



# KINETIC SOLAR K-RACK™ INSTALLATION GUIDE

Kinetic Solar Racking and Mounting

*UL 2703, LTR-AE-001-2012 and TIL A-40 Listed*



## 1. Disclaimer

### Limitation of Liability/Precautionary Measures

Kinetic Solar Racking and Mounting Inc. (henceforth referred to as 'Kinetic Solar') does not install any components of its Racking and Mounting systems. Kinetic Solar does not have any duty or responsibility for the safe and proper installation and/or maintenance of its Racking and Mounting systems, including job site safety standards and procedures.

All installation work must comply with the applicable regional (Authority Having Jurisdiction) and local regulations (including all applicable Building Codes) or other national or international electrical standards and are the sole responsibility of the purchaser, installer, contractor, and/or developer.

Kinetic Solar shall not be held responsible for damages of any kind, including but not limited to bodily harm, damage to property, or injury. Kinetic Solar shall not be held responsible for the proper compliance or non-compliance with the instructions detailed in this manual including handling solar modules, solar racking, or system installation.

Before attempting to install, operate or service a Kinetic Solar system, all instructions should be read and understood. Failure to follow or interpret these instructions/guidelines may result in death, injury, or property damage.

In addition to the instructions provided in this guide, the module manufacturer's mounting guidelines must also be adhered to. It is the sole responsibility of the purchaser, installer, contractor, and/or developer to ensure that a compatible module is used.

Please retain this manual for future reference. Kinetic Solar reserves the right to make additions, deletions, and modifications to the content of this document without prior notice.

Geocel 4500 Roof Bonding Sealant, BES 925 Roof Bonding Sealant, or equivalent is required for wind speeds above 40km/h when installed on pitched roofs.

This manual is only valid for the following Kinetic Solar Racking Systems: K-Rack

The instructions contained in this manual are exclusive to the products referenced. Use of any other products in conjunction with the listed products is done at one's own risk. Failing to comply with the above may result in the warranty being voided.

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#### 4. Certification Details

The system has been evaluated to UL 2703 and TIL A-40 for Grounding/Bonding and Mechanical Loading. The largest module tested with this system was 2384 mm x 1303 mm in size. This racking system may be used to mount and ground PV modules equal to or smaller than 2384 mm x 1303 mm (or equivalent area) in size. Please see Kinetic Solar's List of Compatible Modules Revision 7 for more details.

#### 5. Common System Features

##### 5.1. Torque Specifications

Product	Fastener Size	Torque ft-lbs (N-m)
Lay-In Ground Lug (Nut and Bolt)	#8	N/A
L-Brackets / Angled L-Brackets	5/16"	12 (16.27)
Giraffe Mount (Excluding Roof Mounting Hardware)		
Rhino Mount (Excluding Roof Mounting Hardware)		
Quonset Hut Mount		
Ridge Rail Mount		
Toepedo Clamp		
Flashing Kit (Excluding Roof Mounting Hardware)		
Mid-Clamp / End Clamp		
Joiner		
Top Mount - Micro Inverter Mounting Kit for Bifacial Rail		
Top Mount - Micro Inverter Mounting Kit for Rapid1 Rail		
Standing-L / Bear Clamp		
Hanger Bolts (Excluding Lag Screw Portion)		
Flashing Kit Base Plate		
4" Base Plate (Excluding Roof Mounting Hardware)		
Hat Rail Micro Inverter Mount		
Conduit Clamp / Toe Clamp		
Conduit Attachment Bracket for Flashing Kit		
Top of Rail Accessory Clamp		
Grounding Lug (to rail)		
Kinetic Rail Jumper Kit (to rail)		
U-Bracket Clamp		
Grounding Lug (to wire)		3 (4.07)
Kinetic Rail Jumper Kit (to wire)		N/A
Rodent Guard Clamp		N/A
Rodent Guard Clip		N/A
Mesh Stud Nut for Bifacial Rail		N/A
End Cap		N/A
Custom L	3/8"	20 (27.12)
Fall Restraint		
Clay Tile Roof Mount		
Tube U-Clamp		

Figure 1 - Torque Specifications

## 5.2. Kinetic Product Configurations

Product Category	Components
M-Type (For use with mill finish aluminum rail <b><u>only</u></b> )	KJS2-MM KHGLUG-M KMWCxxxx-MM KECxxxx-MM KHMNS-MM KHMNL-MM KHMNT-MM KHMTB-MM
A-Type (For use with anodized rail or mill finish rail)	KJS2W-MA KJS2W-BA KJS2W-CA KBRJ-MA KBRU-MA KHGLUG-A KMWCxxxx-BA KMWCxxxx-CA KECxxxx-BA KECxxxx-CA KHMNS-MA KHMNL-MA KHMNT-MA KHMTB-MA
G-Type (For use with galvanized steel only)	KHGLUG-G KMWCxxxx-G KECxxxx-G KAGMM-G

### 5.2.1. Understanding Kinetic SKUs

The following SKU suffixes are used:

____-MM	Mill finished component for use with mill finish rail <b><u>only</u></b>
____-M	For use with mill finish rail <b><u>only</u></b>

____-MA	Mill finish component for use with anodized rail or mill finish rail
____-CA	Clear anodized component for use with anodized rail or mill finish rail
____-BA	Clear anodized component for use with anodized rail or mill finish rail
____-A	For use with anodized rail or mill finish rail
____-G	For use with galvanized rail

KJS2-MA	Example	Kinetic Joiner - Mill Finish for Anodized Rail or Mill Finish Rail
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## 5.3. Components

### 5.3.1. Kinetic Nut (K-Nut)

The Kinetic Nut (K-Nut) [*KHNTS-M* or *KHNTS-A*] is a common component utilized in many Kinetic products.

#### 5.3.1.1. Inserting *K-nut* into side channel

If attaching a component to the side channel of the rail such as an L-Bracket follow the steps shown in Figure 2.

1. At a 30° angle insert the L-Bracket with the K-Nut at the top of the slot.
2. Rotate into position so that the entirety of the K-Nut ends up inside the channel.
3. Drop into place. The inserted component should sit in place and easily slide back and forth in the channel.



Figure 2: Inserting K-Nut into Side Channel



#### 5.3.1.2. Inserting *K-Nut* into top channel

If attaching a component to the top channel of the rail such as an End or Mid Clamp, follow the steps shown in Figure 3

1. At a 30° angle insert the clamp assembly with the clamp held at the top of the bolt. Ensure that the K-Nut is positioned at the lowest point on the bolt so that there is clearance to pivot the clamp into an upright position.
2. Rotate into position so that the entirety of the K-Nut is inside the top channel of the rail.
3. Drop into place. The inserted component should easily slide back and forth in the channel see Figure 3 B.

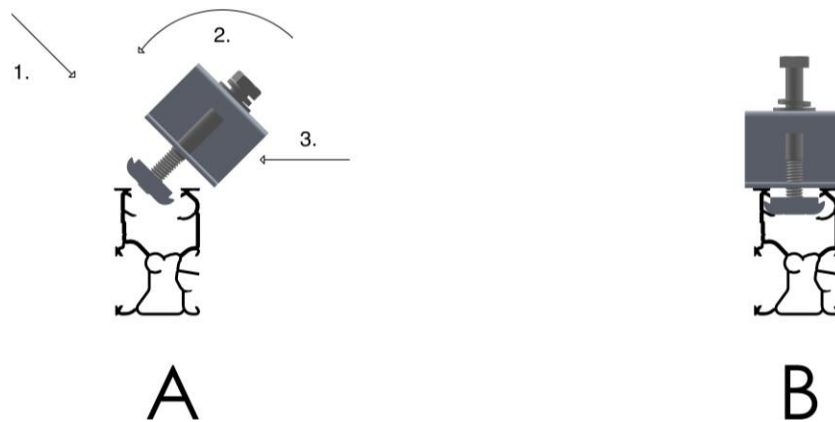


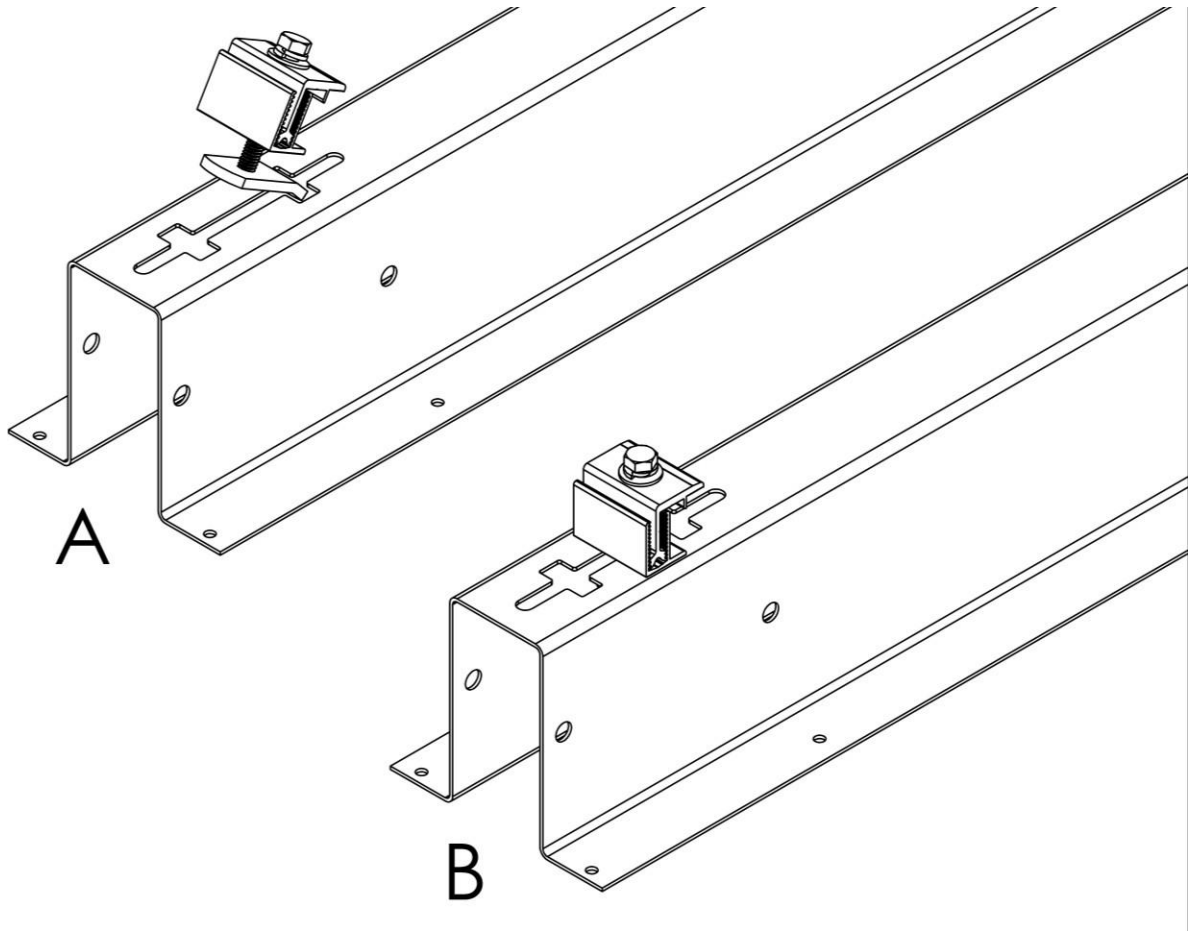
Figure 3 - Inserting K-Nut into Top Channel (End-Clamp shown)

#### 5.3.1.3. *K-Nut* Tightening Procedure

For components utilizing the K-Nut, check to ensure that the K-Nut is properly seated in the channel and that its sides are parallel to the length of the rail.

### 5.3.2. Steel Nut

When installing Mid or End Clamps onto the Hat Rail, follow the steps shown below:



- Insert bent end of Nut into wide portion of slot at a 30° angle.
- Insert nut fully into slot.
- Drop into place.

### 5.3.3. Cable Management Options

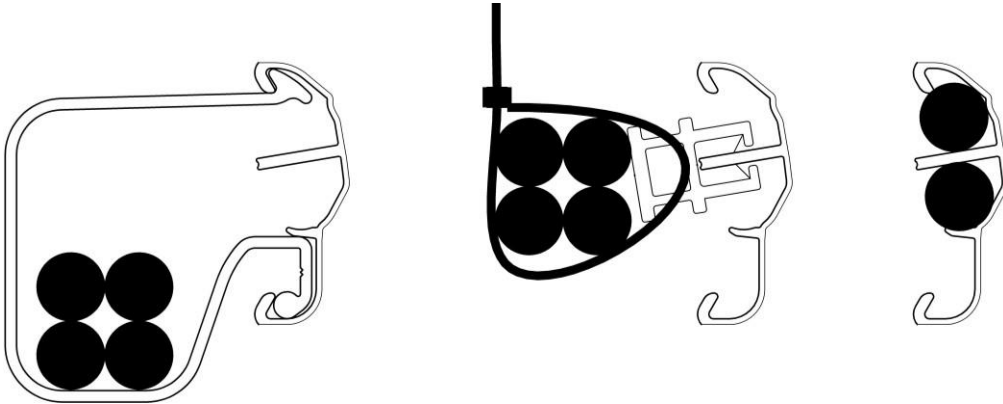


Figure 5 Cable Management Options (Left) Cable Raceway, (Middle) Lock-On Cable Tie, (Right) Integrated Cable Management

#### 5.3.3.1. Lock-on Cable Tie

Unlike traditional cable ties, the Rail Locking Cable Tie (KCMT-1) connects directly to Rail instead of wrapping around it; extending the life of the Cable Tie by reducing stress points.



Figure 6 Lock-on Cable Tie

#### 5.3.3.2. Integrated Cable Management

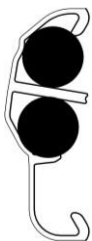


Figure 7 Integrated Cable Management

The rail itself provides a channel which may be used to secure cables in certain scenarios. Simply press the cable into the grooves at the top of the cable management channel along the length which you would like to secure. A maximum of two cables can be secured this way using the channel.

#### 5.3.3.3. Cable Raceway

The Cable Raceway may be attached to the cable management channel or the side channel. The same method of installation can be used for both. Cable Raceway Kits include a sufficient number of segments to cover the indicated length or span between L-Brackets.

Sold in kits of 16", 24", 32", & 48"

1. Hang the Cable Raceway segment on the bottom edge of the side channel of the rail. Lay cables into Cable Raceway segment.
2. Rotate Raceway segment until it snaps into top edge of side channel of rail

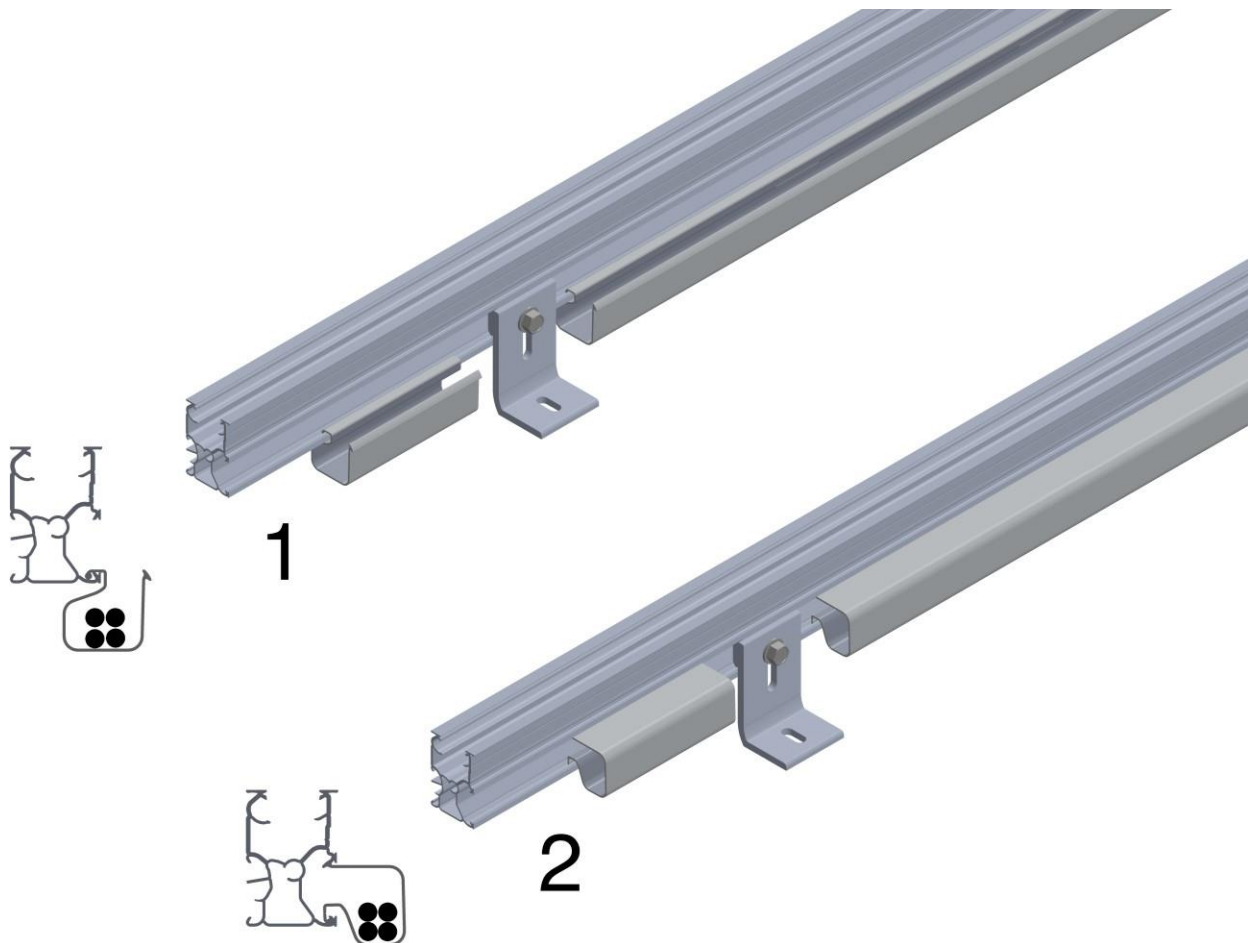


Figure 8 Cable Raceway Installation Procedure

## 6. Bonding Path

### 6.1. Traditional Grounding Path

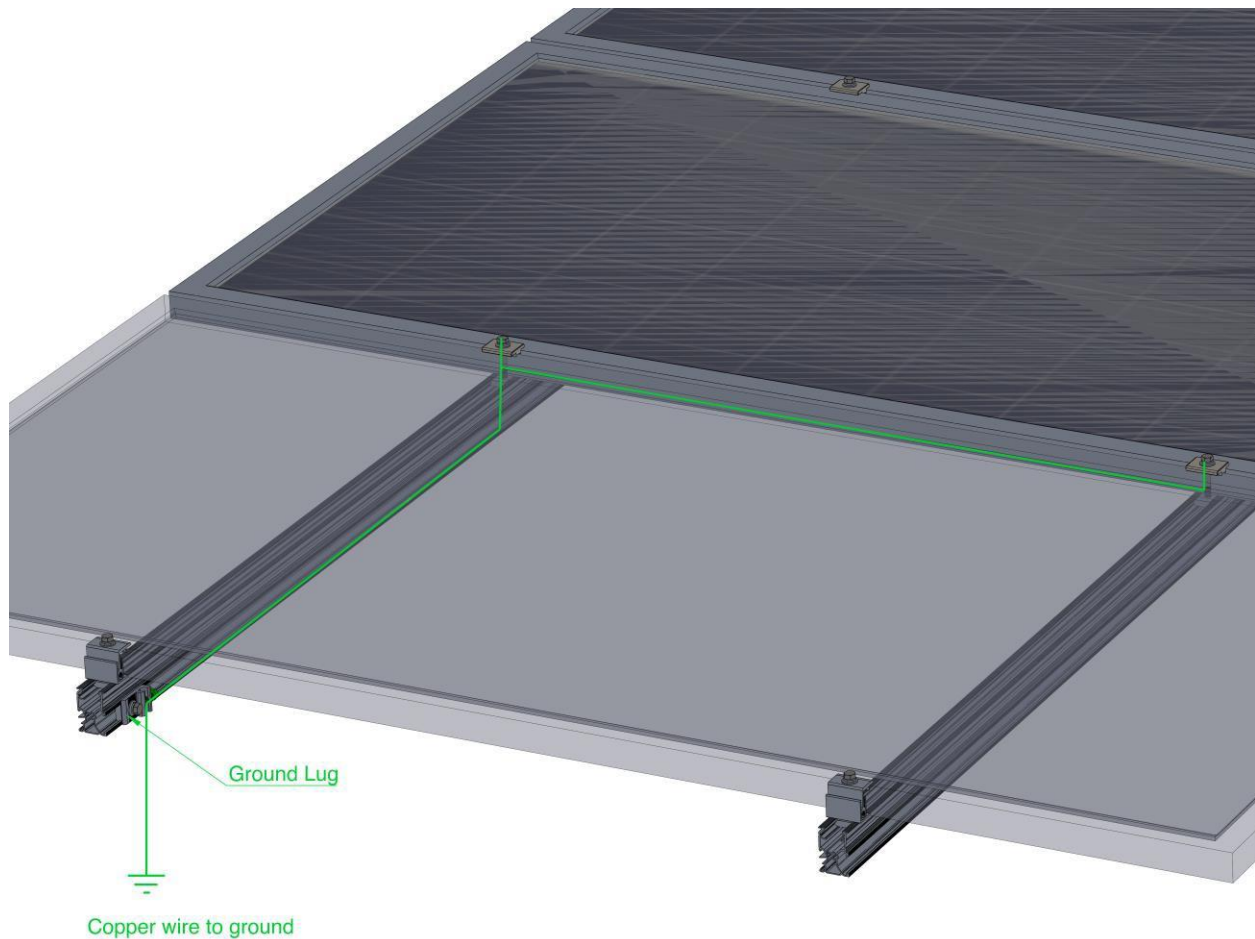
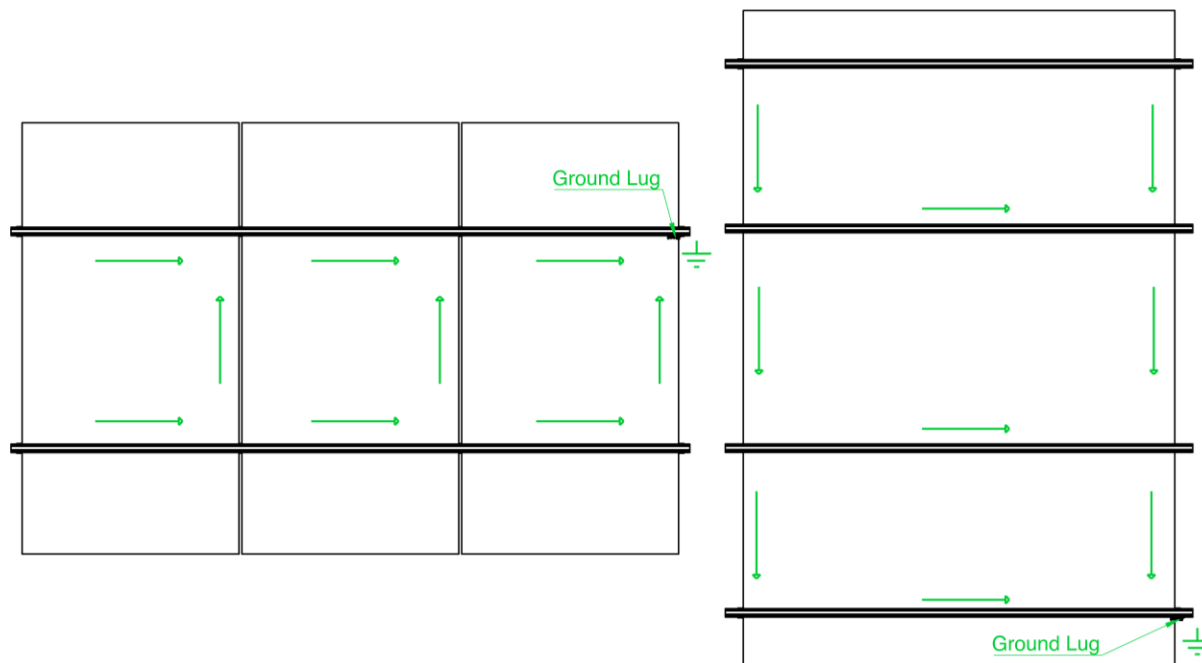


Figure 9 Grounding Path Detail

The grounding path through the main bonding components is shown above. The rail shown is the Rapid Rail, however this bonding path is consistent for the Venture Rail, Ground Hog Rail, Hat Rail, Bifacial Rail and Ridge Rail. The module bonding is achieved through the Mid-Clamp. If anodized rail is to be used, then the A-Type of Kinetic Mid-Clamps and Ground Lugs must be used in order to penetrate the anodized coating of the rail and provide adequate bonding. If mill finished rail is to be used, then the M-Type of components or A-Type may be used. Similarly, if bonding is to be achieved through the rail joiner, the correct rail joiner must also be used. For anodized rail, either the KJS2-MA, KJS2-BA or KJS2-CA must be used. For mill finish rail, either the KJS2-MM, KJS2-MA, KJS2-BA or KJS2-CA may be used.

Rail	Component
Mill Finish Aluminum Rails	M-Type or A-Type
Black Anodized Aluminum Rails	A-Type only
Clear Anodized Aluminum Rails	A-Type only
Hat Rail	G-Type only

Figure 10 Component Compatibility Chart



### Conventional Rail

One ground lug is required per row of modules. KHGLUG-A must be used on anodized rail

### Shared Rail

One ground lug is required per array. KHGLUG-A must be used on anodized rail

Figure 11 Grounding Path of Conventional and Shared Rail Systems

Grounding can be achieved with side and top mounts through the use of a ground lug attached to the Mounting Kit or directly to the rail.

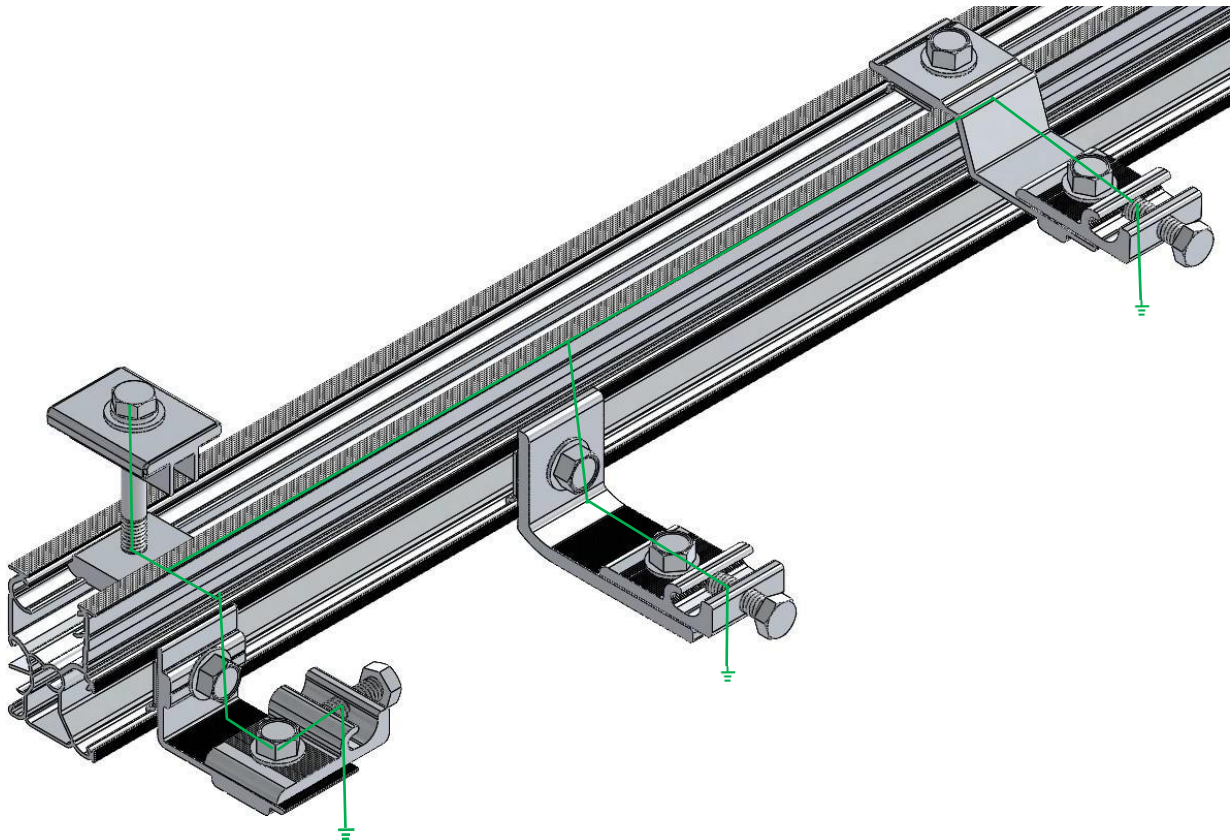


Figure 12 Grounding Path for Top and Side Mounts (Mill Finish Shown)



## 6.2. Groundhog Rail Grounding Path

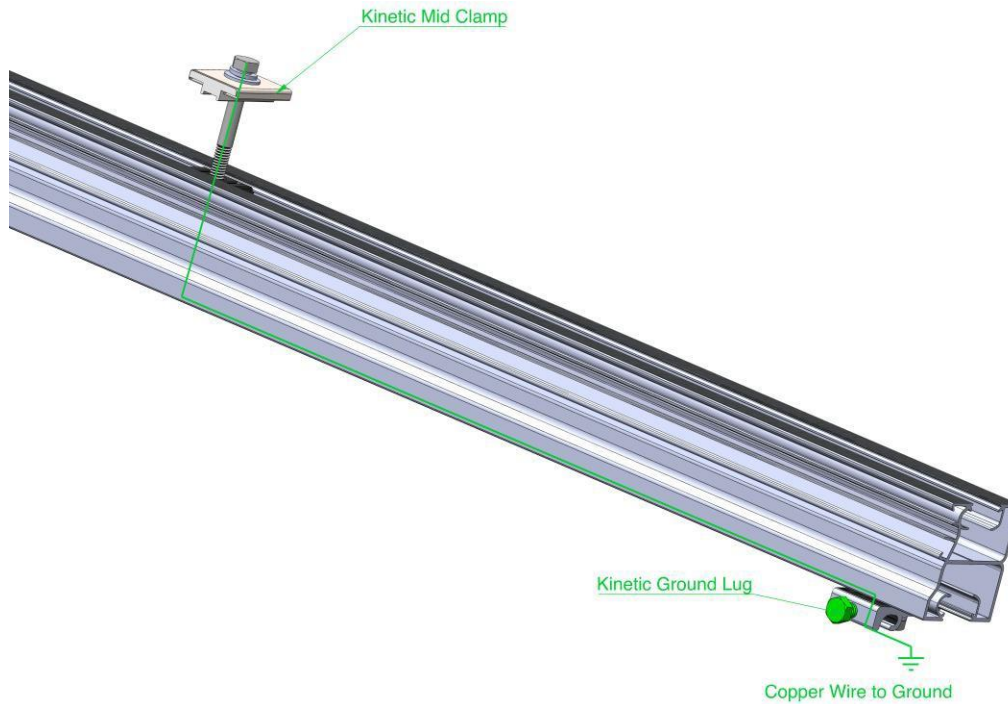


Figure 13 Fixed Angle Ground Mount Grounding Path (Bottom Ground Lug Attachment Shown)

Grounding can be achieved on the Groundhog Rail through the use of a ground lug (KHGLUG-M) for mill finish rails or (KHGLUG-A) for anodized rails. The ground lug can be positioned at either the top or the bottom of the rail.



### 6.3. Hat Rail Grounding Path

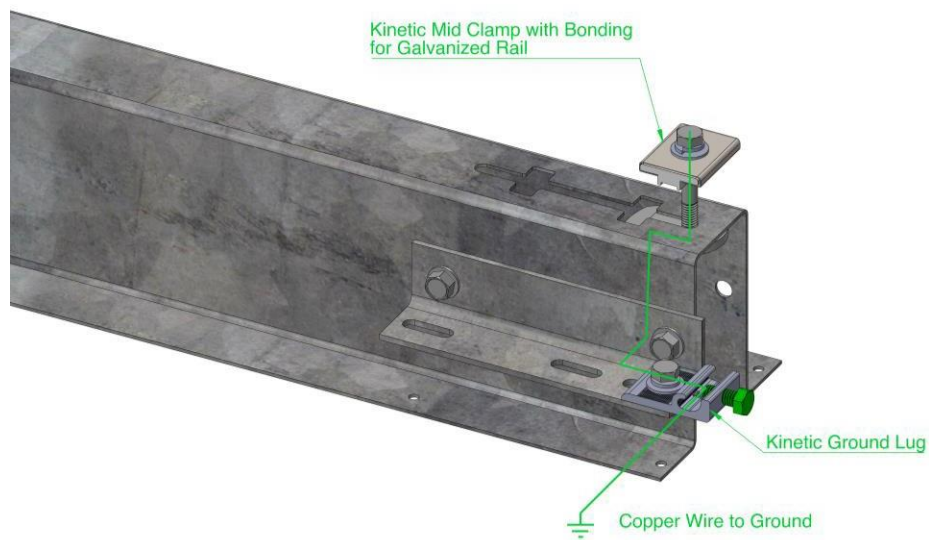


Figure 14 Adjustable Ground Mount Grounding Path

Grounding can be achieved on the Hat Rail through the use of a ground lug (KHGLUG-G) attached to the Mounting Kit or directly to the Hat Rail.

#### 6.4. Grounding Path in Bifacial Rail

Grounding can be achieved on the Bifacial Rail through the use of a ground lug (KHGLUG-M) for mill finish rails or (KHGLUG-A) for anodized rails. The ground lug can be positioned at either the top or the bottom of the rail.

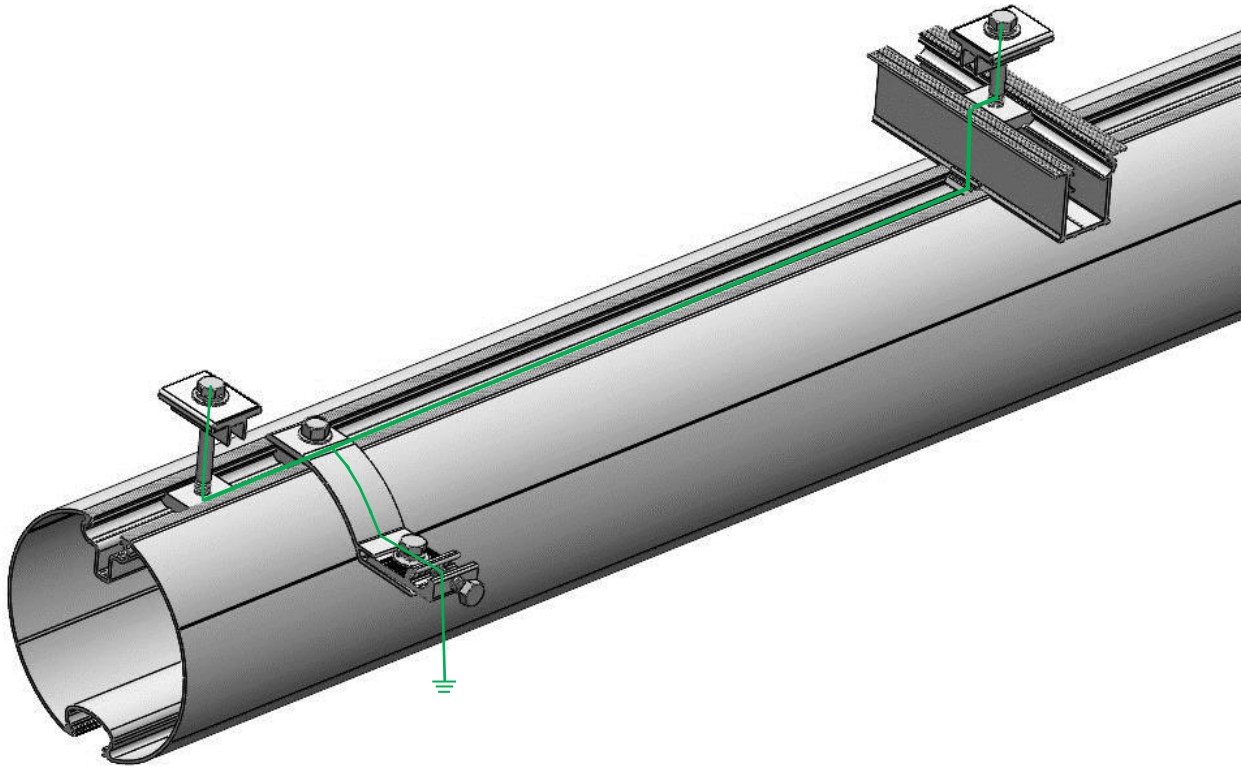


Figure 15 Static Ground Mount Grounding Path

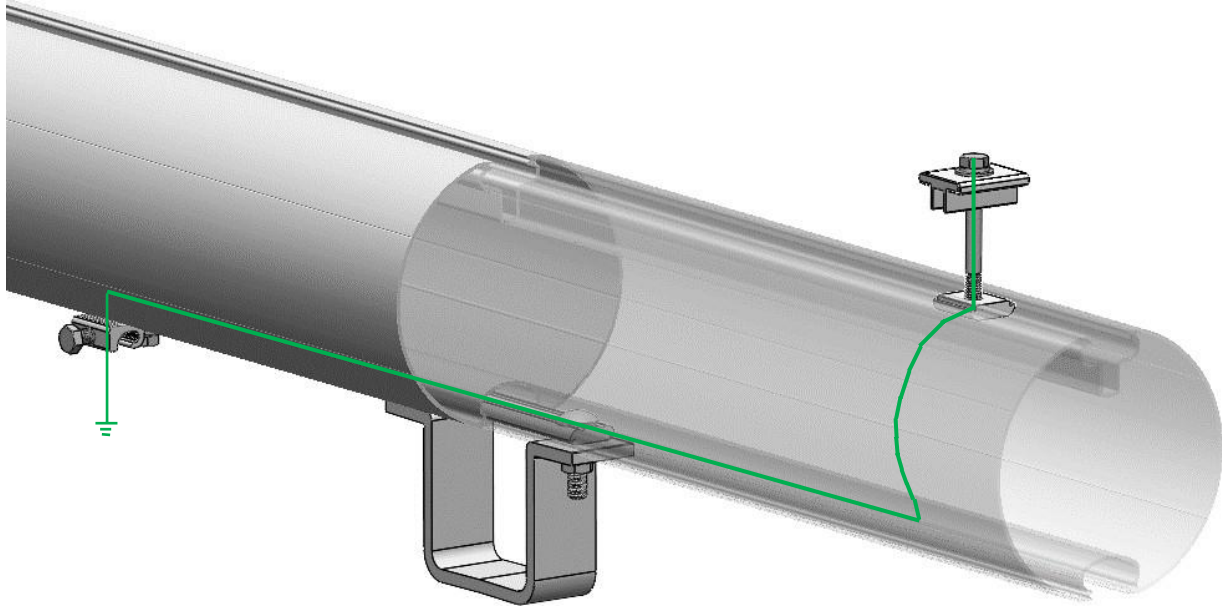


Figure 17 Static Ground Mount Grounding Path through Tube-Clamp

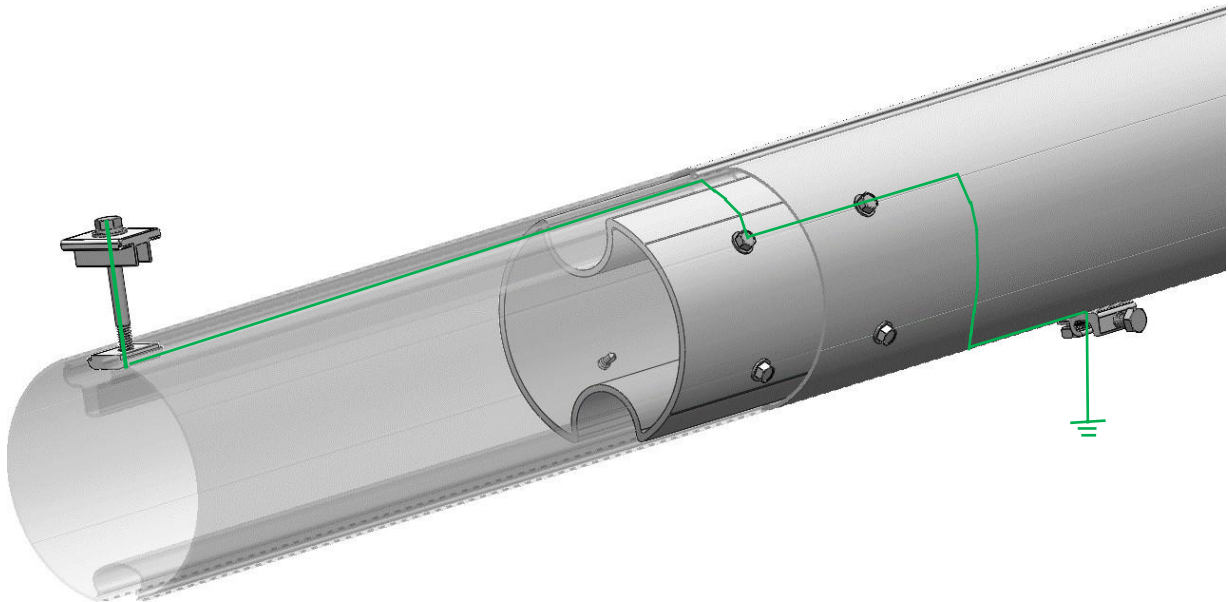


Figure 16 Static Ground Mount Grounding Path through Rail Joiner

## 6.5. Grounding Path in Ridge Rail

Grounding can be achieved on the Ridge Rail through the use of a ground lug (KHGLUG-M) for mill finish rails or (KHGLUG-A) for anodized rails.

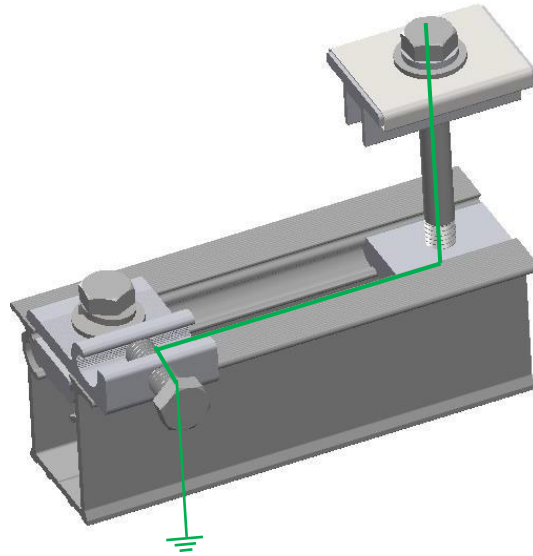


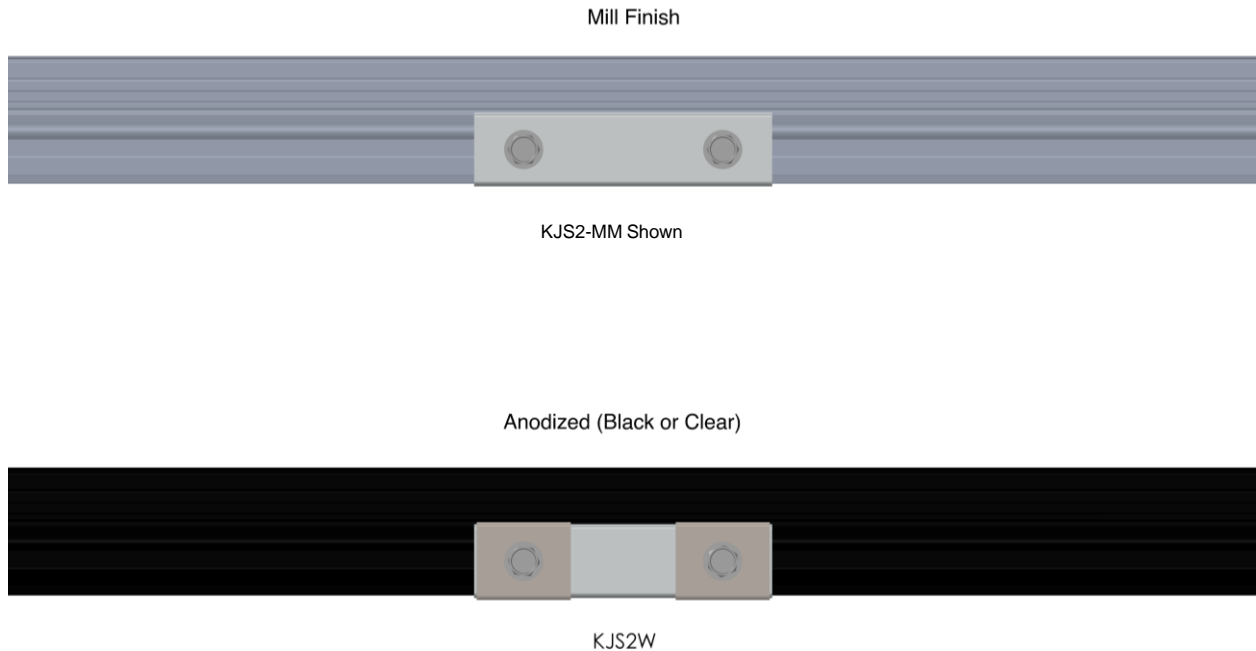
Figure 18 Grounding Path for Ridge Rail

## 6.6. Joiners

### 6.6.1. Rapid Rail Joiner

If there are any rail joiners, adequate bonding must be used between rail sections. If an anodized rail is being used then a KJS2-BA, KJS2-CA or KJS2-MA joiner must be used.

Figure 19 Joiner Compatibility



### 6.6.2. Bifacial Rail Joiners

If there are any Bifacial rail joiners (KBRJ-MA), adequate bonding must be used between rail sections. If an anodized rail is being used, then a KBRJ-MA joiner must be used at all rail joints. For mill finished bifacial rails, a bifacial rail joiner is not required when the rail joint is over a supporting member. A tube U-Clamp (KRBU-MA) is required on all supporting members.

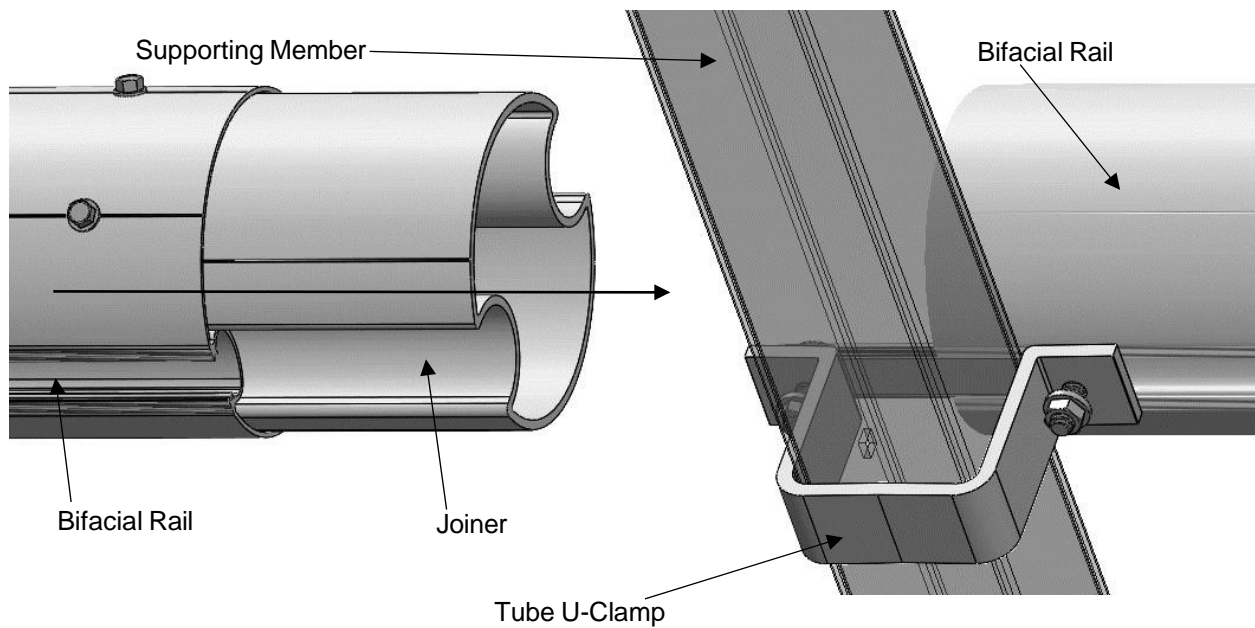


Figure 20 Rail/Joiner and Tube U-Clamp Assembly

### 6.6.3. Landscape Ridge Rail

1. Insert the K-nut into the deep groove of the bifacial rail and tighten the 5/16" Bolt with a 1/2" socket with extension.
2. Install End-Clamps and Mid-Clamps on the ridge rail.

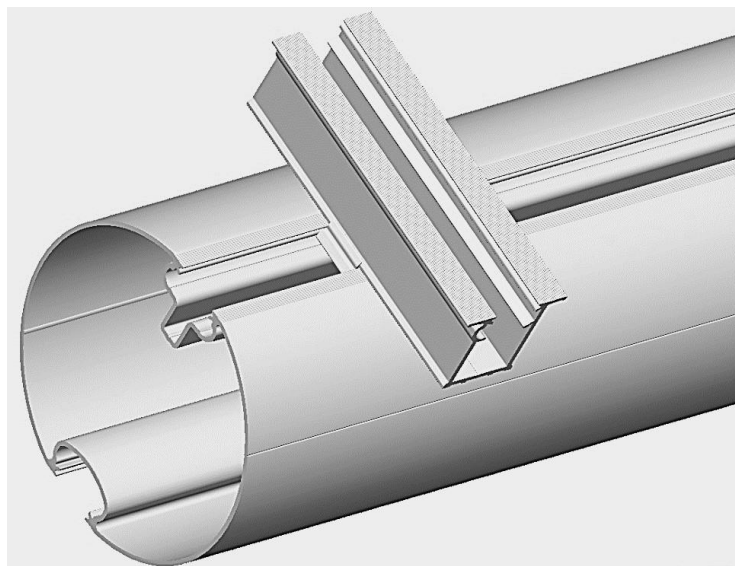


Figure 21 Landscape Ridge Rail

## 6.7. Thermal Break

A thermal break of ½” is required every 50ft of rail if the installation site has a temperature difference of more than 28.5°C. If there is a thermal break, two ground lugs (KHGLUG-M, KHGLUG-A or KHGLUG-G) on either side of the break, joined with a piece wire that meets the specifications in the table below is required.

## 6.8. Grounding

Grounding is to be achieved through the Kinetic Grounding Lug (KHGLUG-M, KHGLUG-A or KHGLUG-G) and a copper or aluminum wire that meets the specifications in the table below. Systems mounted in a conventional rail design require a minimum of one ground lug per row. Systems mounted in a shared rail design require a minimum of one ground lug per array. The grounding of the system is intended to comply with the latest edition of the National Electrical Code, to include NEC 250 & 690. Local code compliance is required, in addition to national codes.

Conductor Material	Minimum Cable Size	Cable Type	Temperature Rating
Aluminum	10 AWG	Solid or Braided	75 °C
Copper	8 AWG	Solid or Braided	60 °C

Figure 22 Bonding Conductor Requirements



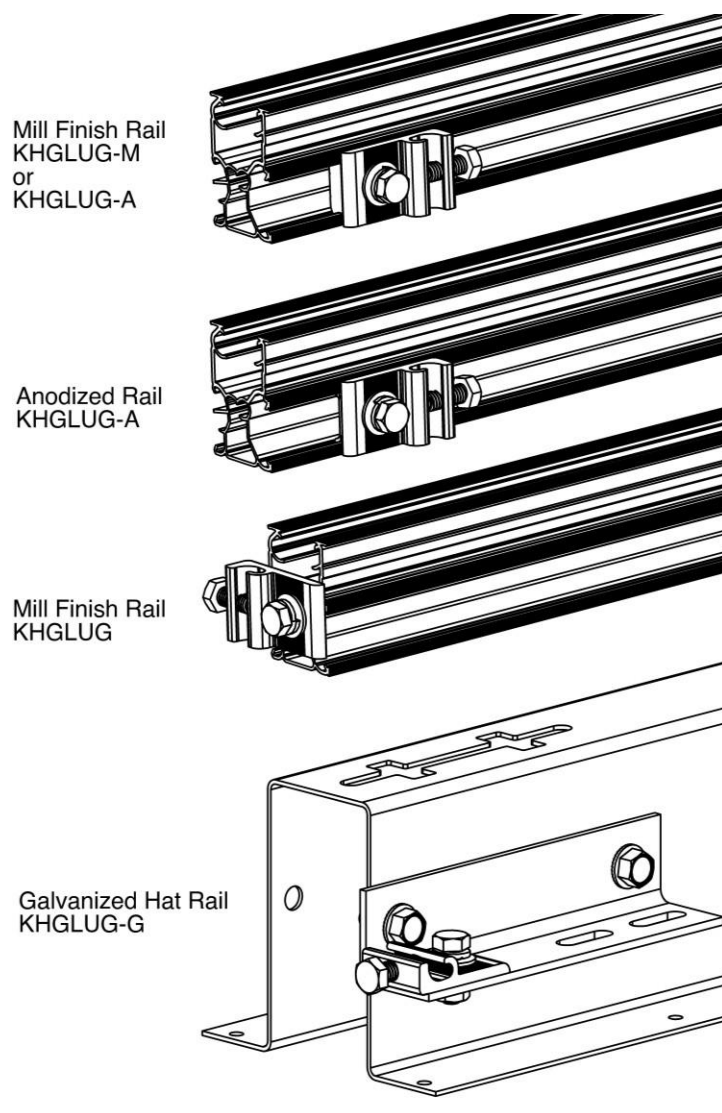


Figure 23 Ground Lug Mounting Options



### 6.8.1. Aluminum Ground Lug TiN Plated with Tech Screw and Serrated Washer (KHGL-BN1)

1. Locate the grounding hole on the solar module as per the module specification sheet (this may or may not be marked on the Aluminum frame of the module) and install the serrated washer on to the Tech Screw. Insert the screw into the grounding hole.
2. Place the ground lug on to the screw.
3. Install the nut onto the Tech Screw and tighten (snug tight).



Figure 24 Installed Grounding Lug

### 6.9. Bonding and Grounding Devices

SKU	Component Description	Use With	Associated Hardware
KMWC3037-MM	Kinetic Mid Clamp with Bonding Washer 30-37mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/4" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC3037-BA/CA	Kinetic Mid Clamp with Bonding Washer 30-37mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/4" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC3037-G	Kinetic Mid Clamp with Bonding Washer 30-37mm	-Galvanized Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/4" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>

KMWC3843 -MM	Kinetic Mid Clamp with Bonding Washer 38-43mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC3843 -BA/CA	Kinetic Mid Clamp with Bonding Washer 38-43mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC3843 -G	Kinetic Mid Clamp with Bonding Washer 38-43mm	-Galvanized Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC4450 -MM	Kinetic Mid Clamp with Bonding Washer 44-50mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC4450 -BA/CA	Kinetic Mid Clamp with Bonding Washer 44-50mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC4450 -G	Kinetic Mid Clamp with Bonding Washer 44-50mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KMWC3046-G	Mid Clamp with Integrated Bonding 30-46 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KMWC3046L-G	Long Mid Clamp with Integrated Bonding 30-46 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- KHBW</li> </ul>

KMWC4750-G	Mid Clamp with Integrated Bonding 47-50 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KMWC4750L-G	Long Mid Clamp with Integrated Bonding 47-50 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- KHBW</li> </ul>
KMWC3046-MM/BM	Kinetic Mid Clamp with Bonding Washer 30-46 mm (Mill Finish or Black Anodized)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KMWC3046L-MM/BM	Kinetic Long Mid Clamp with Bonding Washer 30-46 mm (Mill Finish or Black Anodized)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- KHBW</li> </ul>
KMWC3046-BA/CA	Kinetic Mid Clamp with Bonding Washer 30-46 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KMWC3046L-BA/CA	Kinetic Long Mid Clamp with Bonding Washer 30-46 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- KHBW</li> </ul>
KMWC4750-MM/BM	Kinetic Mid Clamp with Bonding Washer 47-50 mm (Mill Finish or Black Anodized)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>

KMWC4750L-MM/BM	Kinetic Long Mid Clamp with Bonding Washer 47-50 mm (Mill Finish or Black Anodized)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- K-Nut</li> <li>- KHBW</li> </ul> </li> </ul>
KMWC4750-BA/CA	Kinetic Mid Clamp with Bonding Washer 47-50 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- Serrated K-Nut</li> </ul> </li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KMWC4750L-BA/CA	Kinetic Long Mid Clamp with Bonding Washer 47-50 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- Serrated K-Nut</li> <li>- KHBW</li> </ul> </li> </ul>
KHGLUG-M	Kinetic Ground Lug with K-Nut	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Green, Stainless, Hex Head Bolt</li> <li>- 5/16" x 1" Stainless Hex Head Bolt <ul style="list-style-type: none"> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- K-Nut</li> </ul> </li> </ul> </li> </ul>
KHGLUG-A	Kinetic Ground Lug with Serrated K-Nut	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Green, Stainless, Hex Head Bolt</li> <li>- 5/16" x 1" Stainless Hex Head Bolt <ul style="list-style-type: none"> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- Serrated K-Nut</li> </ul> </li> </ul> </li> </ul>
KHGLUG-G	Kinetic Ground Lug	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Green, Stainless, Hex Head Bolt</li> <li>- 5/16" x 1 1/4" Stainless Hex Head Bolt <ul style="list-style-type: none"> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer <ul style="list-style-type: none"> <li>- 5/16" Stainless Hex Nut</li> </ul> </li> </ul> </li> </ul>
KJS2-MA/BA/CA	Kinetic Joiner with Bonding (Mill Finish, Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Stainless Serrated Flanged Hex Head Bolt (2)</li> <li>- SBWK-312 or WEEB-M-KR</li> </ul>
KJS2-MM	Kinetic Joiner (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" (2) Stainless Serrated Flanged - Hex Head Bolt <ul style="list-style-type: none"> <li>- Kinetic Joiner Clamp</li> </ul> </li> </ul>

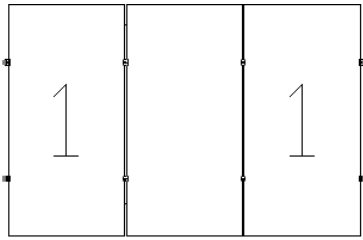
KBRU-MA	Tube Clamp for 3" square tube	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 3/8" x 1.5" Stainless Steel Carriage Bolt</li> <li>- 3/8" Serrated Flanged Nut</li> <li>- Kinetic Channel Nut</li> </ul>
KEC3046-G	End Clamp Kit with Bonding 30-46 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEC3046L-G	Long End Clamp Kit with Bonding 30-46 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- KHBW</li> </ul>
KEC4750-G	End Clamp Kit with Bonding 47-50 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEC4750L-G	Long End Clamp Kit with Bonding 47-50 mm	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Hat Rail Nut</li> <li>- KHBW</li> </ul>
KEWC3037-MA	Kinetic End Clamp with Bonding Washer 30-37mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/4" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEWC3037-BA/CA	Kinetic End Clamp with Bonding Washer 30-37mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/4" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEWC3843-MA	Kinetic End Clamp with Bonding Washer 38-43mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>

KEWC3843-BA/CA	Kinetic End Clamp with Bonding Washer 38-43mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEWC4450-MA	Kinetic End Clamp with Bonding Washer 44-50mm (Mill Finish)	<ul style="list-style-type: none"> <li>- Mill Finish Rail</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KEWC4450-BA/CA	Kinetic End Clamp with Bonding Washer 44-50mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KECW3046-MM	Kinetic End Clamp with Bonding Washer 30-46 mm (Mill Finish)	<ul style="list-style-type: none"> <li>- Mill Finish Rail</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KECW3046L-MM	Kinetic Long End Clamp with Bonding Washer 30-46 mm (Mill Finish)	<ul style="list-style-type: none"> <li>- Mill Finish Rail</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- KHBW</li> </ul>
KECW3046-BA/CA	Kinetic End Clamp with Bonding Washer 30-46 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KECW3046L-BA/CA	Kinetic Long End Clamp with Bonding Washer 30-46 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 2 1/2" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- KHBW</li> </ul>
KECW4750-MM	Kinetic End Clamp with Grounding Washer 47-50 mm (Mill Finish)	<ul style="list-style-type: none"> <li>- Mill Finish Rail</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>

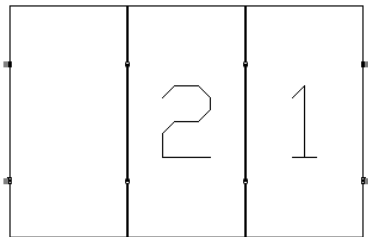
KECW4750L-MM	Kinetic Long End Clamp with Bonding Washer 47-50 mm (Mill Finish)	- Mill Finish Rail	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- K-Nut</li> <li>- KHBW</li> </ul>
KECW4750-BA/CA	Kinetic End Clamp with Grounding Washer 47-50 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- SBWK-312 or WEEB-M-KR or KHBW</li> </ul>
KECW4750L-BA/CA	Kinetic End Clamp with Bonding Washer 47-50 mm (Black Anodized or Clear Anodized)	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3" Stainless Hex Head Bolt</li> <li>- 5/16" Stainless Flat Washer</li> <li>- 5/16" Stainless Lock Washer</li> <li>- Serrated K-Nut</li> <li>- KHBW</li> </ul>
KSGMM-G	Mounting Kit for Hat Rail	-Galvanized Steel	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Serrated Flanged Hex Head Bolt</li> <li>- 5/16" Serrated Nut</li> </ul>
KHMNS/ KHMNL/ KHMNB/ KHMT-MM	Rail Mounting Kit	- Mill Finish	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Serrated Flanged Hex Head Bolt</li> <li>- 5/16" Serrated Nut</li> <li>- K-Nut</li> </ul>
KHMNS/ KHMNL/ KHMNB/ KHMT-MA	Rail Mounting Kit	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- 5/16" x 3/4" Serrated Flanged Hex Head Bolt</li> <li>- 5/16" Serrated Nut</li> <li>- Steel K-Nut</li> </ul>
KRJK-MM	Kinetic Rail Jumper Kit	-Mill Finish	<ul style="list-style-type: none"> <li>- KHGLUG-M (2)</li> <li>- 8 AWG Braided Copper Wire</li> </ul>
KRJK-MA	Kinetic Rail Jumper Kit	<ul style="list-style-type: none"> <li>- Mill Finish</li> <li>- Black Anodized</li> <li>- Clear Anodized</li> </ul>	<ul style="list-style-type: none"> <li>- KHGLUG-A (2)</li> <li>- 8 AWG Braided Copper Wire</li> </ul>

Figure 25 Bonding and Grounding Devices

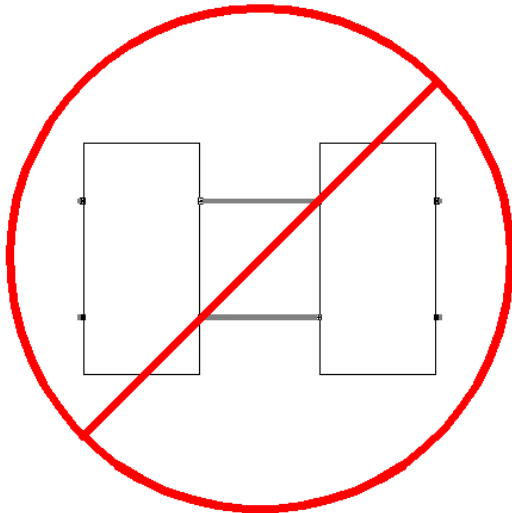
## 6.10. Removing Modules from an Array



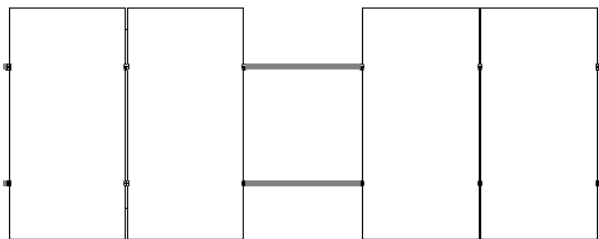
If removing the module at the end of a row, no special precautions need to be taken.



If a module (or modules) needs to be removed from the second from the end of a row, the modules on the end need to be removed first. This may be avoided if module 1 is grounded independently of module 2.



Never remove the module second from the end of a row before removing the end module unless the end modules are grounded independently.



If there are two or more modules remaining at the end of a row, there is no need to remove the modules at the end.

Figure 26 Module Removal Procedure



## 7. List of Compatible Modules

Please see Kinetic Solar's List of Compatible Modules Revision 7 for a full list of modules certified for use with our system.

## 8. Required Maintenance

All installed systems should be checked at least annually to ensure that no components have come loose, become damaged or corroded. If any inadequacies are found, they are to be immediately remedied.

## 9. Pitched Roof Installation Instructions

Please note that other fasteners can be substituted for lag bolts as long as they meet or exceed the mechanical properties (including, but not limited to pull-out strength) of the specific Kinetic self-drilling screws. Installation procedures may differ, follow manufacturer guidelines in place of Kinetic instructions where necessary.

### 9.1. Layout Considerations

The span (typically 48") between L-Brackets in a conventional (2 rails per run of modules) system typically supports 1.0-1.2 modules (144 cells) in portrait or 0.5-0.6 modules (144 cells) in the landscape. Refer to Appendix 1 to determine the locations of the mounts from the span charts. In a shared rail system, a shared rail may support up to 0.5-0.6 modules (144 cell) between L-Brackets (typically 48") in landscape.

#### 9.1.1. Design Loads

All rails except Bifacial rail:

##### 9.1.1.1. UL 2703 Design Load

		Maximum Span
Downward Design Load	3600 Pa (75.3 lb/ft <sup>2</sup> )	48"
Upward Design Load	1600 Pa (33.4 lb/ft <sup>2</sup> )	48"
Down Slope Load	239 Pa (5.0 lb/ft <sup>2</sup> )	48"

Figure 27 UL 2703 Design Loads

#### 9.1.1.2. LTR-AE-001-2012 Design Load

		Maximum Span
Downward Design Load	5400 Pa (113 lb/ft <sup>2</sup> )	48"
Upward Design Load	2400 Pa (50 lb/ft <sup>2</sup> )	48"

Figure 28 LTR-AE-001-2012 Design Loads

#### 9.1.1.3. TIL No. A-40

		Maximum Span
Downward Design Load	3600 Pa (75.2 lb/ft <sup>2</sup> )	48"
Upward Design Load	1067 Pa (22.3 lb/ft <sup>2</sup> )	48"

Bifacial rail only:

#### 9.1.1.4. Mechanical ratings UL 2703 and TIL A-40

		Maximum Span
Downward Design Load	804.3 Pa (16.8 lb/ft <sup>2</sup> )	144"
Upward Design Load	804.3 Pa (16.8 lb/ft <sup>2</sup> )	144"
Down-Slope Load	239.4 Pa (5.0 lb/ft <sup>2</sup> )	144"

\*Please note that for loads greater than 2400 Pa (50 lb/ft<sup>2</sup>) the attachment to the L-Bracket must be positioned at the bottom of the slot.

\*\*Ground Mount Systems have not been mechanical load tested.

### 9.1.2 Horizontal

Mounting the rail horizontally on a pitched roof is the most common and typically the easiest way to install solar modules.

#### 9.1.2.1 Shared Rail

Rails are to be spaced according to module manufacturer guidelines. Attachments are to be spaced at a maximum of 48" depending on local wind and snow loads.

When installing a shared rail system, the top and bottom rails can be installed in a conventional

Landscape orientation in order to avoid roof edges and peaks.

\*See design loads above.

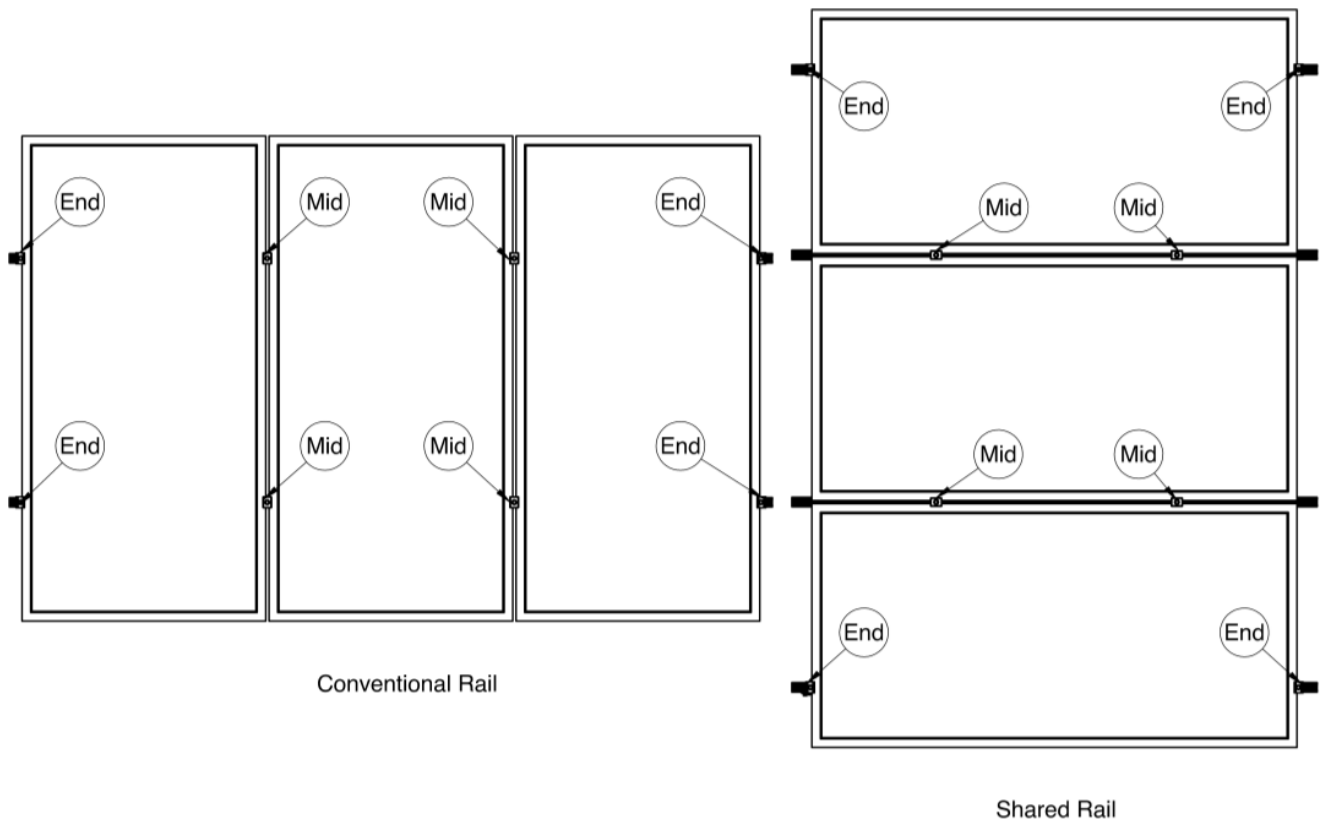


Figure 29 Conventional vs Shared Rail

The rail positions of shared and conventional. It is recommended that the upper and lowermost rails in a shared rail configuration be installed conventionally in order to make installation easier. Please note that not all panel manufacturers support this clamping configuration.

### 9.1.3 Conventional

Rails are to be spaced according to module manufacturer guidelines. Attachments are to be spaced at a maximum of 48" depending on local wind and snow loads.

\*See design loads above.

#### 9.1.3.1 Vertical Conventional

In some cases, the rails can be installed vertically up the roof in order to reduce the amount of rail required. The ability to do this will ultimately rely on the structural assessment of the roof and whether or not it can be supported. Other than the orientation of the rails, the installation will be identical to a conventional rail system.

## 9.2 Install Roof Mounts

### 9.2.1 Shingled Roof

#### 9.2.1.1 Flashing & Mounting Kit

- i. Measure and mark the appropriate mount locations. Use a measuring tape to ensure chalk lines are straight and square. When marking, take care to ensure that the top of the flashing is at least  $\frac{1}{4}$ " above the top of the tab in the shingle (Figure 30 Flashing Positioning). Install on an individual shingle surface. The surface must be flat and even (within  $\frac{1}{16}$ ") to ensure a watertight seal – do not install over cut out or butt edge of the shingle. If the flashing bubble interferes with the shingle edge, minor trimming may be required of the lower edge of the top shingle.

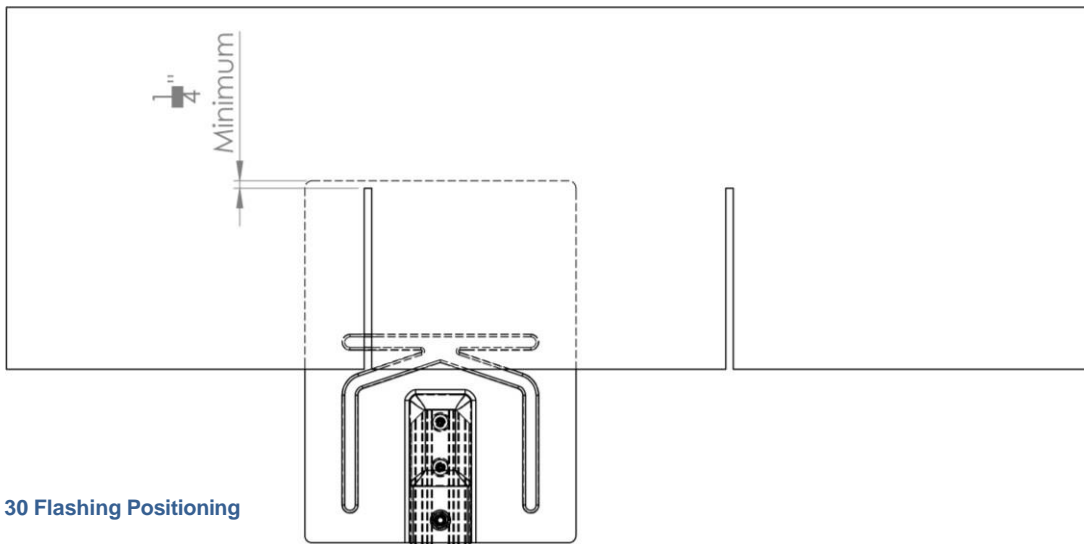


Figure 30 Flashing Positioning

ii. K-Flash attaching to Truss:

- (a) When using Kinetic 4" self-drilling screws, install baseplate using one or two 4" self-drilling screws. When installing with only one self-drilling screw, install it the center hole closest to the stud. The Base Plate should be facing downward (holes up with respect to the peak of the roof, stud facing the eaves).

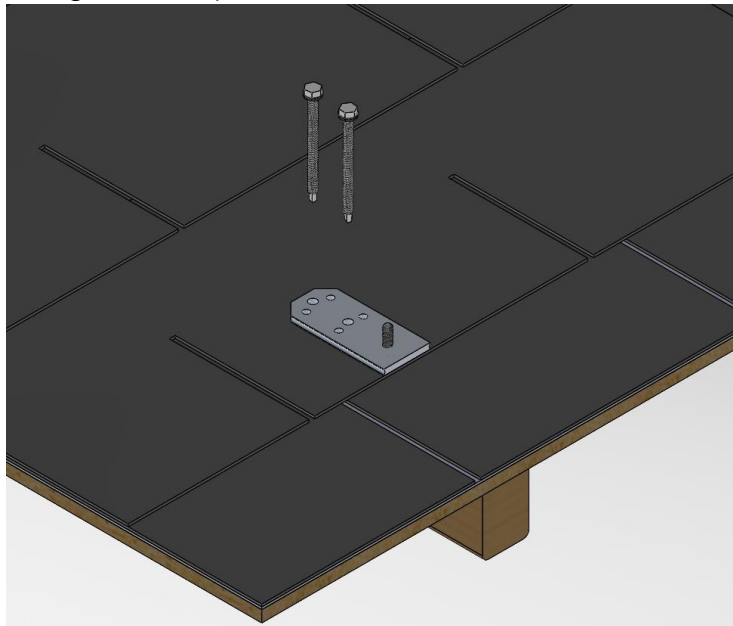


Figure 31 Install Self-Drilling Screws  
Kinetic Solar K-Rack™  
Installation guide

- (b) If two 5/16" lag bolts are used, prepare the roof by pilot drilling two 7/32" holes into the rafter for each baseplate that will be affixed.

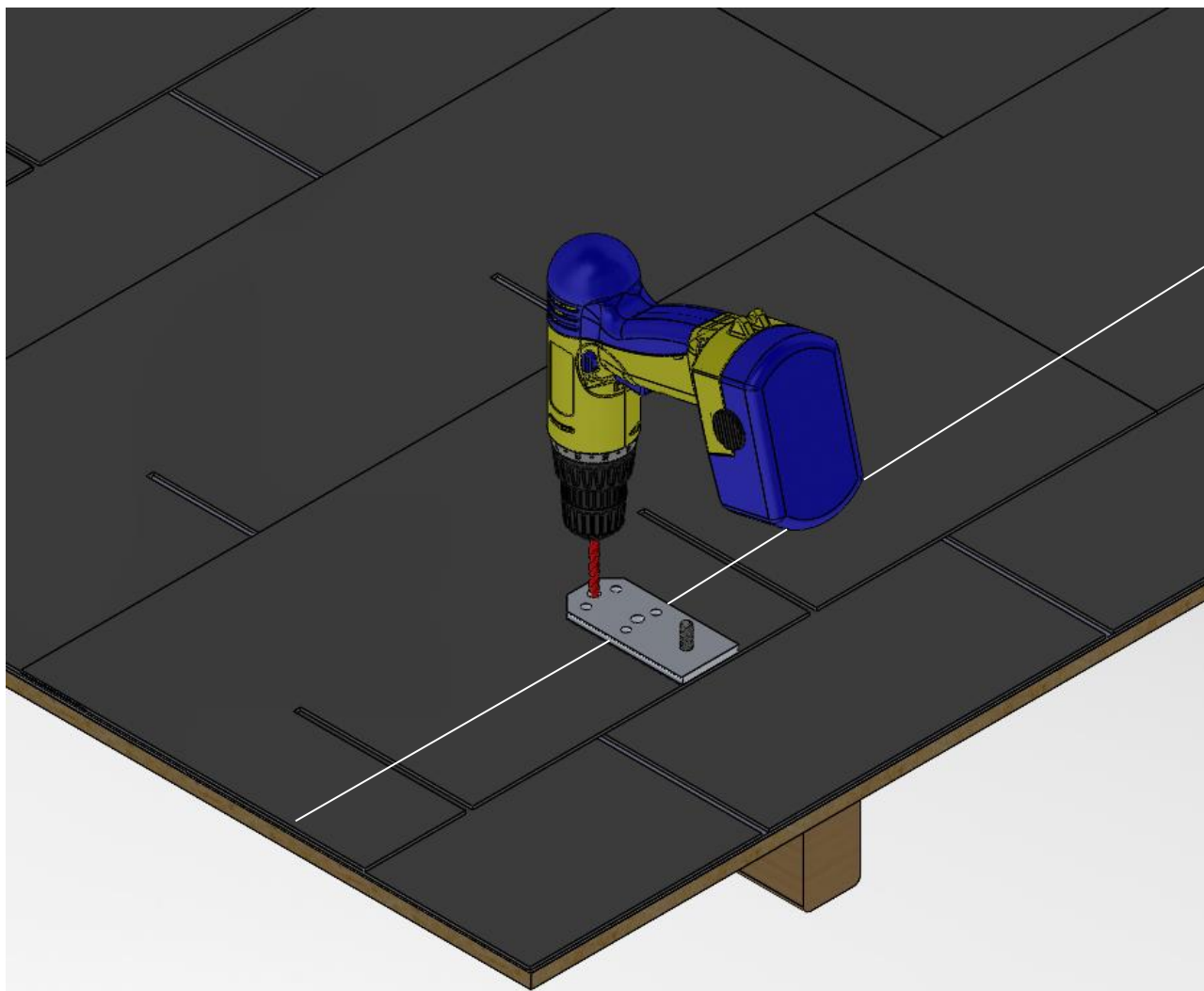
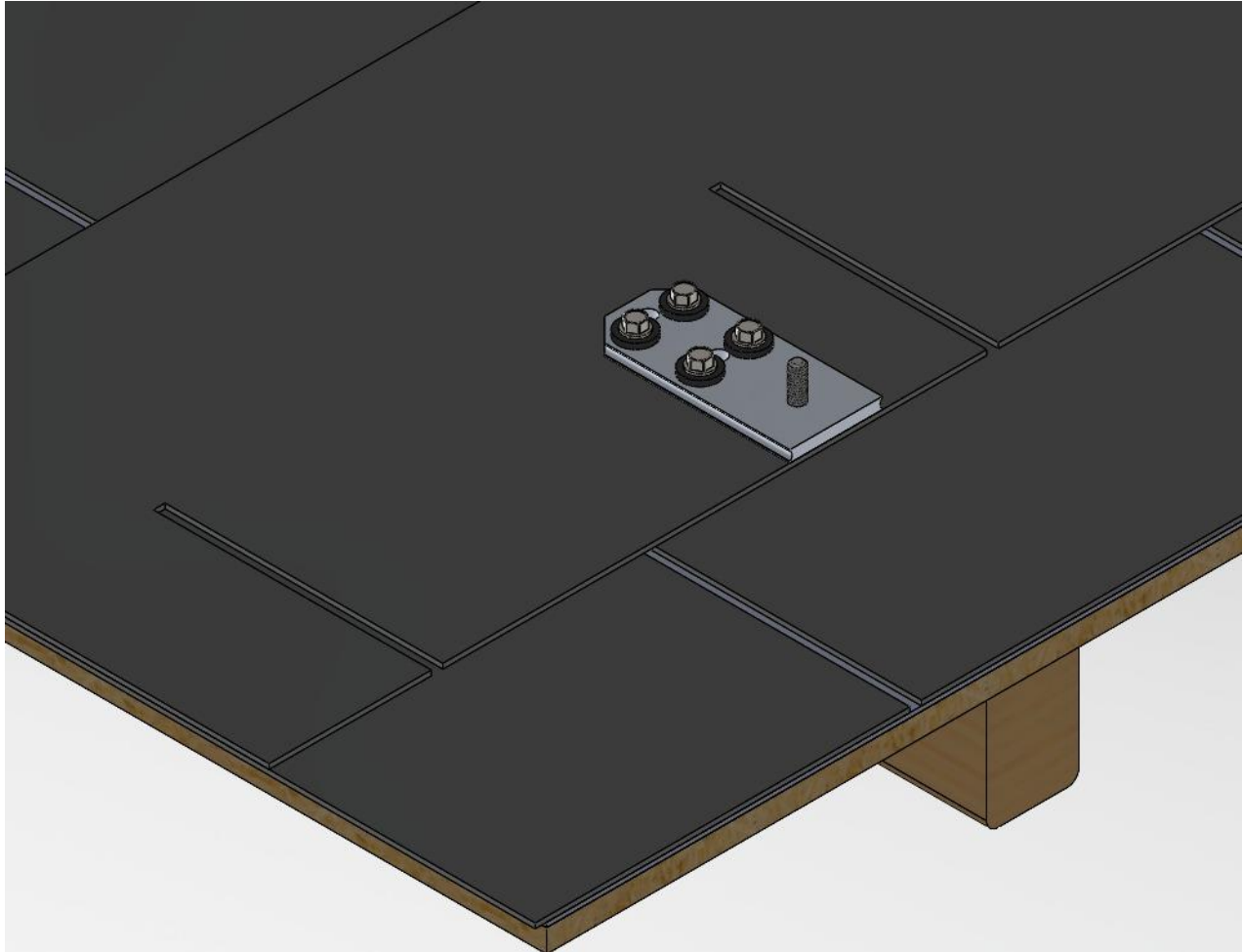


Figure 32 Measure and Pre-Drill

### iii. K-Flash attachment to Sheathing

Screw each Baseplate into position using four ¼" x 2" self-drilling screws. The attachment can be installed on min. 7/16" OSB roof sheathing. This product does not require attachment to a rafter.



**Figure 33** Installing ¼" self-drilling screws

Note: Watertight assumes that an appropriate roof surface is being used. Not intended for use on roofs less than 4:12 in areas where ice damming may occur.

The spacing between two baseplates is stated in Appendix 2. Please ensure that all span conditions are met as per Appendix 1.

- (iv) Apply Geocel 4500 Roof Bonding Sealant, BES 925 or equivalent to the underside of your *K-Flash* sheet



Figure 36 Geocel 4500



Figure 34 Geocel PROFLEX

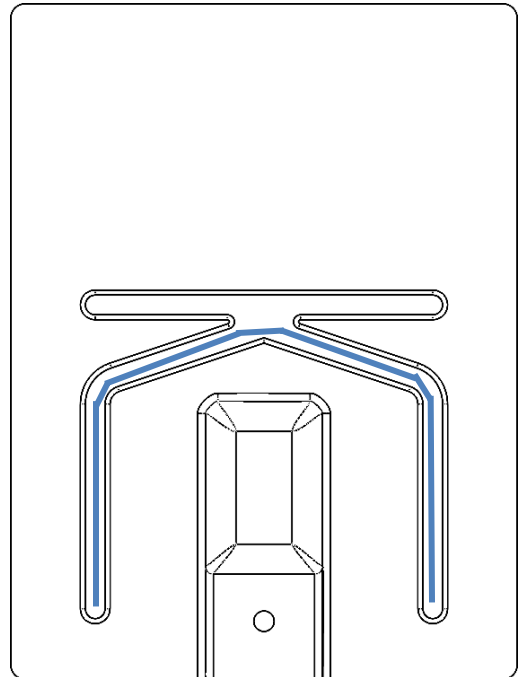


Figure 35 Caulking Path

- iv. Slide the *K-Flash* sheet under shingles and position over the baseplate stud; the *K-Flash* sheet should sit flush against the roof.

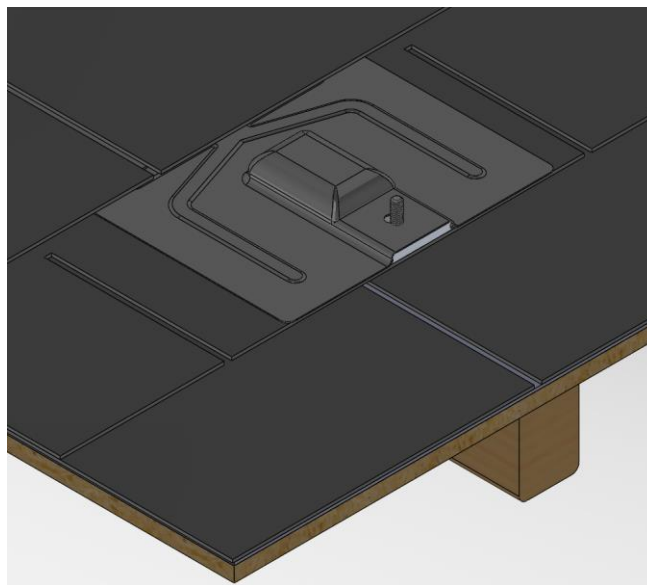


Figure 37 Installed Flashing (Truss Mounting Shown)



### 9.2.2 Universal L-Mount

Install the Universal L Mount on the individual shingle surface. The surface must be flat and even (within 1/16") to ensure a watertight seal – do not install over cut out or butt edge of the shingle. The spacing between two Universal L mounts is determined from the Load tables in Appendix 3.

#### A. For Attaching to the truss:

1. When using one or two Kinetic 4" self-drilling screws, install the self-drilling screw(s) into the rafter similar to Figure 38. No predrilling is required. The wood roof truss or joist should have at least a 1.5" chord width.
2. When using lag bolts, measure and mark the appropriate mount locations. Use a measuring tape to ensure chalk lines are straight and square.
3. Prepare roof for the installation of lag bolts by drilling two 7/32" pilot holes through the roof and into the rafter for each mount that will be affixed.
4. Peel the wax paper off the back of the mount prior to its final placement.
5. Screw each mount into position using two 3" lag bolts. The wood roof truss or joist should have at least a 1.5" chord width.

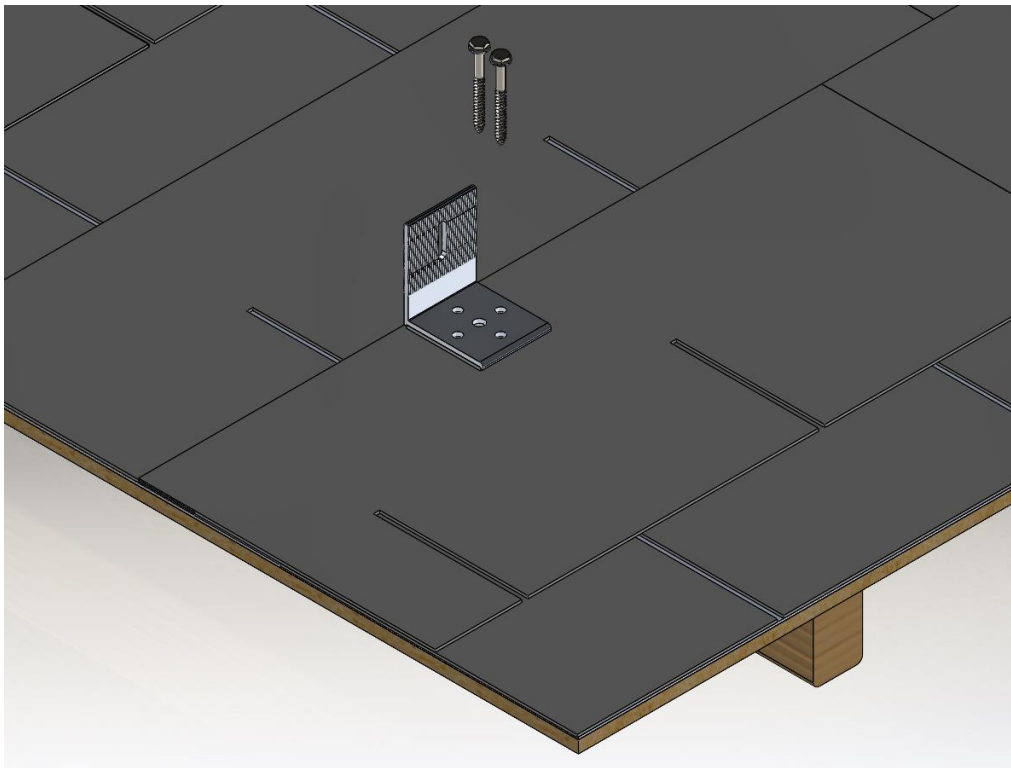


Figure 38: Mounting Universal L Mount using 2 two lag bolts

B. For attaching to Sheathing:

Use four 2" self-drilling screws to attach the Universal L into position. The attachment can be installed on min. 1/2" Plywood or OSB roof sheathing. This product does not require attachment to a rafter.

### 9.2.3 Metal Roof

#### 9.2.3.1 Trapezoidal/Corrugated

##### 9.2.3.1.1 Hippo Mount

- i. Drill two 7/32" pilot holes through the seam and into the rafter for each Hippo Mount.
- ii. At each location, position the Hippo Mount parallel to the seam of the roof
- iii. Insert a bead of Geocel 4500 or BES 925 into each of the pilot holes
- iv. Install Lag Bolts (with EPDM washer) through the Hippo Mount and into the pilot holes.

##### 9.2.3.1.2 Hanger Bolt

Hanger Bolt valley installation (Figure 38 Hanger Bolt Valley Installation):

- i. Drill a Ø 7/32" pilot hole into the steel roof's truss/rafter.
- ii. (Optional) Insert a bead of Geocel 4500 or BES 925 into the pilot hole
- iii. (Optional) Apply a bead of Geocel 4500 or BES 925 around the outside perimeter of the hole
- iv. Insert Hanger Bolt assembly into the drilled hole.
- v. Using a long series 1/2" socket drive, tighten until the EPDM Neoprene Washer is seated firmly enough to ensure a watertight seal.

**DO NOT OVERTIGHTEN - THIS MAY DAMAGE THE ROOF AND CAUSE LEAKAGE**

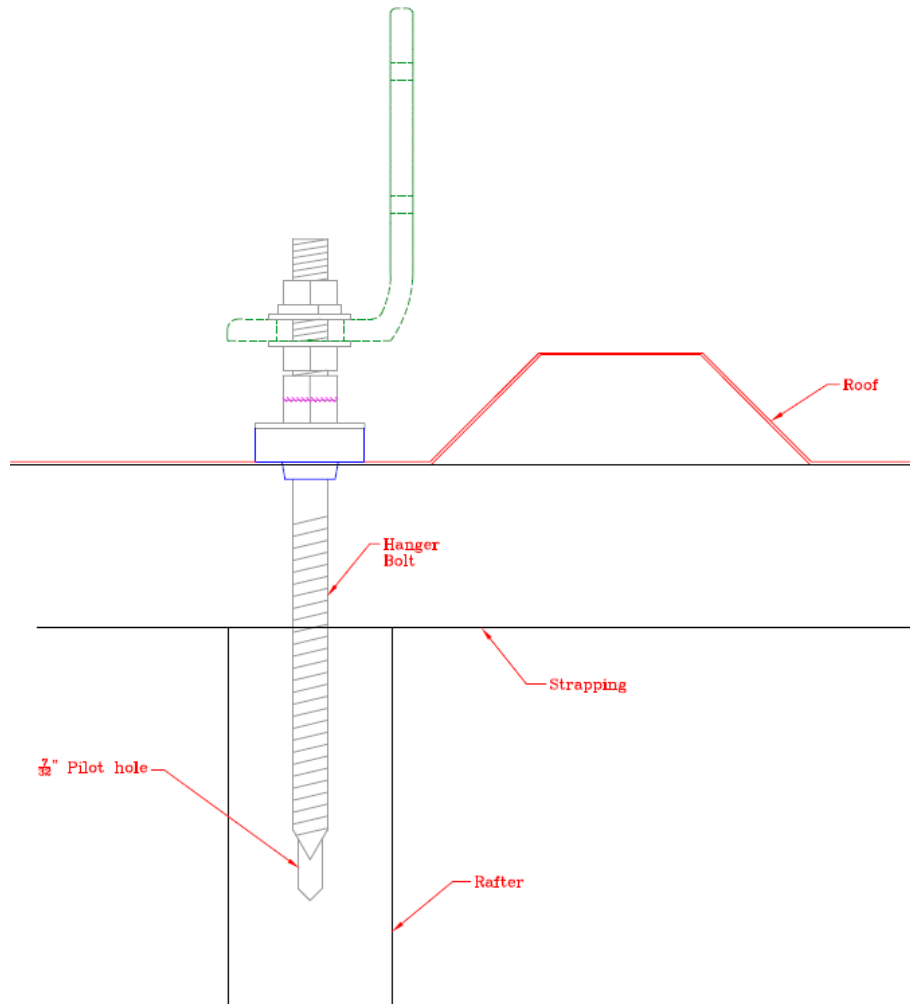


Figure 39 Hanger Bolt Valley Installation

**Hanger Bolt peak installation (Figure 39 Hanger Bolt Peak Installation):**

- i. When installing into the peak of the roof drill a  $\text{Ø } 3/4"$  hole into the steel portion of the roof only.
- ii. Drill a  $\text{Ø } 7/32"$  pilot hole into the truss/rafter.
- iii. (Optional) Insert a bead of Geocel 4500 or BES 925 into the pilot hole
- iv. (Optional) Apply a bead of Geocel 4500 or BES 925 around the outside perimeter of the hole.
- v. Insert the anti-crush spacer around the pointed end of the bolt.
- vi. Insert Hanger Bolt assembly (with spacer) into the drilled hole.
- vii. Using a long series  $1/2"$  socket drive, tighten until the EPDM Neoprene Washer is seated firmly enough to ensure a watertight seal.

**DO NOT OVERTIGHTEN - THIS MAY DAMAGE THE ROOF AND CAUSE LEAKAGE**

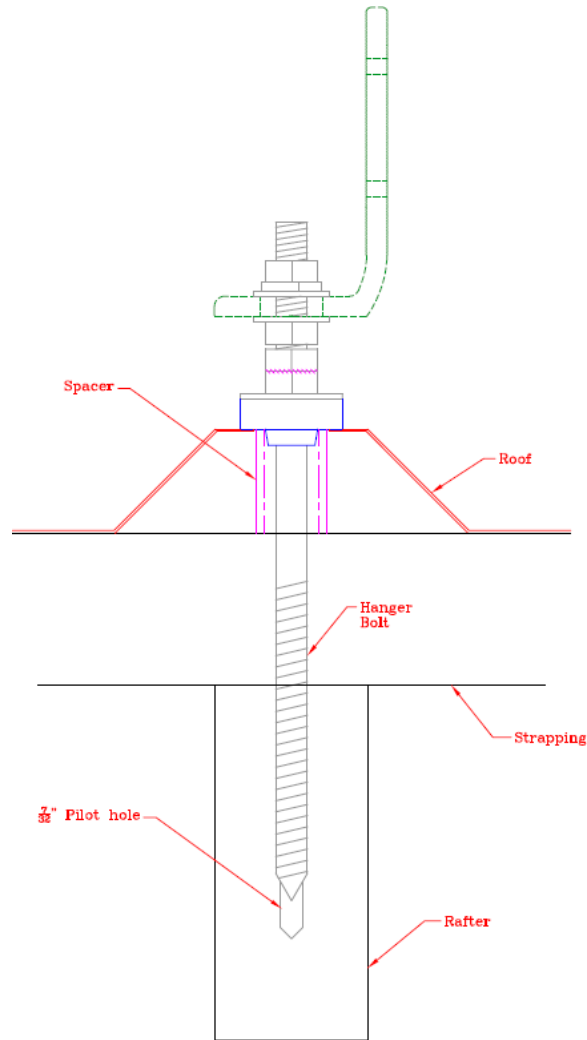


Figure 40 Hanger Bolt Peak Installation

#### 9.2.3.1.3. Square Roof Mount

**Lag Bolt Instructions:**

- i. Drill one or two 7/32" pilot holes in line with the holes of the mounting plate at each mounting location.
- ii. Insert a bead of Geocel 4500, BES 925 or equivalent into each of the holes.
- iii. At each location, install two Lag Bolts through the holes of the steel plate into the predrilled holes.
- iv. Lay a bead of Geocel 4500, BES 925 or equivalent on the roof around the outside edge of the plate.

#### Self-Drilling Screw Instructions:

For attaching to the sheathing, use four 2" self-drilling screws.

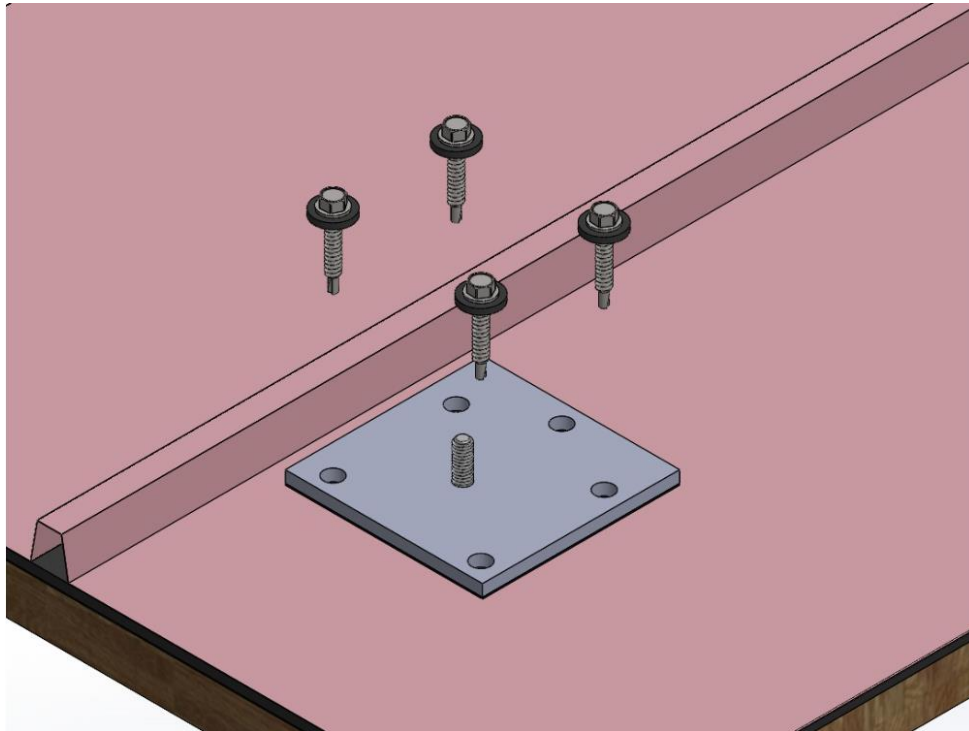


Figure 41 Installing Square Roof Mount using Four 2" Self-Drilling Screws

#### 9.2.3.1.4. Universal L-Mount

- i. Installation surface must be flat and even (within 1/16") to ensure a watertight seal.
- ii. Measure and mark the appropriate mount locations using Tables in Appendix 2. Use a measuring tape to ensure chalk lines are straight and square.
- iii. Prepare the roof for the installation of lag bolts by drilling two 7/32" pilot holes through the roof and into the rafter for each mount that will be affixed.
- iv. Peel wax paper off the backing of the mount prior to its final placement.
- v. Screw each mount into position using two lag bolts.
- vi. Installation using four self-drilling screws will be the same as Shingled Roofs (section 1.2.1.2 Step B).

#### 9.2.3.1.5. Giraffe Mounts and Rhino Mounts

1. Measure and mark the appropriate mount locations. Use a measuring tape to ensure chalk lines are straight and square. Please note that the Giraffe Mount is designed to attach rail that is running towards the peak of the roof i.e., perpendicular to the eaves.

2. Hold the Giraffe Mount / Rhino Mount such that the legs are on either side of the roof protrusion. Attach the mount to the roof strapping or sheathing using lag bolts or self-drilling screws.

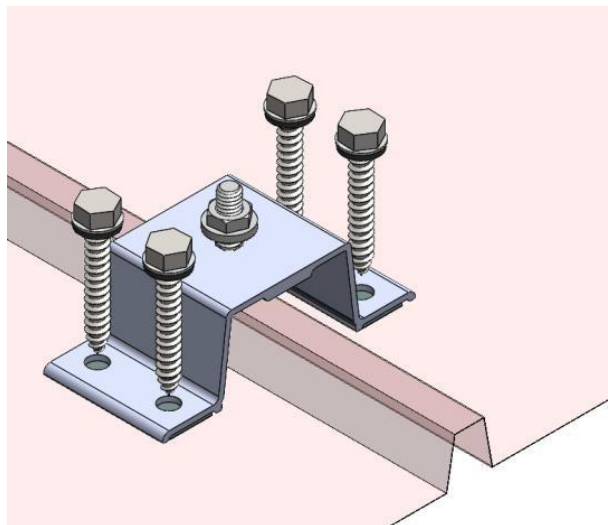
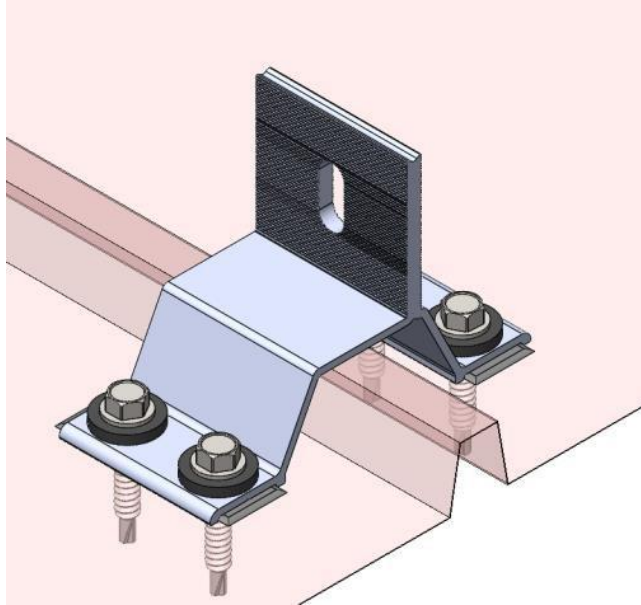


Figure 42 Top- Giraffe Mount (self-drilling screws shown), Bottom- Rhino Mount (2" lag bolts shown)

### 9.2.3.2 Standing Seam

#### 9.2.3.2.1. Regular Standing L & Large Standing L

- i. Measure and mark the appropriate Standing L locations. Use a measuring tape to ensure chalk lines are straight and square.
- ii. Place the Standing L so that it straddles the standing seam, ensure that the underside of the Standing L rests on top of the seam.
- iii. Torque to 12 ft-lbs (16.3 N-m).

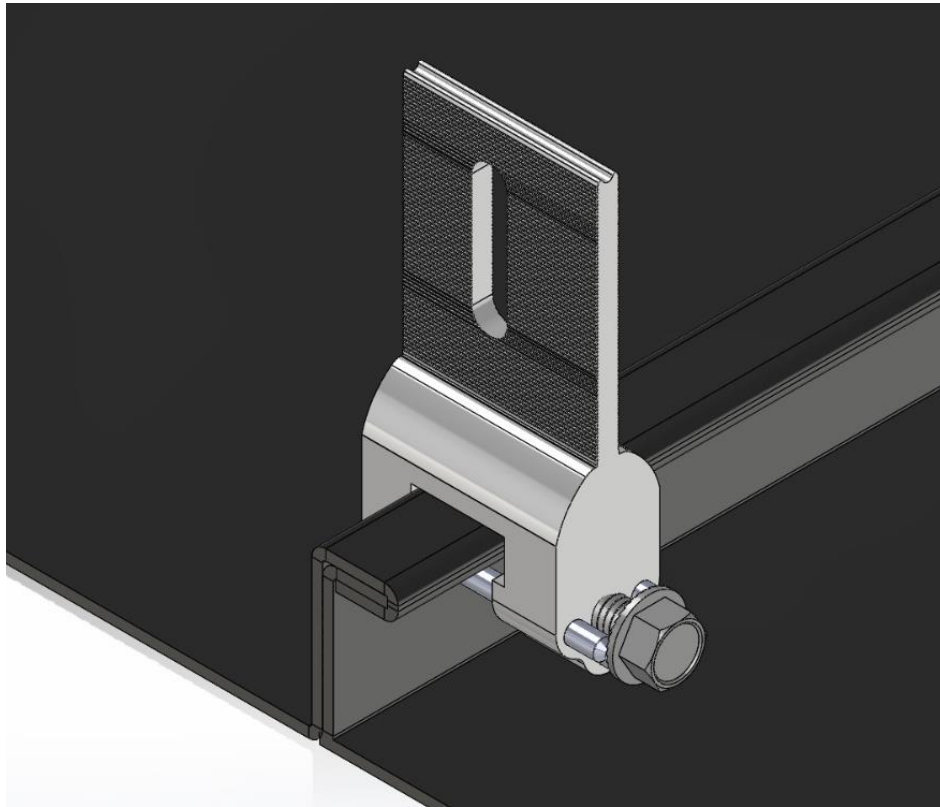


Figure 43 Standing L

#### 9.2.3.2.2. S-5! / A2

Please refer to the manufacturer's installation instructions.

## 9.2.4 Quonset Hut

### 9.2.4.1 Quonset Hut Mount

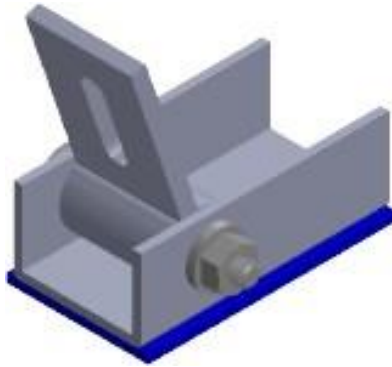


Figure 44 Quonset Hut Mount

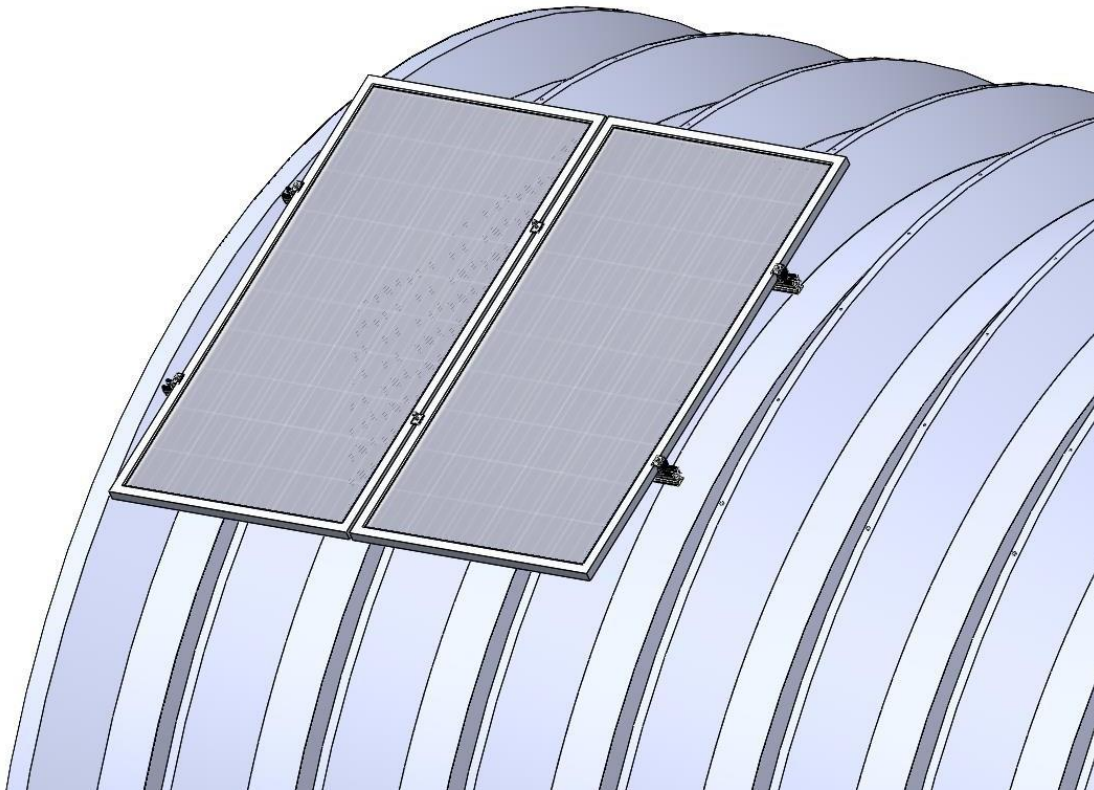


Figure 45 Modules mounted on a Quonset Hut

The Quonset Hut Mount is attached to Rapid1 Rails using a K-Nut. The modules and clamps are mounted on the rails following steps that were previously described.



### 9.3. L-Brackets / Rails

a) Insert the K-Nut of the L-Bracket assembly into the side channel of the rail.

\*See section 5.3.1

b) Attach the short end of the L-Bracket to the baseplate using the supplied flange nut. The long end should be upright.



Figure 46 Installed Rails

### 9.4. Bear Clamp

- a) Insert the nose of the bear clamp ensuring that the clamp's groove is aligned on the length wise protrusion of the rail.
- b) Position the rail by installing the bolt and nut.
- c) Torque to spec.

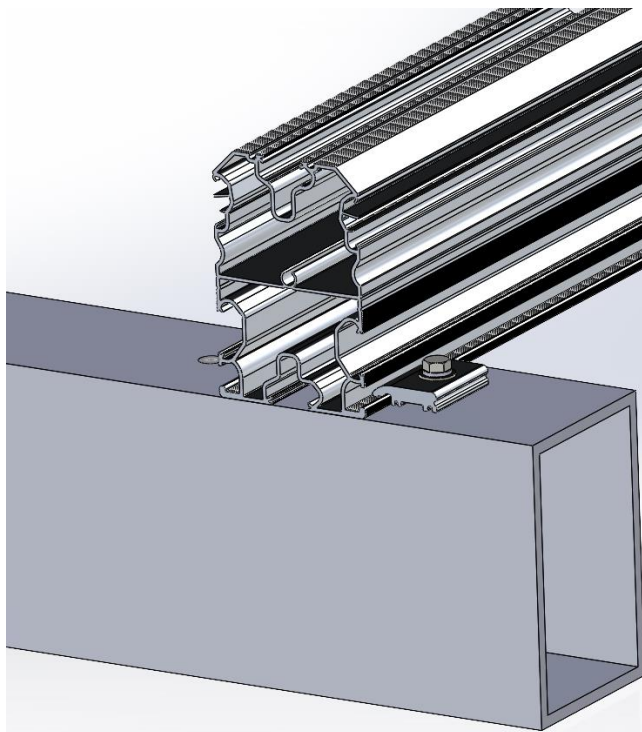


Figure 47 Bear Clamp

## 9.5. Rail Joiners

\*If not using Rail Joiners, continue to section 9.6.

- a) Insert the Joiner assembly into the side channel of the rail at the ends being joined. Ensure Joiner is centered between the two rail ends. Tighten the bolts of the Joiner. Torque to 12 ft-lbs (16.3 N-m).

## 9.6. Awning Mounts

- a) Determine the desired location of the Awning Brackets and mark each position. The maximum spacing between the awning brackets is 48 in and the maximum cantilever is 19 in.
- b) Using fasteners of choice, attach the awning brackets to the wall in marked locations.

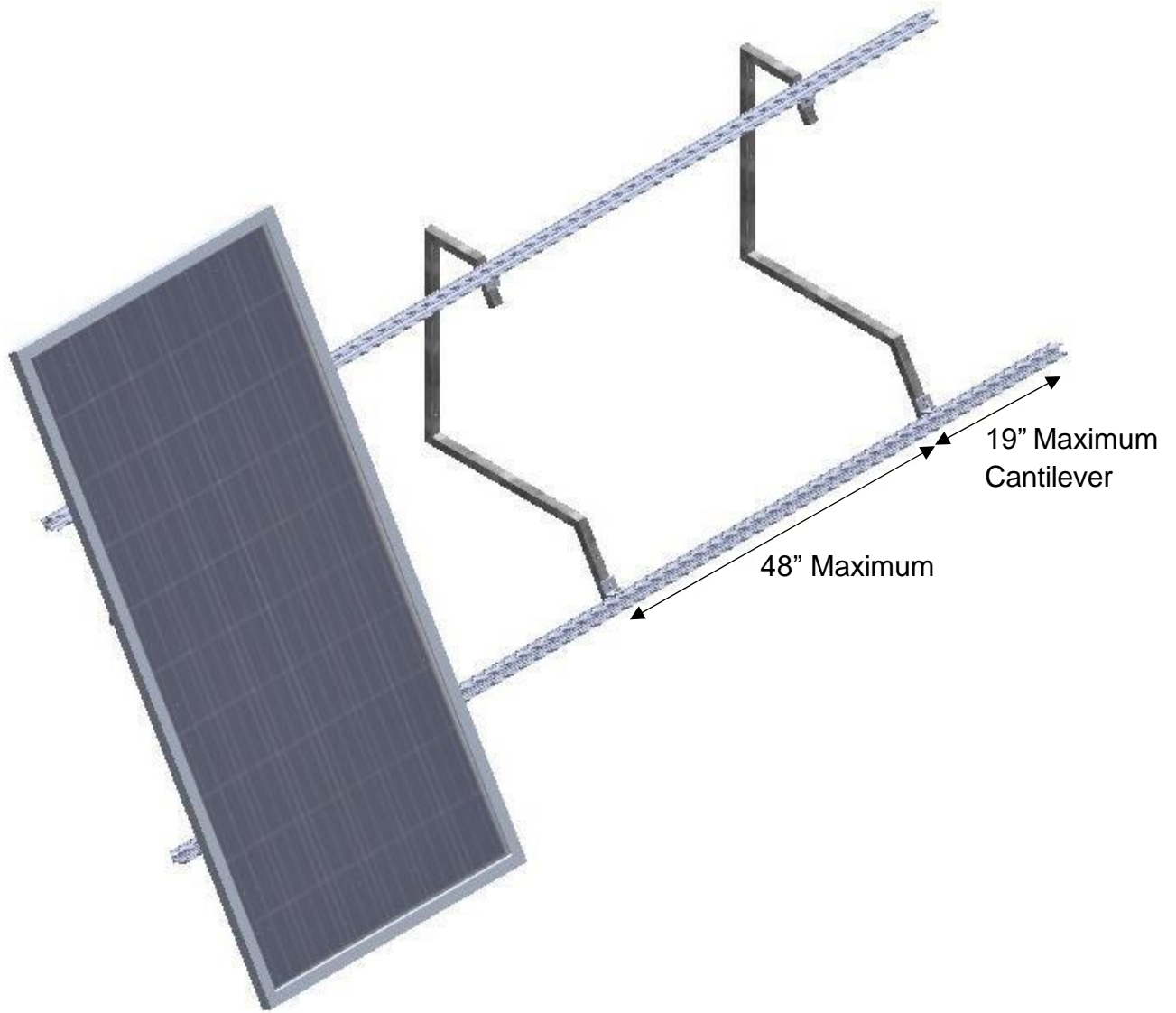


Figure 48 Awning Mounts

### 9.7. Micro Inverters

\*Install Micro Inverters according to manufacturer specifications. The following attachment methods can be used.

#### 9.7.1. Side Mount

- a) Insert the K-Nut portion of the microinverter mount assembly into the side channel of the Rail at 30 degrees.
- b) Install the microinverter onto the mount (Figure 12).
- c) Tighten and torque to spec.

#### 9.7.2. Top Mount

- a) Insert the K-Nut portion of the microinverter mount assembly into the top channel of the Rail at 30 degrees.
- b) Install the microinverter onto the mount (Figure 12).
- c) Tighten and torque to spec.

### 9.8. Mount Solar Modules

- a) Position the module on the rails (make sure to hold modules securely until properly fastened). Ensure the first module is square before continuing, as this will affect the squareness of the array.
- b) Insert the K-Nut of the End-Clamp assembly into the top channel of the rail. Insert the K-Nut of the Mid-Clamp assembly into the top channel of the rail. Slide Mid and End-Clamps into place against the edge of the panel.

- c) Tighten Mid and End-Clamps to hold module in place - do not fully torque.

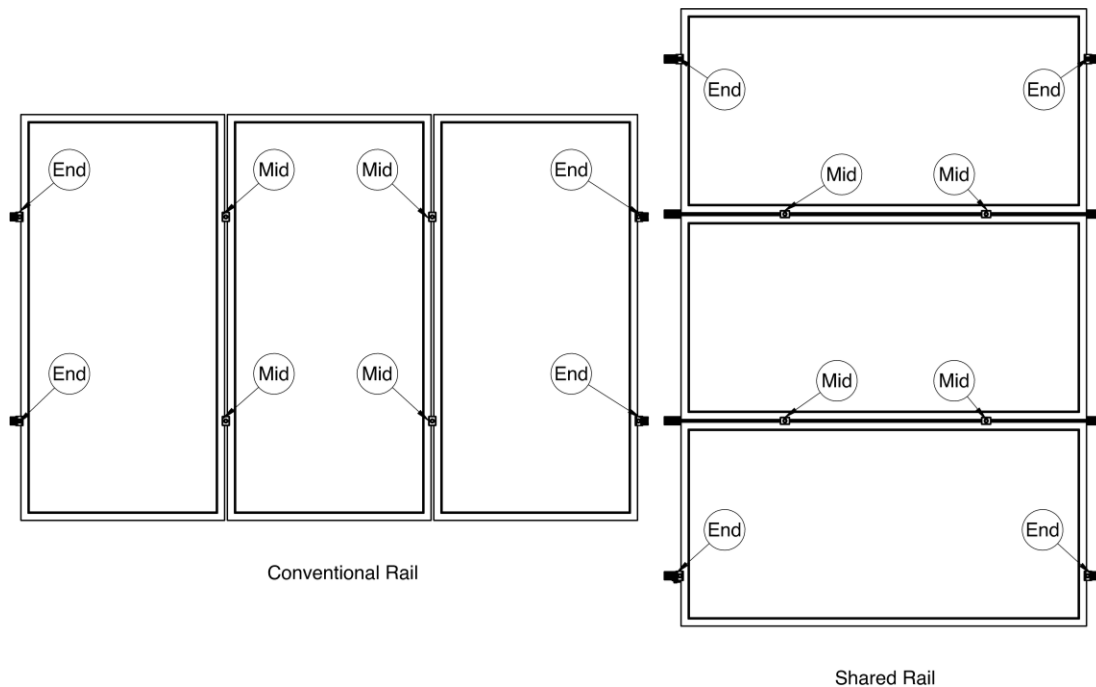


Figure 49 End and Mid Clamp Positions in Conventional and Shared Rail Layouts

- d) Repeat steps 1-4 as required for the remaining modules.  
e) Torque clamps to 12 ft-lbs (16.3 N-m).

## 9.9. Wire Management

Various Wire Management methods can be combined.

### 9.9.1. Cable Raceway

- Hang the Cable Raceway segment on the bottom edge of the side channel of the rail.
- Lay cables into the Cable Raceway segment. Rotate the Raceway segment until it snaps into the top edge of the side channel of the rail.

### 9.9.2. Lock-On Cable Tie

- Place on the rail where needed; approximately 1 x Cable Tie for every 1 foot of rail.
- Wrap Cable Tie around cables and fasten tightly.

### 9.9.3. Integrated Cable Management

The rail itself provides a channel which may be used to secure cables in certain scenarios. Simply press the cable into the grooves at the top of the cable management channel along the length which you would like to secure. A maximum of two cables can be secured this way using the channel.



Figure 50 Integrated Cable Management

## 10. Venture Rail System

### 10.1. O-Ring Cord Sealing Channel

- a) Without stretching, press the O-Ring cord into the O-Ring Cord Sealing Channel along its top edge.
- b) Repeat for the other side and other rails as necessary.

### 10.2. Install Rails

#### 10.2.1. L-Brackets

- a) Position the rail in the desired location, place the L-Bracket in the side channel of the rail in the appropriate position.
- b) Install your desired fasteners along with the L-Brackets in the appropriate locations according to the manufacturer's guidelines.
- c) Repeat steps 1-2 as necessary for the remaining rails.

#### 10.2.2. K-Nut & Bolt

- a) Drill holes at the desired locations and insert the bolts from the underside and attach the K-Nuts
  - b) Starting from either end, slide the rail onto the K-Nuts
  - c) Position the rail and tighten the bolts
- \*Ensure bolt does not come into contact with top edge of bottom channel

### 10.3. Mounting Modules

- a) Position the module on the rails (make sure to hold modules securely until properly fastened)

- b) Ensure the first module is square before continuing, as this will affect the squareness of the array.
- c) Insert the K-Nut of the End-Clamp assembly into the top channel of the rail.  
Insert K-Nut of the Mid-Clamp assembly into the top channel of the rail.
- d) Slide clamps into place against the edge of the panel
- e) Tighten the clamps to hold the module in place (do not fully torque)
- f) Repeat steps 1-4 as required for remaining modules
- g) Torque clamps to 12 ft-lbs (16.3 N-m)

#### 10.4. Wire Management

Various Wire Management methods can be combined

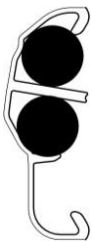
##### 10.4.1. Cable Raceway

- a) Hang the Cable Raceway segment on the bottom edge of the side channel of the rail
- b) Lay cables into Cable Raceway segment. Rotate Raceway segment until it snaps into top edge of side channel of rail

##### 10.4.2. Lock-On Cable Tie

- a) Place on rail where needed; approximately 1 x Cable Tie for every 1 foot of rail
- b) Wrap Cable Tie around cables and fasten tightly

##### 10.4.3. Integrated Cable Management



The rail itself provides a channel which may be used to secure cables in certain scenarios. Simply press the cable into the grooves at the top of the cable management channel along the length which you would like to secure. A maximum of two cables can be secured this way using the channel.

Figure 51 Integrated Cable Management

## 10.5. Micro-Inverter Mounts

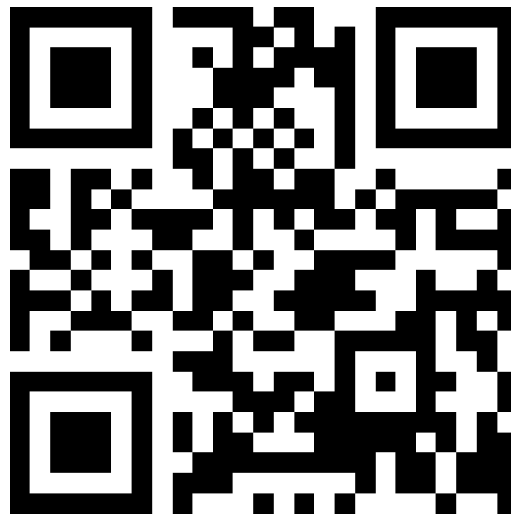
\*Install Micro Inverters according to manufacturer specifications. The following attachment methods can be used.

### 10.5.1. Side Mount

- a) Insert K-Nut portion of micro inverter mount assembly into side channel of Rail at 30-degrees.
- b) Install micro inverter onto mount
- c) Tighten and torque to spec

### 10.5.2. Top Mount

- d) Insert K-Nut portion of micro inverter mount assembly into top channel of Rail at 30-degrees.
- e) Install micro inverter onto mount
- f) Tighten and torque to spec



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