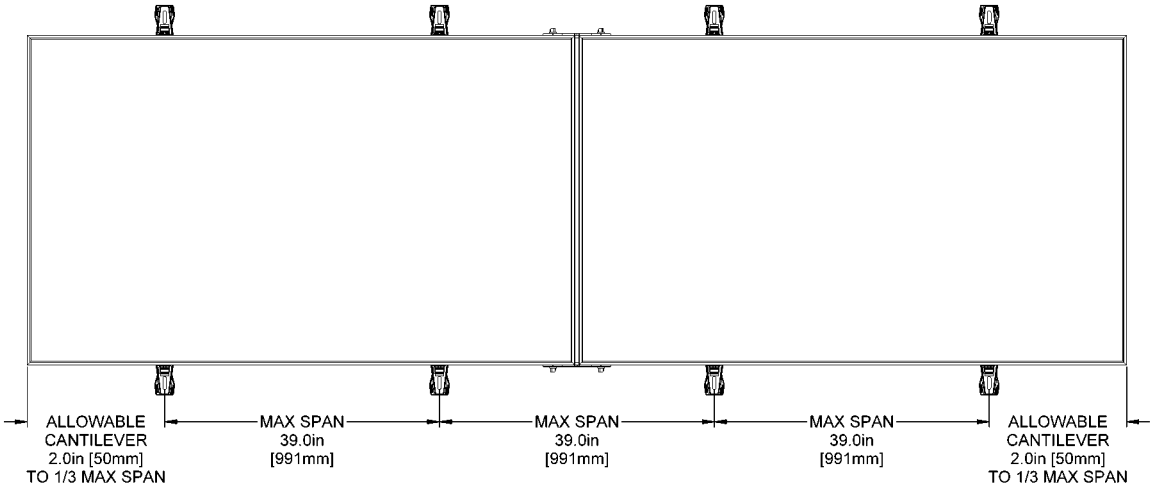


Figure 1.6 Layout With Leveling Feet, Landscape Example, 112 psf (5400 Pa) Design Load

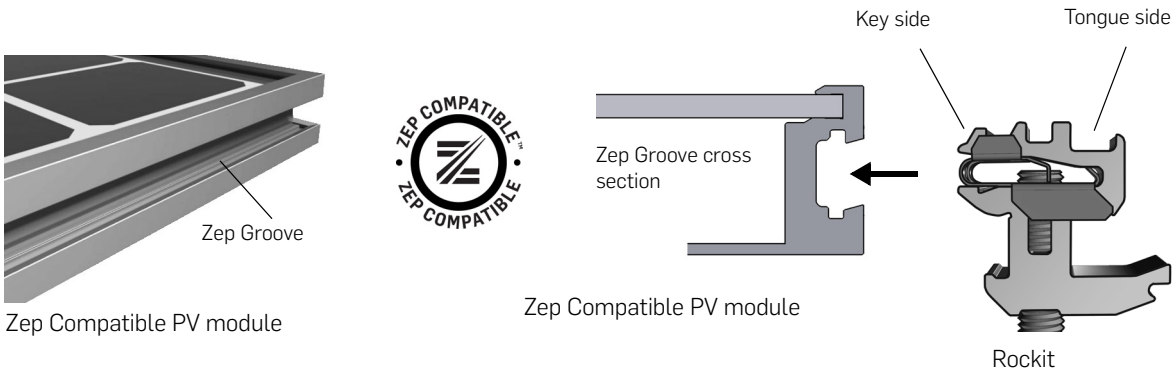


2 Zep Compatible™

Zep Solar mounting solutions are based on the Zep Groove, a patented module frame profile designed to mate easily and precisely with Zep components. Module frames with the Zep Groove are considered "Zep Compatible", and are manufactured according to specifications determined by Zep Solar, Inc.

2.1 Zep Groove and Rockit

Figure 2.1 Zep Groove and Rockit



One example of Zep Compatible hardware mating is the “Rockit”. The Rockit is a hardware feature used to secure PV modules to the roof attachments. The Rockit fits into the Zep Groove on both sides: The Key side inserts, while the Tongue side receives.

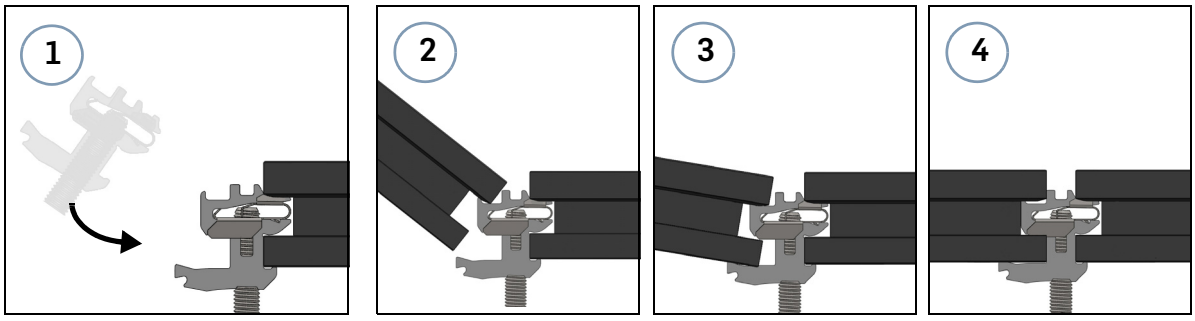
The Rockit is used in several Zep Solar hardware components, including the Cam Foot and the Leveling Foot.

2.2 Key and Tongue

The Key and Tongue concept informs all Zep Compatible designs. 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 side.

2.2.1 Key and Tongue: Module Drop-In on Rockit

Figure 2.2 Module Drop-In Example



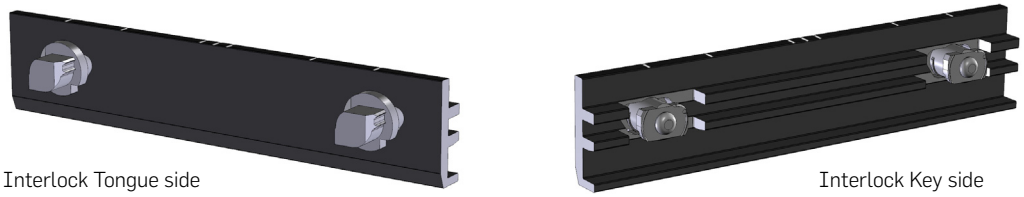
First, the Key side of the Rockit is inserted into the Zep Groove.

In the next row, modules are “dropped in” on the Tongue side (the receiving side). Each Tongue provides an in/out adjustability with the Zep Groove, allowing for optimized placement of each module.

2.2.2 Key and Tongue: Interlock

Another example of the use of Key and Tongue in a Zep Compatible design is seen with the Interlock, a component that couples and bonds two modules together. Here, the Key and Tongue are differently shaped, but they still fit into the Zep Groove in the same manner as the Rockit.

Figure 2.3 Interlock, Key and Tongue Side Views



Interlock Tongue side

Interlock Key side

3 Component Installation

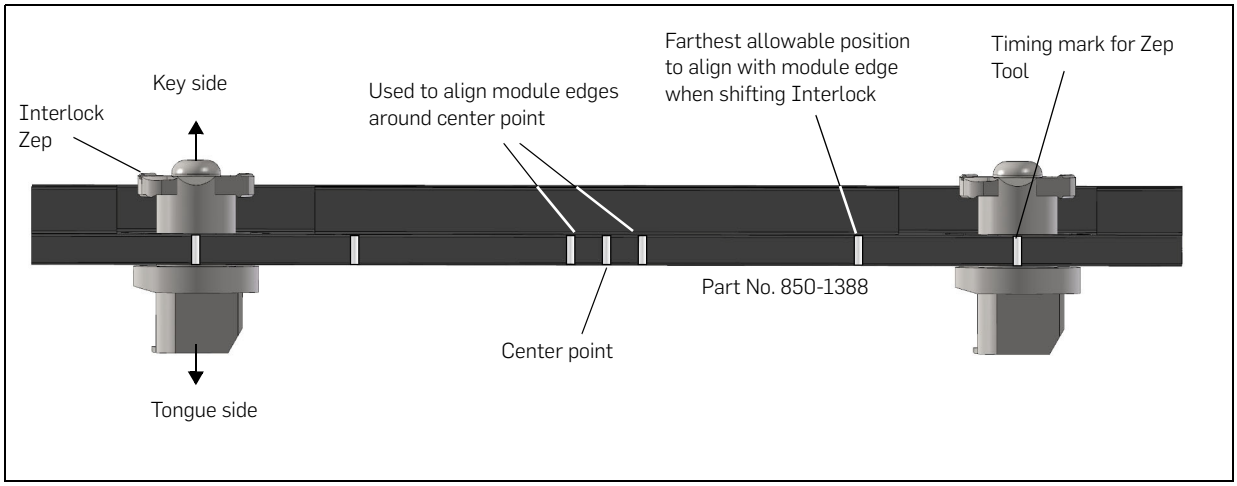
Zep Solar components are installed using precision-fitted, quarter-turn connections.

3.1 Interlock Installation

The Interlock provides module-to-module frame bonding through the interface with the Zep Groove. The Interlock is UL Listed to UL 2703.

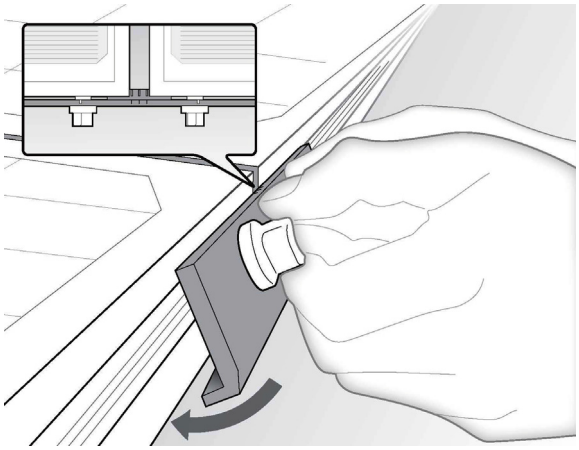
Alignment marks along the top edge of the Interlock aid in module positioning and tightening of the fasteners.

Figure 3.1 Interlock Alignment Marks



The Interlock is used to connect modules together.

Figure 3.2 Interlock Insertion

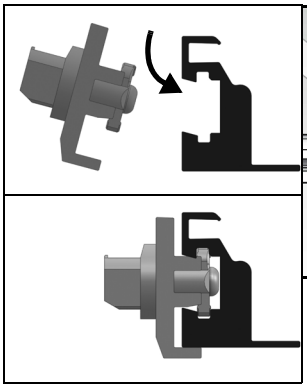


During installation of the Interlock, the Key side is inserted into the Zep Groove with a downward sweeping motion.

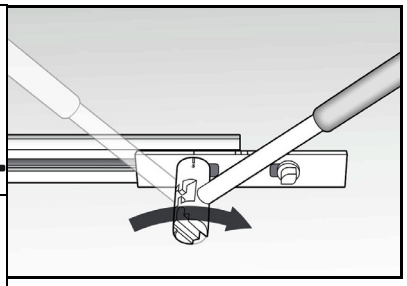
When modules are connected together using the Interlock, there must be a 1/2" (12.7mm) gap between modules

After the Interlock is inserted into the Zep Groove, the fasteners on the Interlock (the Interlock Zeps) are rotated to provide East-West module bonding.

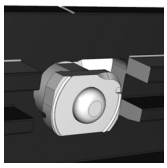
Figure 3.3 Interlock Key Side Installation Uses Zep Tool



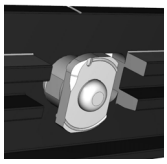
Key side of Interlock is manually inserted into Zep Groove



The fasteners on the Interlock (the "Interlock Zeps") are tightened one-quarter turn to lock securely into the Zep Groove.



Open



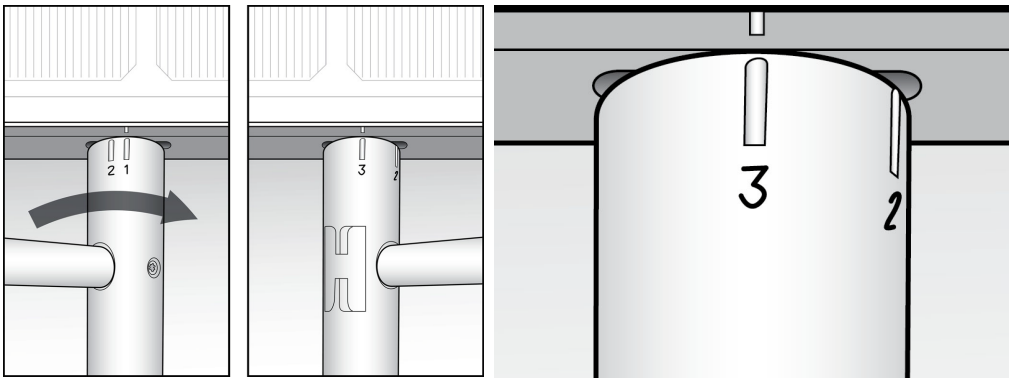
Closed

Rotation seen from Key side

Alignment marks on the Interlock and the Zep Tool indicate exactly how far to rotate the Interlock Zeps to secure the Key side. Installers should not over-tighten or under-tighten.

Figure 3.4 Zep Tool Rotation Positions

The Zep Tool is rotated from Position 1 to Position 3.



Position 1 - Open Position 3 - Closed

When the Interlock Zeps are rotated to the closed position (Position 3), they are also in the correct position to receive a module drop-in on the Tongue side. The difference between positions is easily visible.

Figure 3.5 Interlock Zeps Showing Open and Closed Position

Position 1 - Open Position 3 - Closed

After the Interlock Zeps are secured on the Key side, the next row of modules is dropped-in on the Tongue side to provide North-South bonding within the array.

Figure 3.6 Module Drop-In on Interlock Tongue Side 1

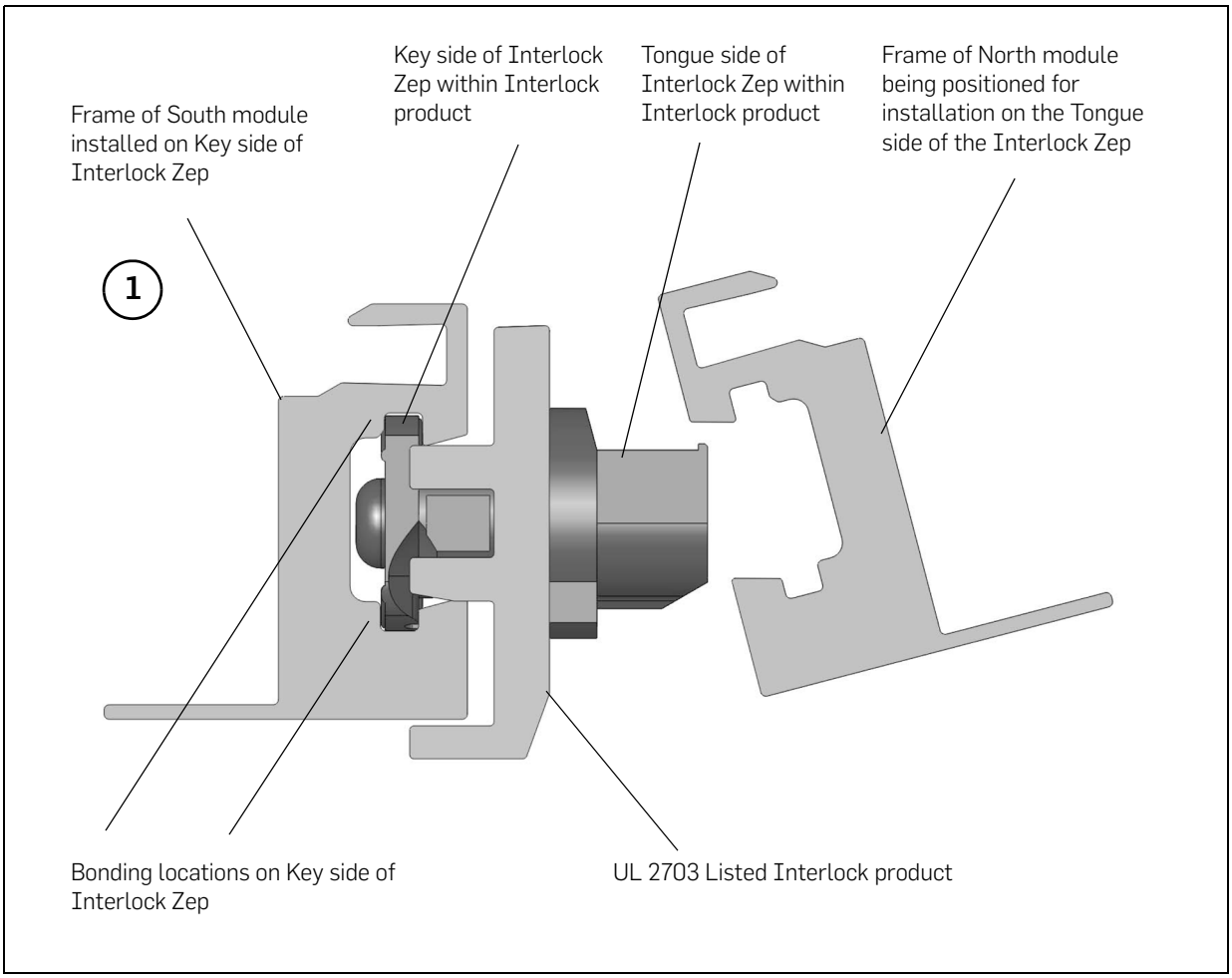


Figure 3.7 Module Drop-In on Interlock Tongue Side 2

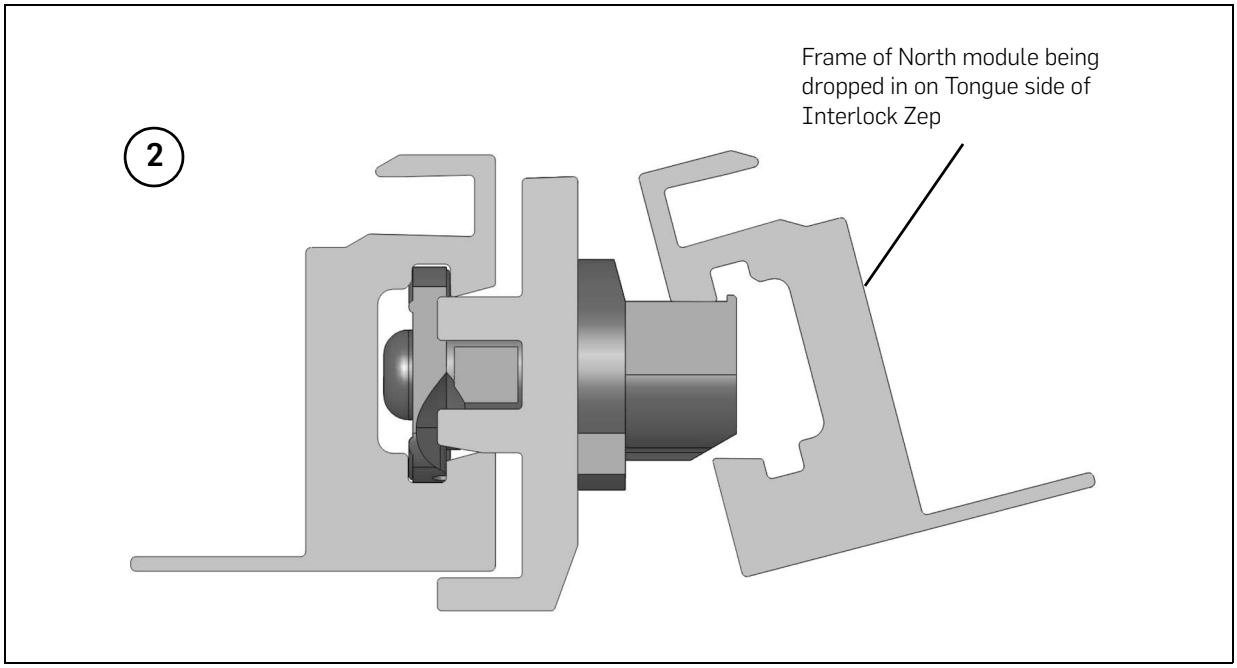


Figure 3.8 Module Drop-In on Interlock Tongue Side 3

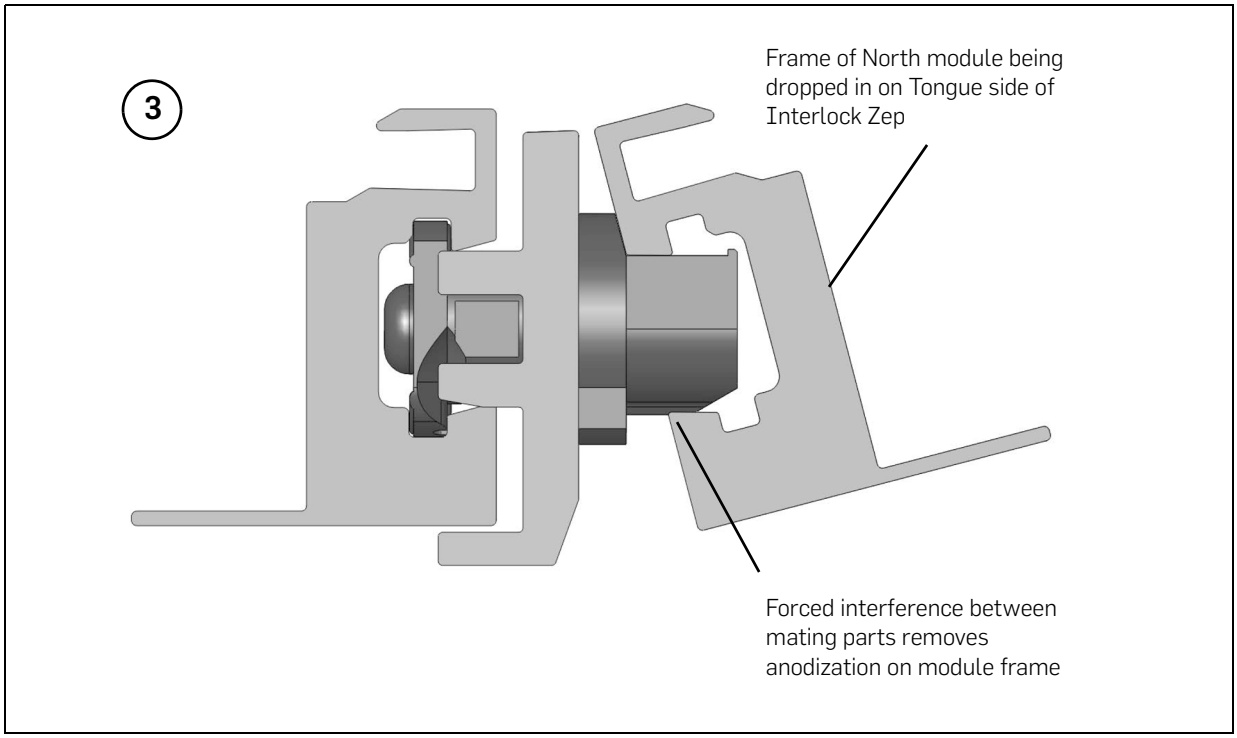
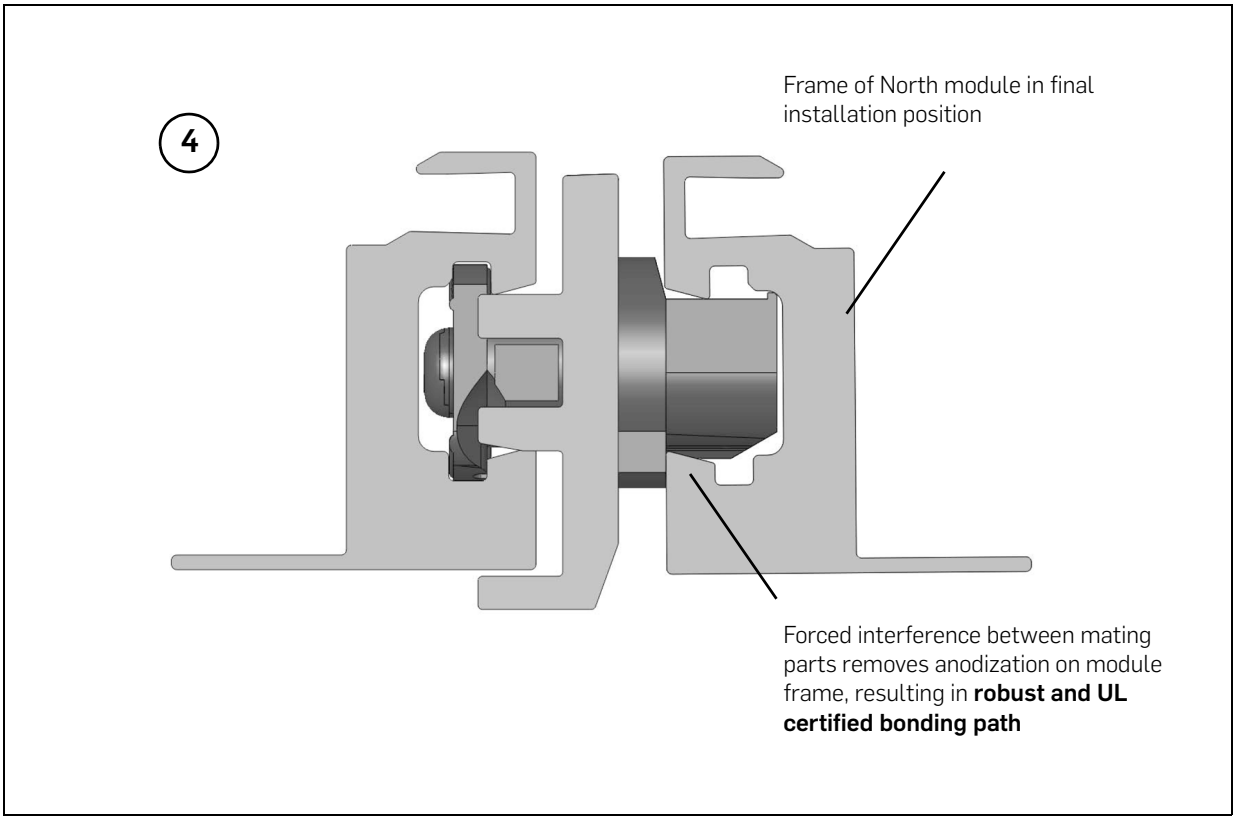


Figure 3.9 Module Drop-In on Interlock Tongue Side 4

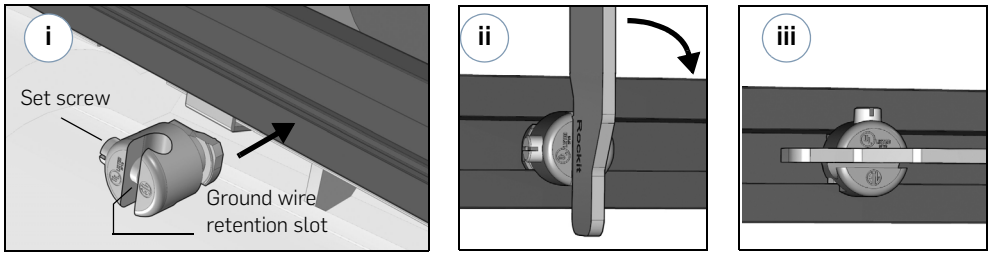


3.2 Ground Zep Installation

The Ground Zep is used to provide a path to ground for a Zep Compatible array. The Ground Zep is UL Listed to UL 467 and UL 2703.

Figure 3.10 Ground Zep Installation

1 Insert a Ground Zep Into Module



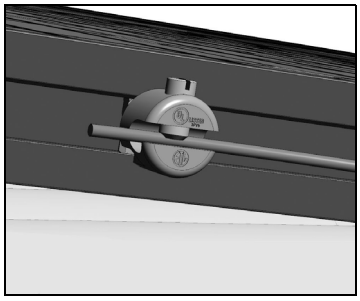
Insert a Ground Zep in the Zep Groove of any module around the array perimeter.

Start with the set screw at 9 o'clock position (pointing left).

Using either the Zep Tool or the Flat Tool (shown), lock the Ground Zep into place by turning 1/4 turn clockwise. After the Ground Zep is turned 90 degrees, the set screw should be pointing straight up.

This locks the Ground Zep into the Zep Groove and creates a solid ground bond with the module frame.

2 Connect Ground Zep to Building Ground/Earth.



Insert solid copper ground wire into the ground wire retention slot and turn the set screw wtih a flat-bladed screwdriver until the ground wire is captured by the set screw. To fully secure, torque the set screw as follows:

- 14-10 AWG: 40 inch-lbs
- 8 AWG: 45 inch-lbs
- 6 AWG: 50 inch-lbs

3.3 Cam Foot Installation

The Cam Foot is used to connect Zep Compatible modules to a Zep Compatible roof attachment system. For ZS Span, the Cam Foot connects modules to Zep Solar Spanner Bars.

Figure 3.11 Cam Foot

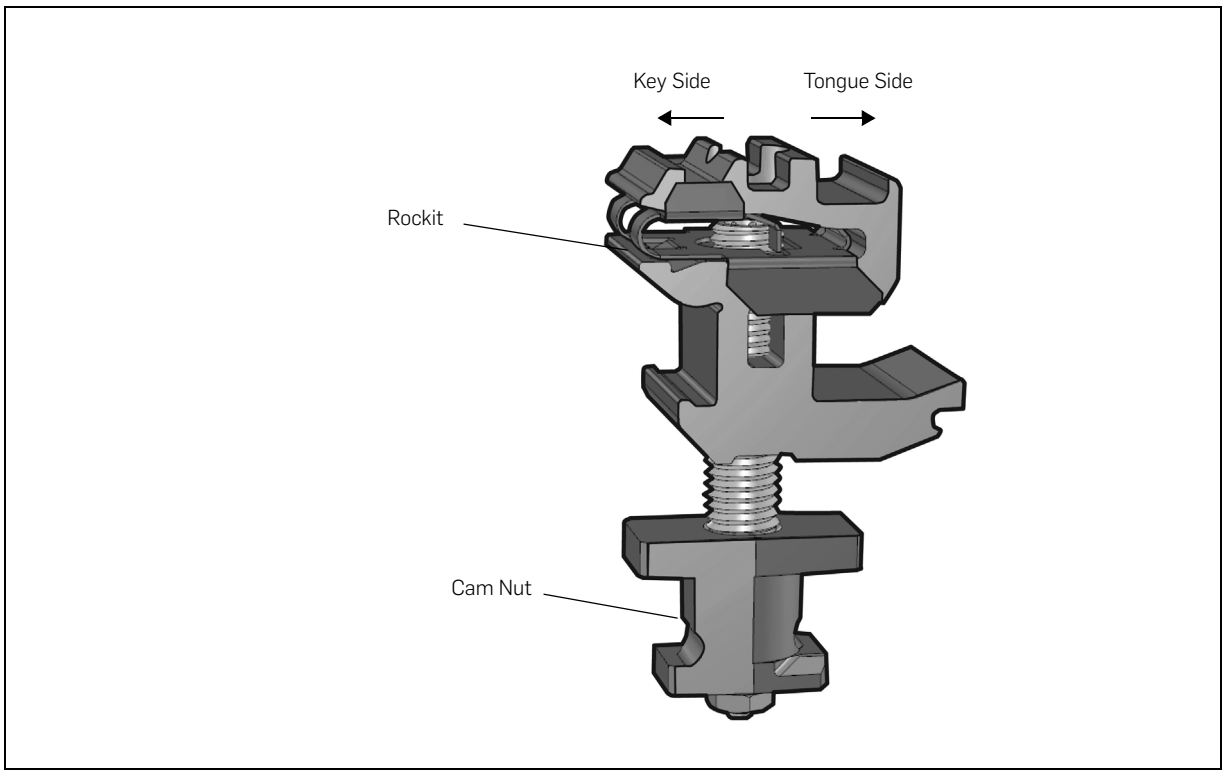
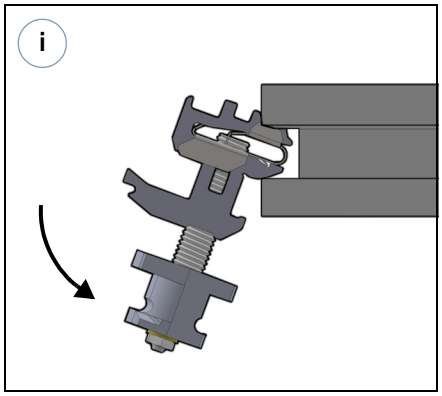
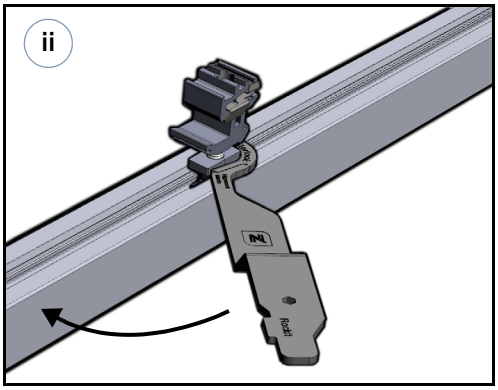


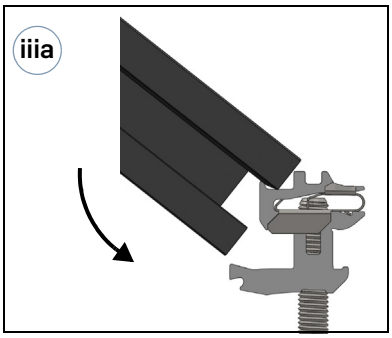
Figure 3.12 Cam Foot Installation - Zep Groove and Spanner Bar

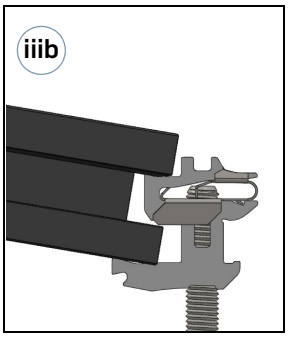


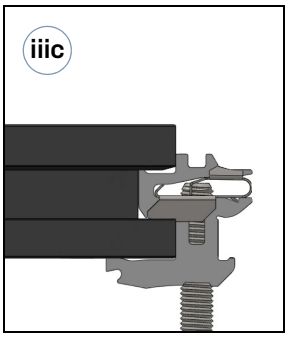
Install the Cam Foot into the rear edge of a module row by inserting the Key side into the Zep Groove. Use a sweeping downward force to rotate the Cam Foot until the Cam Nut is positioned within the Spanner Bar channel.



Use the Flat Tool to rotate the Cam Nut 100 degrees clockwise to lock the Cam Nut into the Spanner Bar.







Install the next row of modules by dropping the module onto the Tongue side of the Cam Foot Rockit to engage the Zep Groove. Pivot the module downwards so that the top surface of the module is parallel with the roof surface.

3.4 Leveling Foot Installation

The Leveling Foot is used to connect Zep Compatible modules to a Zep Compatible roof attachment system. For ZS Comp, the Leveling Foot connects modules to Zep Solar Comp Mounts or Zep Solar-approved standoffs.

Figure 3.13 Cam Foot

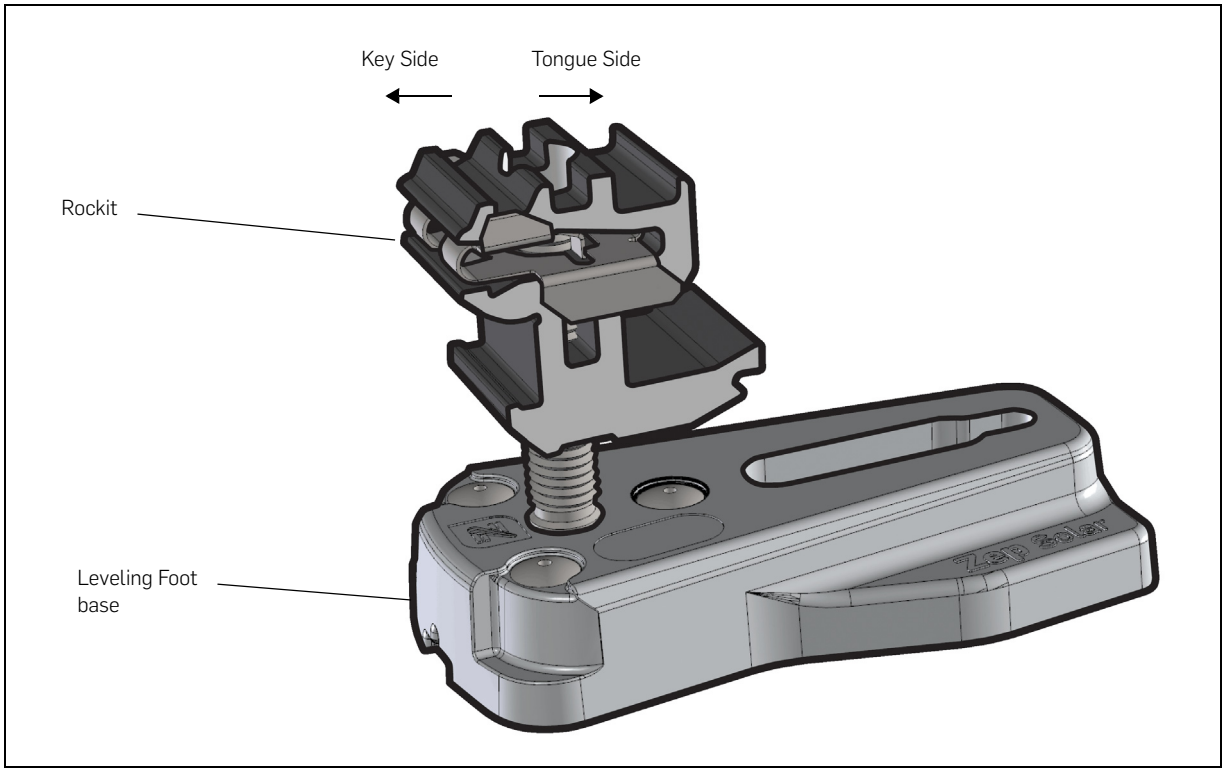
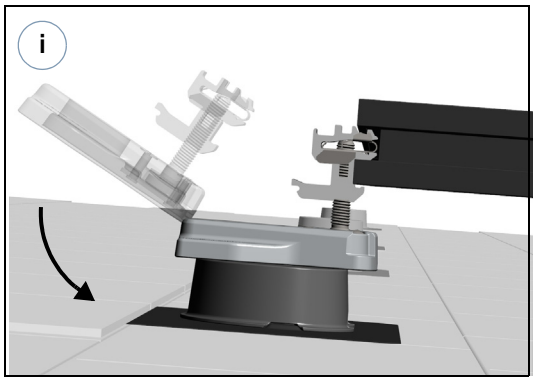
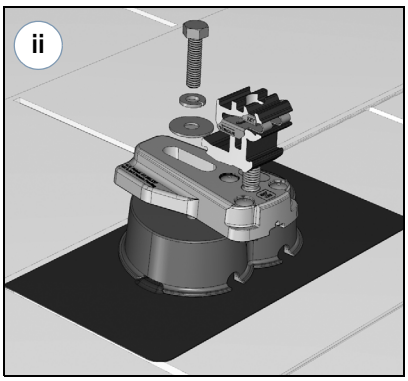


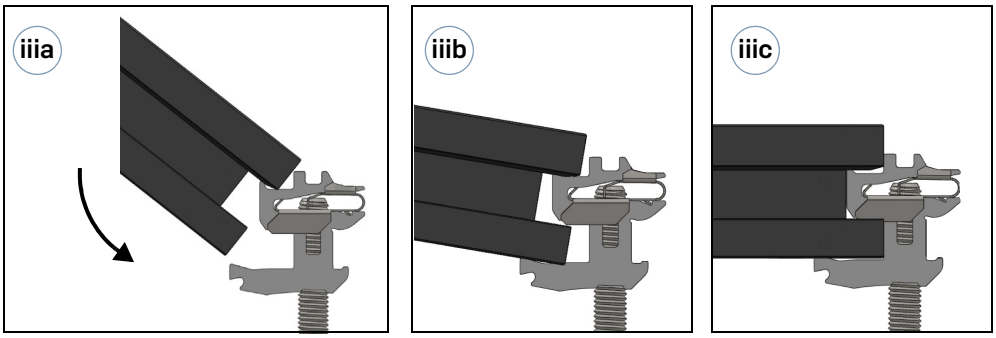
Figure 3.14 Leveling Foot Installation - Zep Groove and Comp Mount



Install the Leveling Foot into the rear edge of a module row by inserting the Key side into the Zep Groove, using a sweeping downward force. Base of Leveling Foot should be positioned directly over the Comp Mount.



Secure Leveling Foot base to Comp Mount using hardware provided by Zep Solar, Inc.



Install the next row of modules by dropping the module onto the Tongue side of the Leveling Foot Rockit to engage the Zep Groove. Pivot the module downwards so that the top surface of the module is parallel with the roof surface.

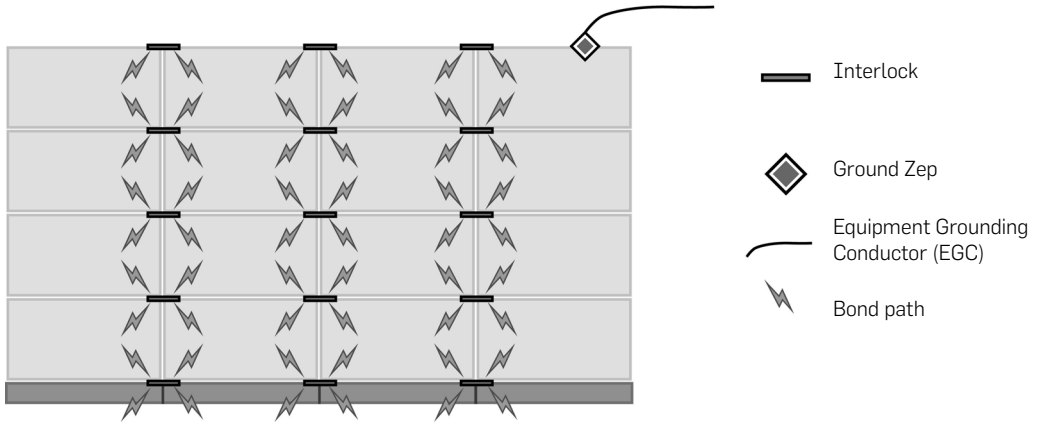
4 Array Bonding

The Zep Compatible design concept allows the installer to build a hyper-bonded array with a single ground bond connection. In a hyper-bonded array, every module is structurally and electrically bonded to the surrounding modules, on all sides. The rotation of the Key side into the Zep Groove, and the dropping in of the next row of PV modules onto the Tongue side, acts to establish a bond for all UL listed components by cutting through the surface coating on the Zep Groove. This eliminates the need for extensive lengths of copper wire run to every module in order to ground the array.

4.1 Grounding Path Examples

The following examples show how a Zep Compatible PV array is hyper-bonded using Interlocks.

Figure 4.1 Grounding Path - Simple Array



NOTE: If an array contains Hybrid Interlocks or Thermal Expansion Joints, an additional Ground Zep may be required. Please refer directly to the Zep Solar installation manuals for further details.

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