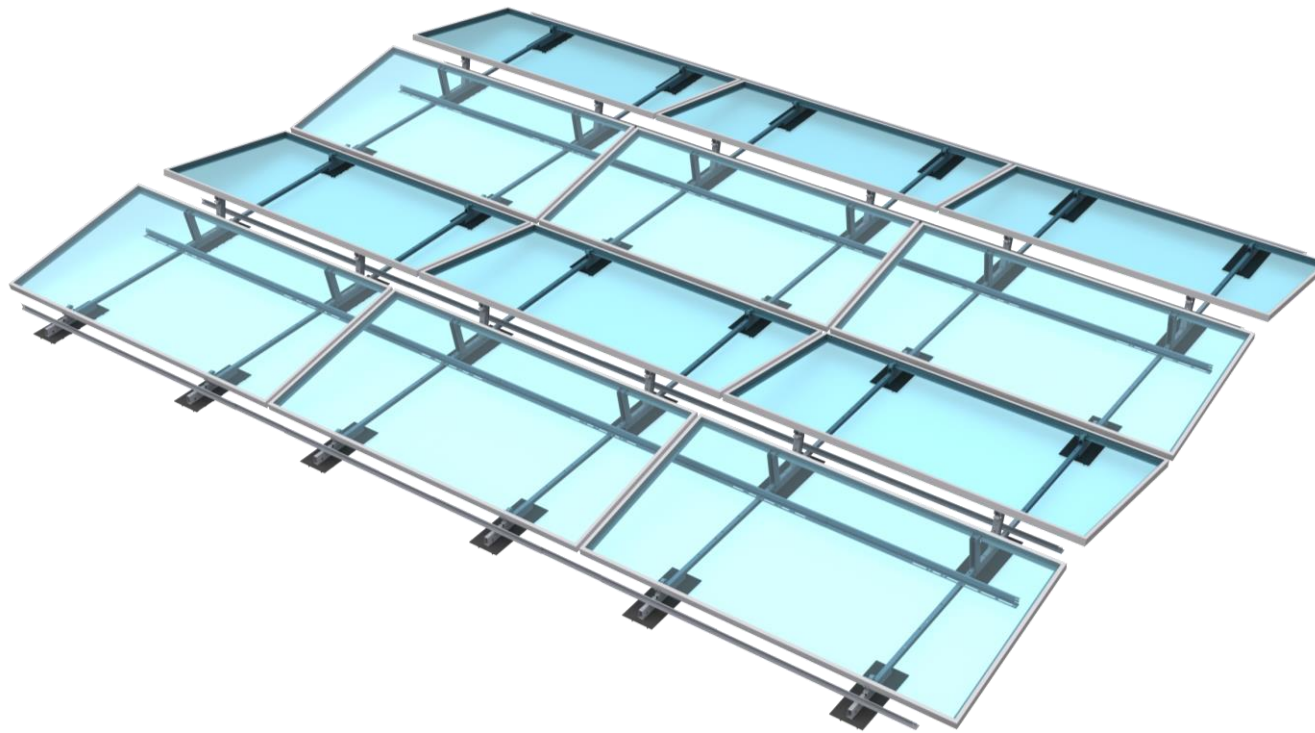


# PowerCap Dual Tilt 10 Degree Installation Manual



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# Disclaimers

## Introduction

The PowerCap Dual Tilt (DT) 10 Degree mounting system is comprised of four major components that intuitively assemble into a support structure for photovoltaic (PV) modules. This installation manual explains how to build a PV array using PowerCap DT 10 Degree.

ALL RACKING COMPONENTS IN EACH SUBARRAY AND THEIR CONNECTIONS, BALLAST, AND MECHANICAL ATTACHMENTS (IF ANY IN DESIGN) MUST BE INSTALLED BEFORE MOUNTING MODULES. WHEN FORECASTED WIND GUSTS EXCEED 25% OF THE WIND SPEED LISTED IN THE SITE CRITERIA TABLE OF THE RACKING CONSTRUCTION SET, ALL MOUNTED MODULES MUST BE COMPLETE PAIRS (DOMES) TO AVOID POSSIBLE SYSTEM DAMAGE.

A CORROSION INSPECTION ONE YEAR AFTER INSTALLATION AND ONCE EVERY THREE YEARS THEREAFTER IS REQUIRED TO MAINTAIN THE PRODUCT WARRANTY. VISIBLE SURFACE RED RUST ON STEEL COMPONENTS MUST BE LOCALLY COATED WITH A COMMERCIALY AVAILABLE GALVANIZED PAINT OR COATING TO MAINTAIN PRODUCT WARRANTY.

THIS PRODUCT MUST BE INSTALLED AND USED ACCORDING TO THESE WRITTEN INSTRUCTION. ANY INSTALLATION OR USE OF THIS PRODUCT NOT IN ACCORDANCE WITH OR NOT AUTHORIZED BY THIS MANUAL SHALL VOID ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, ON THE PRODUCT OR THE USE OF THE PRODUCT AND MAY CAUSE FAILURE, PROPERTY DAMAGE AND PERSONAL INJURY. PANELCLAW/WATERSHED GEOSYNTHETICS (WG) IS NOT LIABLE FOR ANY UNAUTHORIZED USE. INSTALL AND USE ONLY WITH OTHER PANELCLAW/WG AUTHORIZED RACKING PRODUCTS TO ENSURE PROPER FIT AND FUNCTION.

PRIOR TO INSTALLATION, READ THE SAFETY PROVISIONS ATTACHED IN [Appendix C: Safety](#) AND REVIEW THIS INSTALLATION MANUAL IN ITS ENTIRETY.

## Sub Array Dimensions

Each PV system is unique and is frequently made up of multiple sub arrays. The Racking Construction Set, which must be onsite at all times during construction, details sub array dimensions and location on the site. Review the Racking Construction Set in its entirety to prevent unnecessary rework during site construction.

The furthest extent of the racking components or modules of adjacent sub arrays, whichever defines the outermost array boundaries, must be separated by *at least* the minimum dimensions documented in the Racking Construction Set. Refer to the **general notes** and the **Minimum Clearance Requirements table**, if present, within the Racking Construction Set.

## Storage Considerations

PanelClaw/WG recommends installing the racking components shortly after delivery to the project site. If PowerCap components are not deployed immediately, they should be stored in a well-ventilated, dry location. Otherwise, moisture can form between the packed components which may cause staining and/or white rust. Significant white rust formation may decrease the coating service life and, in extreme cases, the component performance.

If storage onsite is unavoidable, remove the plastic and/or cardboard wrapping from the exterior of the packaging and cover with canvas or place components under an open sided tent. Note the use of a plastic cover does more harm than good as it prevents the product from breathing and causes condensation. Storing parts in any other manner is at the customer's own risk. PanelClaw/WG is not liable for claims related to improper storage and any such claims are not covered by the product warranty.

## Operations & Maintenance

See O&M Manual, available upon request, for initial inspection recommendations including steps that can be performed only during construction.

## Installer's Responsibility

### IT IS THE INSTALLER'S RESPONSIBILITY TO:

- Ensure safe installation of all electrical aspects of the array. All electrical installation and procedures should be conducted by a licensed and bonded electrician or solar contractor. Routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path of the system. All work must comply with national, state and local installation procedures, product and safety standards.
- Comply with all applicable local or national building and fire codes, including any that may supersede this manual.
- Ensure all products are appropriate for the installation, environment, and array under the site's loading conditions.
- Use only PowerCap parts or parts recommended by PanelClaw/WG; substituting parts may void any applicable warranty.
- Ensure provided information is accurate. Issues resulting from inaccurate information are the installer's responsibility.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- If loose components or loose fasteners are found during periodic inspection, retighten immediately. Any components showing signs of corrosion or damage that compromise safety shall be replaced immediately.
- Provide an appropriate method of direct-to-earth grounding according to the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems.
- Disconnect AC power before servicing or removing modules, AC modules, microinverters, and power optimizers.
- Review module and any 3<sup>rd</sup> party manufacturer's documentation for compatibility and compliance with warranty terms and conditions.
- Review the "General Notes" section for additional responsibilities.

## Safety Overview

Safety is an essential part of every PV installation and every construction site. Please view [Appendix C: Safety](#) for further information.

# Ratings

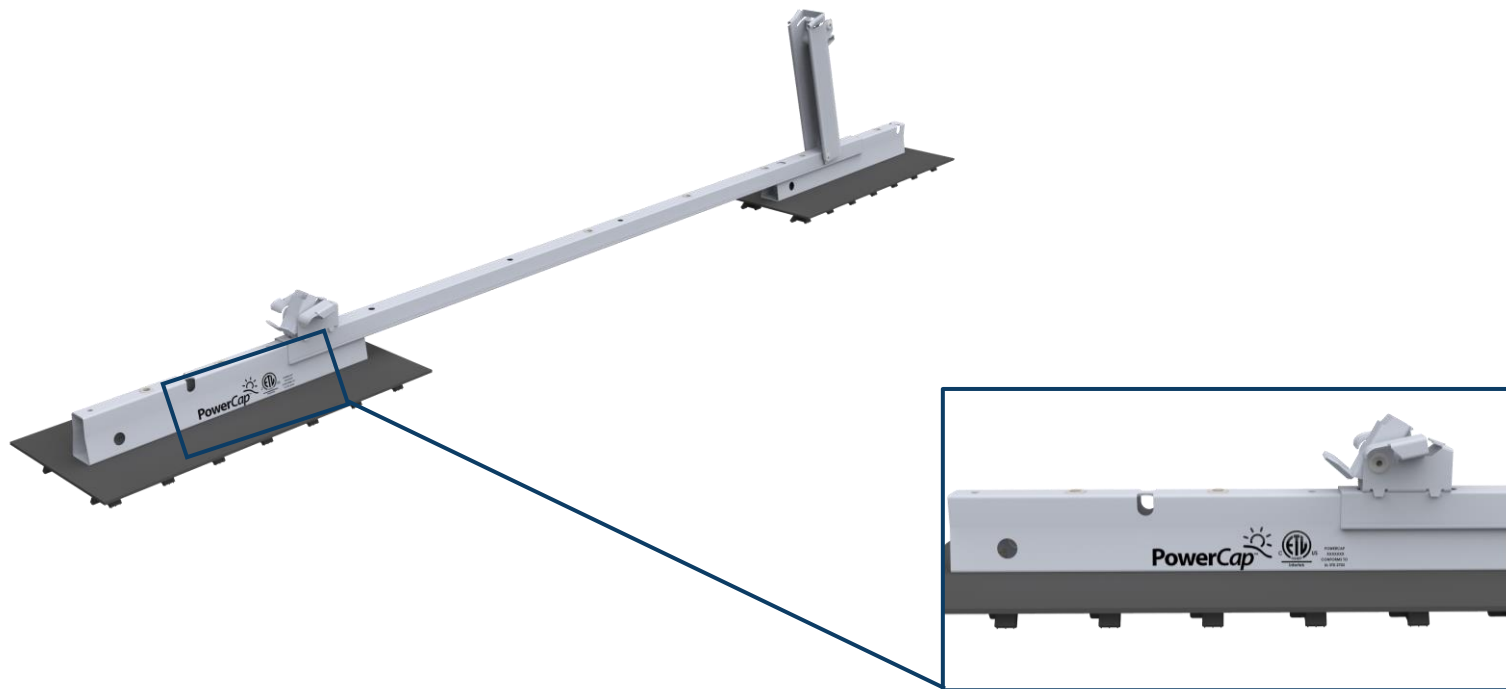
## UL 2703 Listing:

**PowerCap Conforms to UL STD 2703 Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels and Certified to CSA TIL No. A-40.**

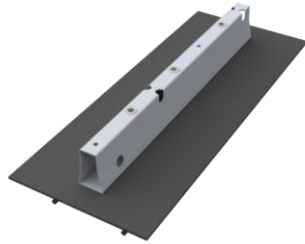
- Max Overcurrent Protective Device (OCPD) Rating: 40A
- Max Module Size: 36.8 ft<sup>2</sup>
- Module Orientation: Landscape
- System Design Load Rating: 30psf downward, 30psf upward, 5psf lateral
- Actual system structural capacity defined by the PE stamped calculation package and racking construction set

# Markings

Markings are located on the PowerCap Base and Bolt, as shown below:



# System Components



Base  
500054201



Module  
Connector  
5000633XX



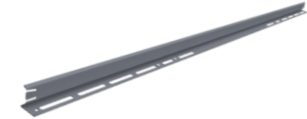
Cam  
5000630



Cam Claw  
2000854



M6x16mm Bolt  
2000697



Rail  
2000695/2000895

## Accessories



MLPE Attachment  
5000619  
See Appendix B for  
more details



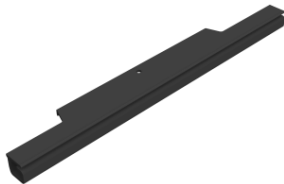
Ground Lug Kit  
5000494



Ballast Block (Local Third Party Supplier)  
See Appendix A for more details

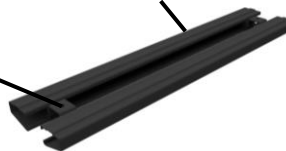
## Wire Management

See: 9910053-Wire Management Manual



Wire Router  
5000225XX

Homerun Clip  
5000628



Wire Management  
Homerun

Homerun Cover  
500062302

Homerun Clip, XL  
5000766



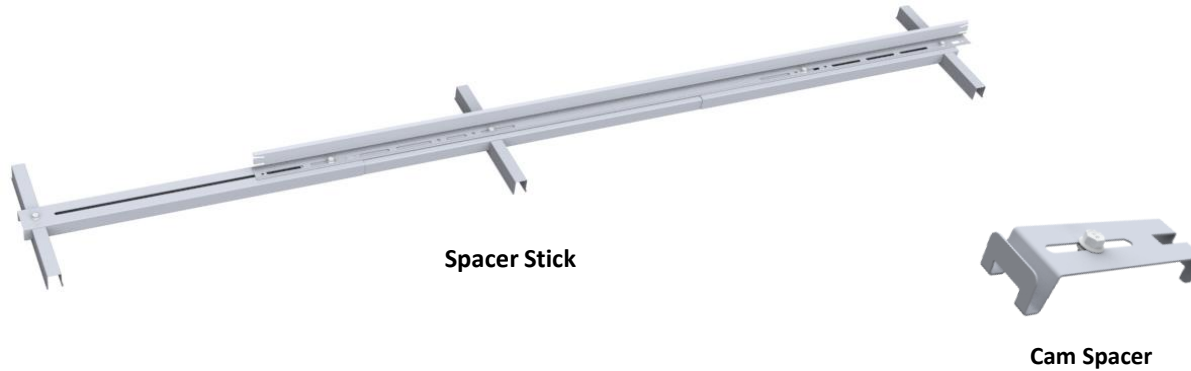
Wire Management  
Homerun XL

Homerun Cover, XL  
5000767



Wire Clip  
5000226

1. This installation manual is limited to the mechanical assembly of a PowerCap system. Refer to other documents for the electrical installation of a PV array.
2. Once parts are delivered to the site, the installer should inspect for any signs of damage or missing parts prior to assembly process. In the event damaged or missing parts are identified, they should be separated from the rest. Also, it is suggested that an accurate inventory is maintained during the inspection.
3. Some parts may be pre-assembled in designated areas to enhance efficiency before being transported to the installation area. It is suggested that the preassembled components be well-organized to uphold work efficiency.
4. Use appropriate handling equipment approved by the owner's representative.
5. The installer is responsible for proper containment, collection, and disposal of waste, packaging, and waste products produced during the installation of a PowerCap system.
6. Construction of access roads may be required on top of ClosureTurf®, particularly along frequently used routes. Performance of routine maintenance on access roads will be expected.
7. Refer to the ClosureTurf design drawings and engineering specifications prepared by the landfill design engineer-of-record and the ClosureTurf general installation specifications and guidance prepared by WG for project requirements including equipment loading limits.
8. During trafficking, do not make sharp turns, sudden acceleration/deceleration, repetitive passes of equipment directly on ClosureTurf. Refer to ClosureTurf engineering specifications prepared by the landfill design engineer-of-record and the ClosureTurf general installation specifications and guidance prepared by WG for more details regarding trafficking on ClosureTurf.
9. Any staging area on ClosureTurf should be free of any sharp objects that can damage ClosureTurf. Damaged pallets, if any, should be repaired prior to placement on ClosureTurf.
10. Ensure that survey control points do not puncture the ClosureTurf system and are securely installed to prevent any movement prior to PowerCap installation. Frequent surveying is suggested to minimize deviation from the design PV array alignment.
11. Quality control (QC) activities should be undertaken to ensure that the PV array installation is performed in accordance with the drawings and technical specifications.



Spacer Stick

Cam Spacer

Spacer Stick and Cam Spacer Kit  
 5000510/5000610  
 2000761 may be required, see  
 page 7 for more information

## Tools

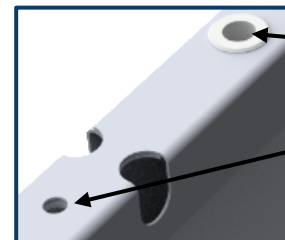
Drill with Inline-Torque Limiter or Torque Wrench

10 mm Magnetic Nut Driver

**ALERT: NO IMPACT DRIVERS**

Torque Setting*	Fastening Operation
6 ft-lb (8.1 Nm)	All System connections except Special Cases
3 ft-lb (4.1 Nm)	Special Cases

\* +/-4% allowable during installation



Bolts which are installed into a pre-installed nut are tightened to **6 ft-lb**

Bolts which are installed into a pilot hole are tightened to **3 ft-lb**

**Note:** Additional tools may be required when installing accessories.

# 1. Construction Aid Setup

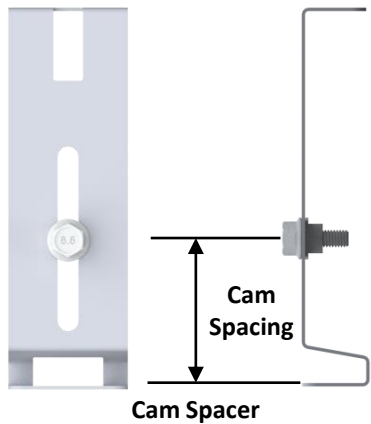
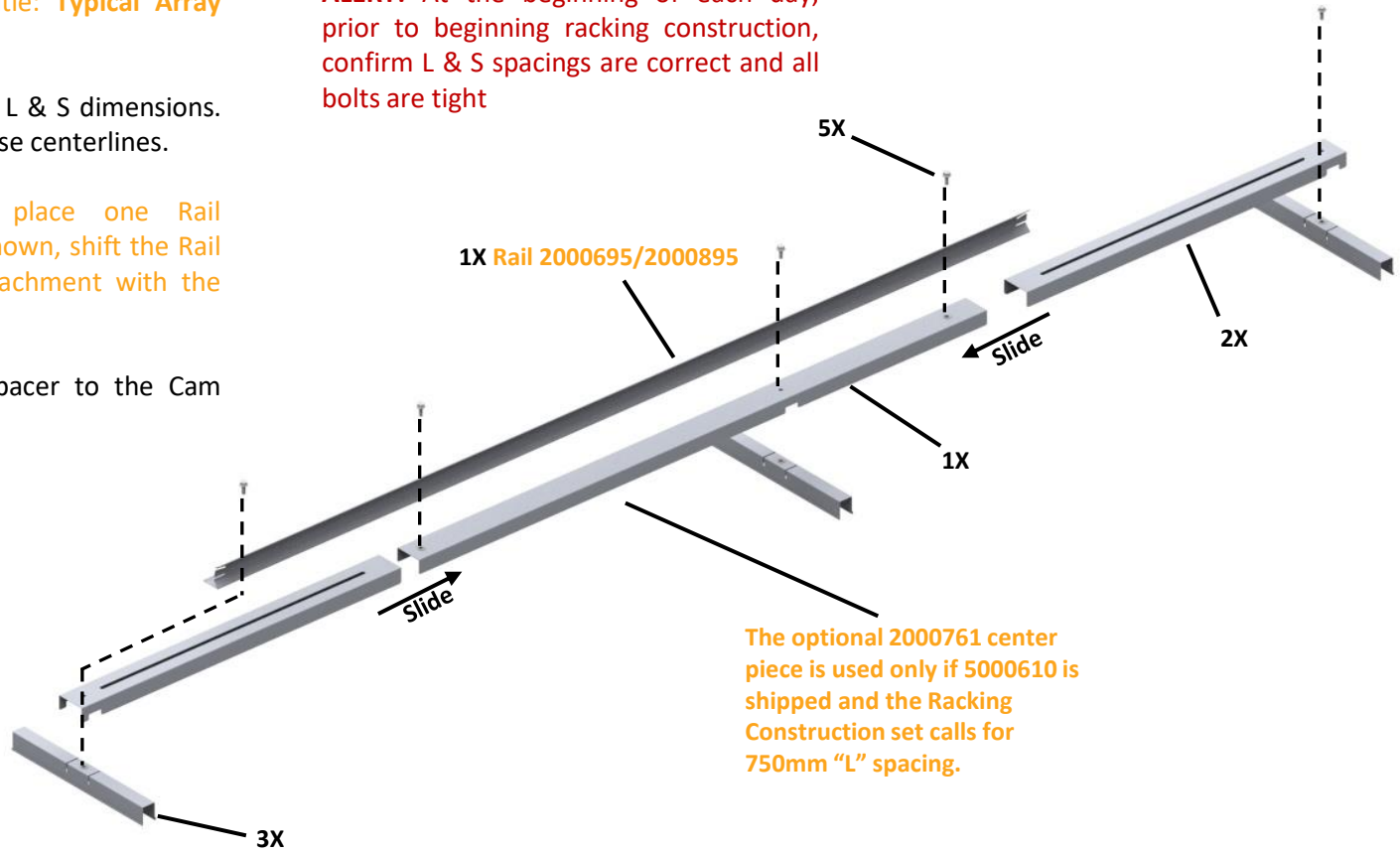
**Tip:** L, S, and Cam Spacer dimensions are found in the Racking Construction Set. See Sheet Title: **Typical Array Dimensions**.

**ALERT:** At the beginning of each day, prior to beginning racking construction, confirm L & S spacings are correct and all bolts are tight

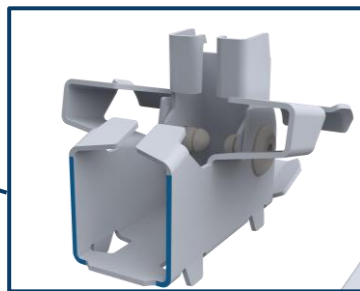
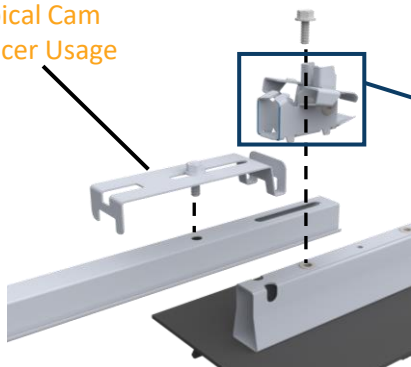
1.1 Assemble the Spacer Stick and adjust to L & S dimensions. All dimensions are measured from the Base centerlines.

**Tip:** To stiffen the Spacer Stick, place one Rail 2000695/2000895 on the assembly as shown, shift the Rail to find a location which allows for attachment with the specified bolts. Tighten the bolts.

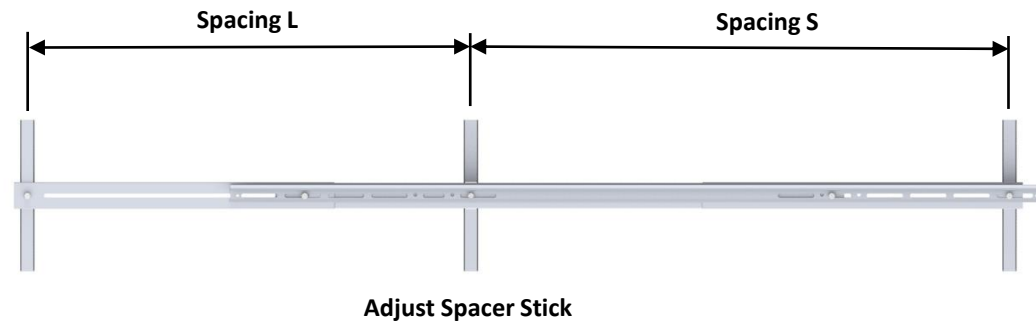
1.2 Insert the bolt and adjust the Cam Spacer to the Cam Spacing dimension.



Typical Cam Spacer Usage



**Tip:** Cam Spacing is measured off the highlighted face and not the extended tab on the back of the Cam Bracket

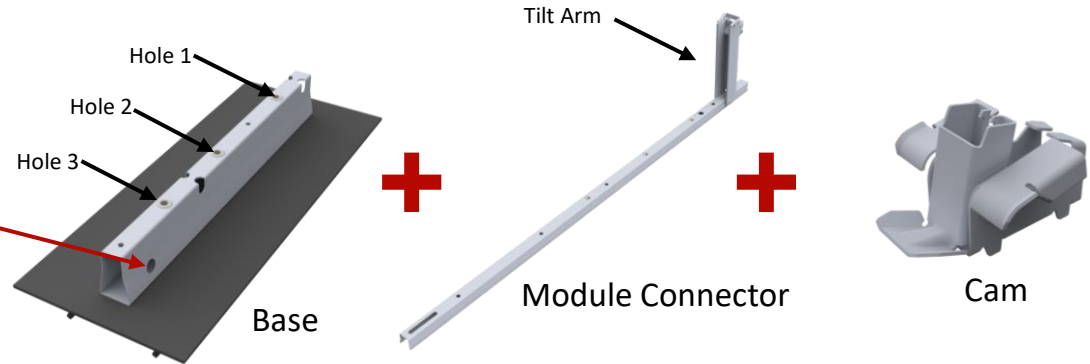


## 2. Build Assemblies

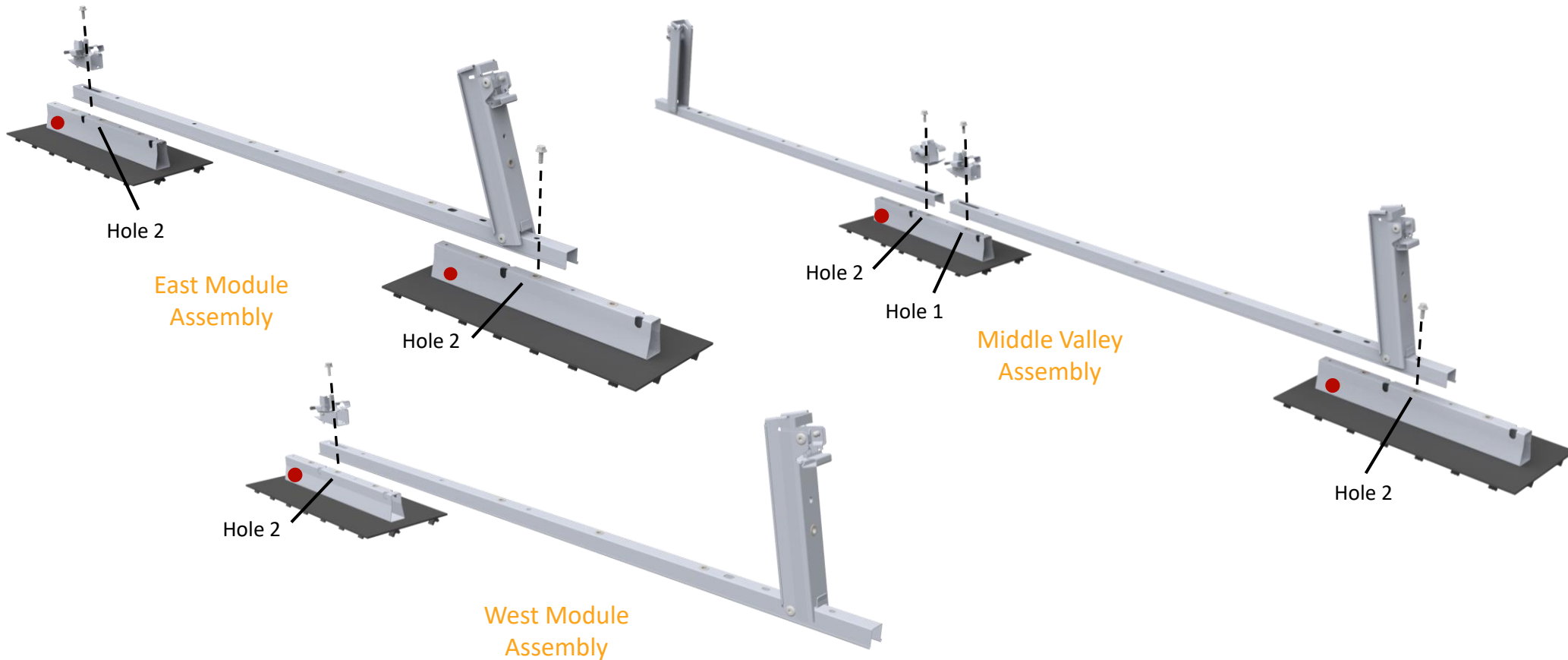
2.1 Position components as required per assembly type and loosely assemble the Cam, Module Connector and Base.

**ALERT:** Note location of orientation marker on Base “●”

**Tip:** Immediately tighten bolts at the Tilt Arm end of the assembly to **6 ft-lb.**



2.2 Use the Cam Spacer tool to correctly locate the Module Connector. Tighten bolt to **6 ft-lb.**





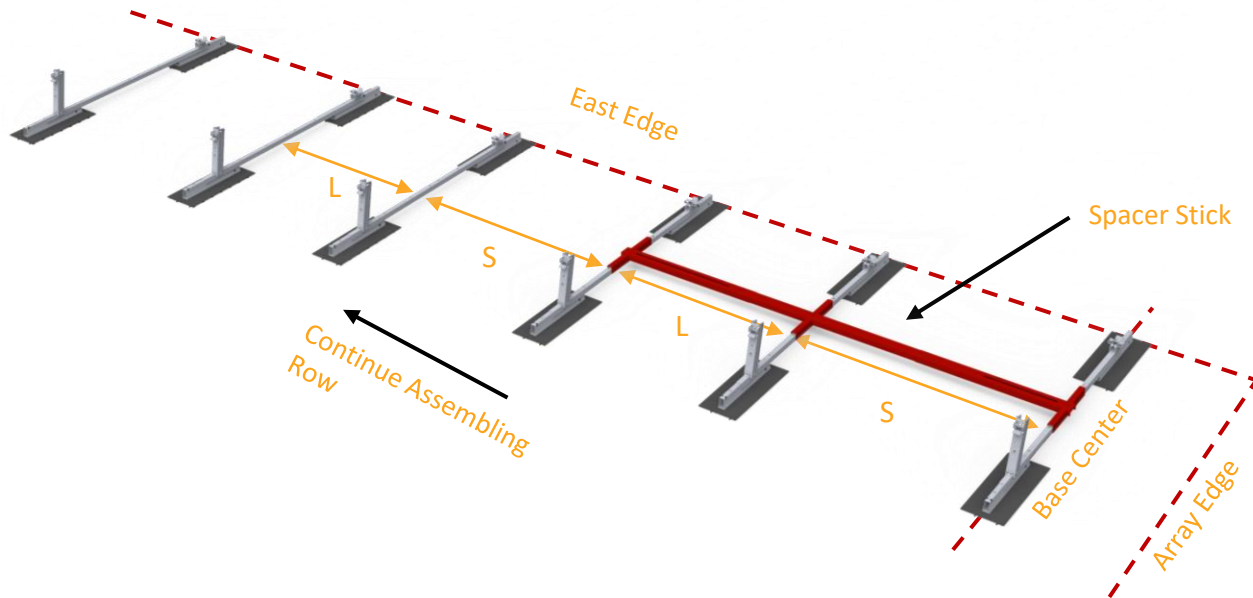
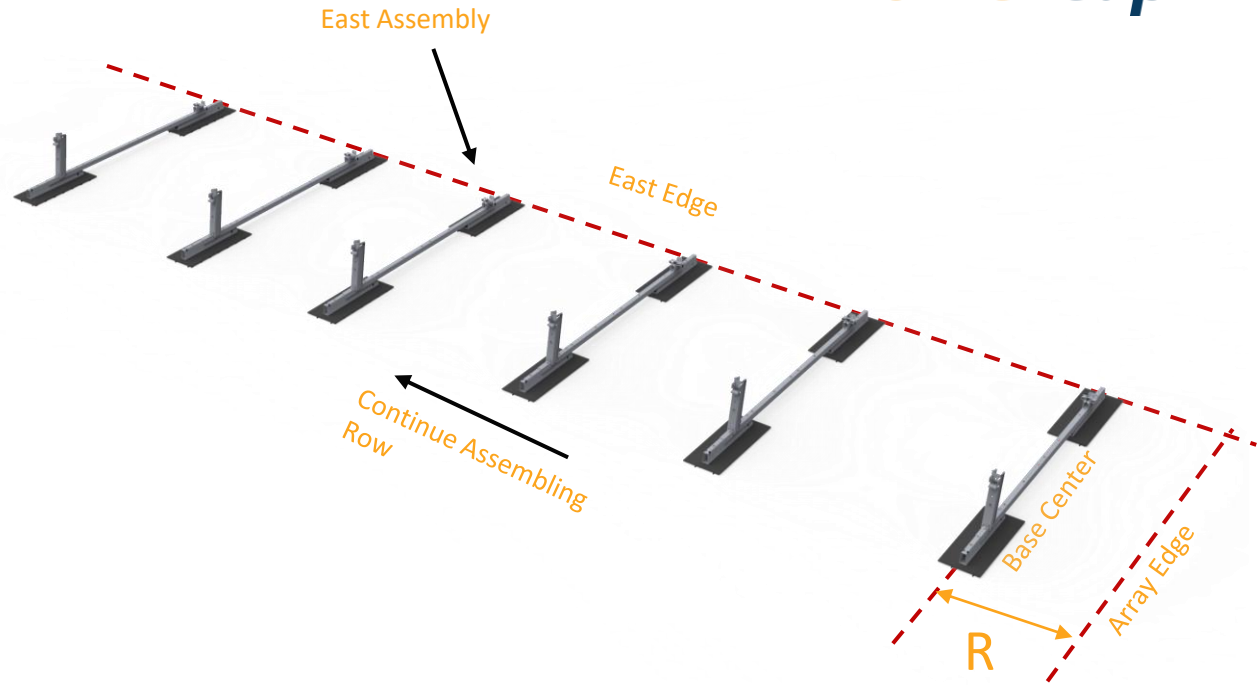
# 3. Build East Row

## 3.1 Snap East Edge, Array Edge, and Base Edge lines.

**Tip:** Snap Array Edge lines on one or both array edges (row ends) and snap Base Center line on the edge where module mounting will begin.

## 3.2 Place East Assemblies with the Base Pads along the East Edge line. The first and last East/West Assemblies should be placed using the “R” dimension, measuring from Array Edge to Base Center.

**Tip:** R dimension can be found in the Racking Construction Set. See Sheet Title: **Typical Array Dimensions**.



## 3.3 To align the Module Connectors before Rail installation, utilize the Spacer Stick to secure the Module Connectors.

**Tip:** “S” spacings are module centered “L” spacings are between modules.

**Tip:** L and S dimensions are found in the Racking Construction Set. See Sheet Title: **Typical Array Dimensions**.

## 4. Rail Installation

- 4.1 Place a Rail on all “S” spacings (module centered). Rails at ends of rows should be flush with array edge when “S” spacings permits.

Place a Rail on all “L” spacings (between modules) on top of and overlapping the Rails on the “S” spacing. Install bolt and tighten to **6 ft-lb**.

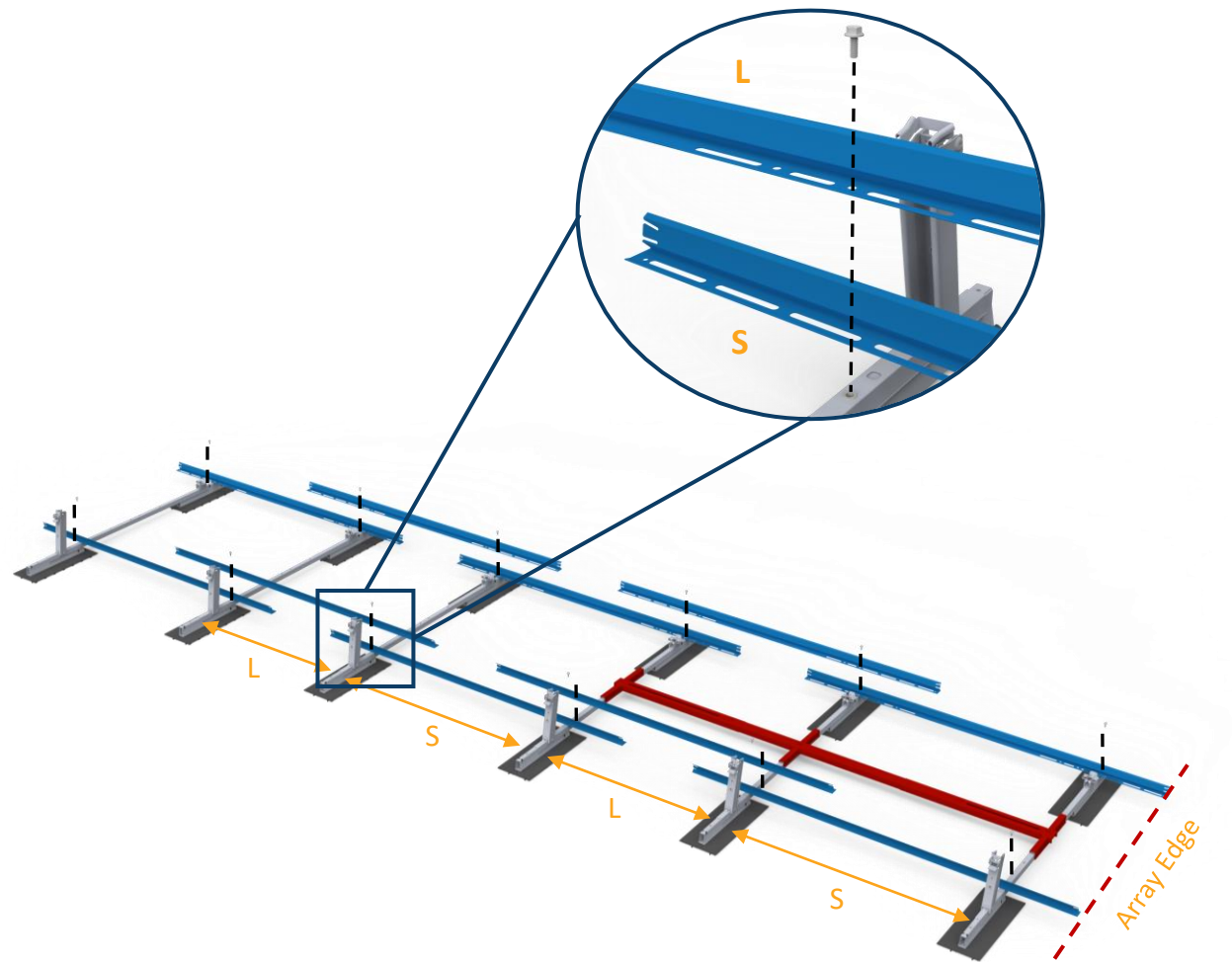
**ALERT:** Tighten fasteners prior to moving spacer stick to next position.

- 4.2 Install Rails throughout the array using the same steps described in 4.1. Alternating between “S” and “L” Spacings. Install bolt and tighten to **6 ft-lb**.

**ALERT:** To ensure system alignment, use the spacer stick to align Module Connectors before securing Rails.

**Tip:** Rail has two holes. Consult Sheet Title: **Typical Array Dimensions** in the Racking Construction Set for appropriate hole use.

**ALERT: “L” Rails must sit on top of “S” Rails. Otherwise, system rigidity is compromised.**



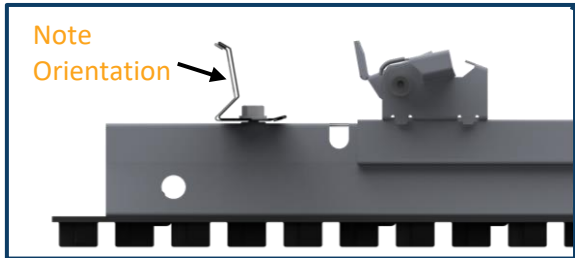
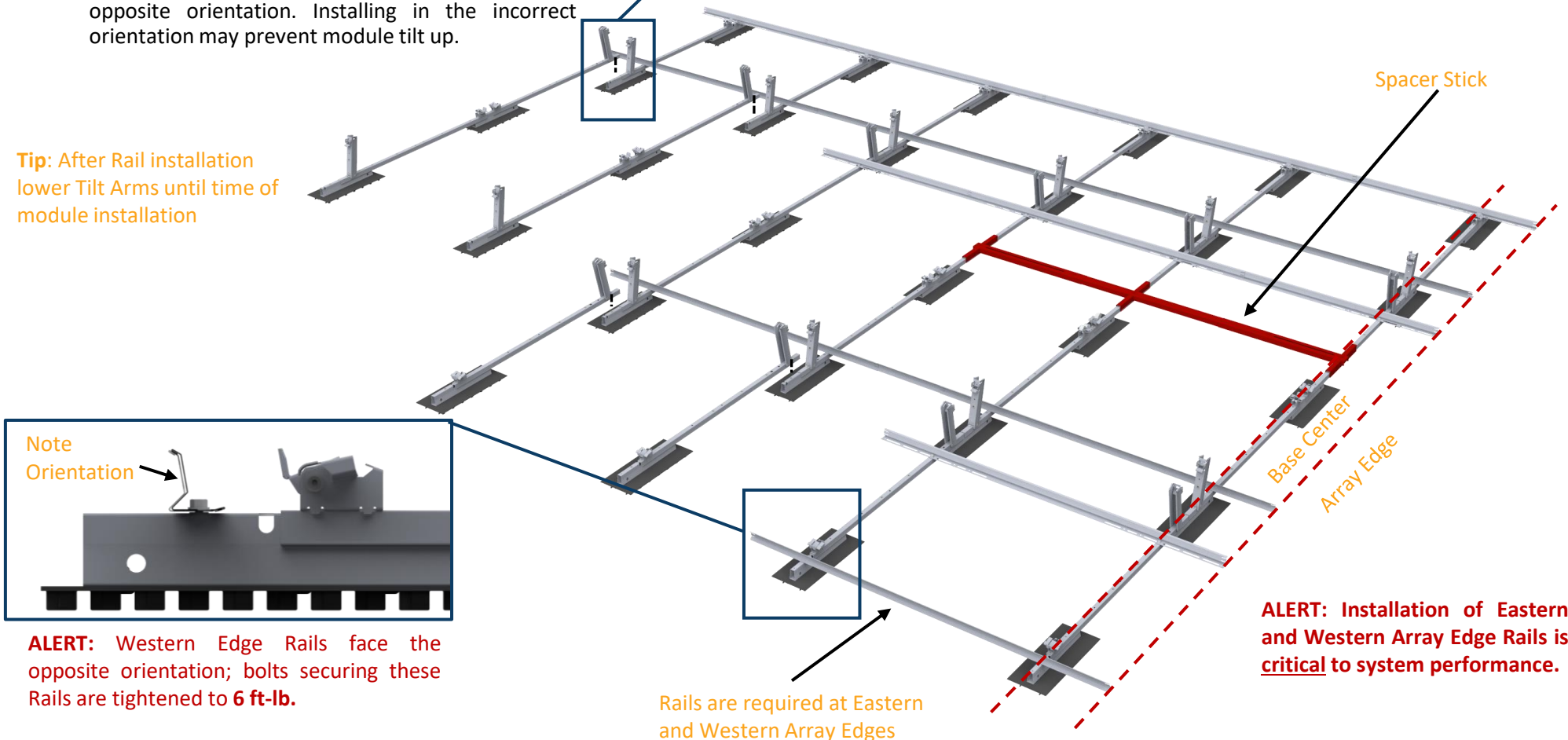
# 5. Build Remaining Rows

5.1 Place “Middle Valley” or “West” Assemblies onto Assemblies from previous row and bolt to **6 ft-lb.**

**Alert:** Sheet Title: **Assemblies** in the Racking Construction Set clearly indicates hole selection. Using the wrong hole will result in an array which does not match site plan.

5.2 After placing “Middle” and “West” Assemblies, install Rails following the same procedure in Step 4, under all modules and for all Eastern and Western Edges. East and West Edge Rails are installed in the opposite orientation. Installing in the incorrect orientation may prevent module tilt up.

**Tip:** After Rail installation lower Tilt Arms until time of module installation



**Note Orientation**

**ALERT:** Western Edge Rails face the opposite orientation; bolts securing these Rails are tightened to **6 ft-lb.**

Rails are required at Eastern and Western Array Edges

**ALERT:** Installation of Eastern and Western Array Edge Rails is critical to system performance.

# 6. Place Ballast

6.1 Install a Rail onto array in locations where Ballast is required. Bolt to both Module Connectors and tighten to **6 ft-lb.**

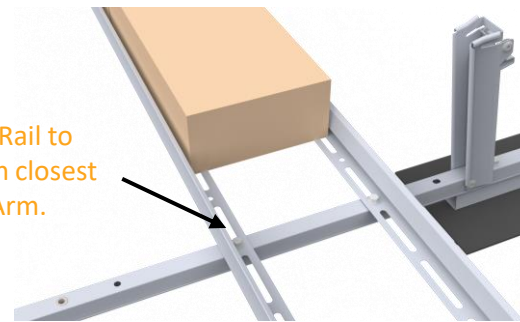
**ALERT:** Every Rail must be fastened to two Module Connector assemblies.

**Tip:** Ballast and Rails are only placed on "S" spacings. Center Rails on the "S" spacing.

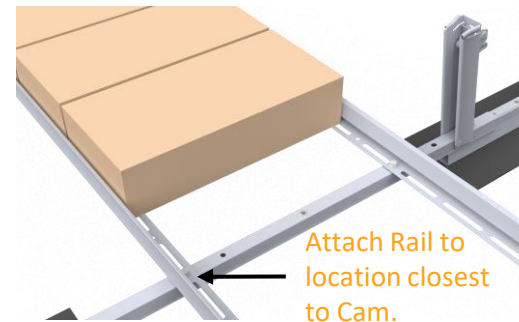
6.2 Place Ballast onto Rails. If rapid cyclic movement of system is expected e.g., due to seismic activity or building vibration from activities within or nearby the structure, bend the Rail tabs to secure Ballast.

**Tip:** Installing the East row ballast blocks helps keep the racking structure from moving as the rest of the array is built.

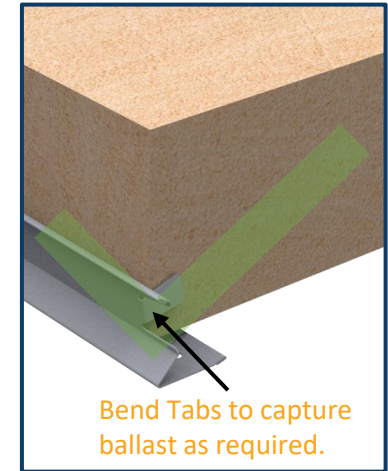
Attach Rail to location closest to Tilt Arm.



Rail Position for 1-4 Ballast blocks



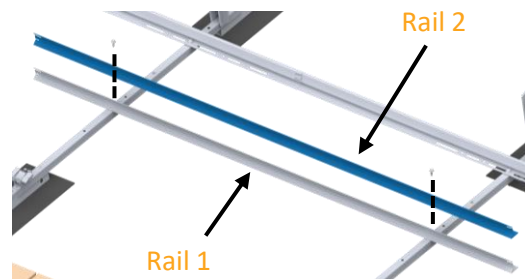
Rail Position for 5-8 Ballast blocks



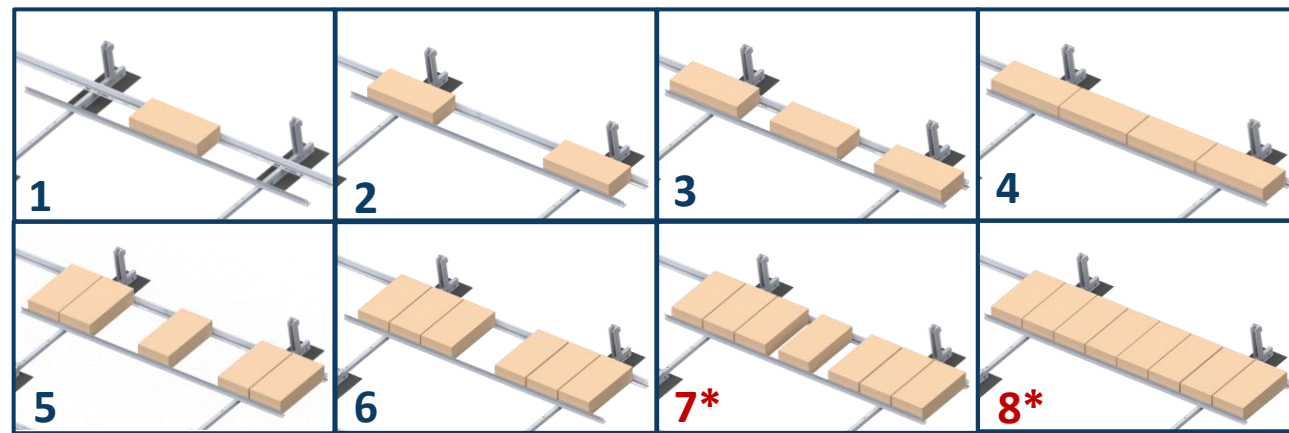
Bend Tabs to capture ballast as required.

6.3 Ballast must be placed as shown. Ballast quantity affects the Ballast placement on the Rails and in some cases additional Rails are required as noted below.

**\*ALERT:** Modules longer than 2100 mm with 7 or 8 ballast blocks require two (2) Rails. Install Rail 2 on top of Rail 1 and tighten to **6ft-lb.**



**ALERT:** Do not step on Ballast blocks



Ballast Positioning for 1-8 Ballast blocks

# 7. Install Module Low Side

7.1 Starting with the East array edge place module on Cam Seat and align with array edge.

**Tip:** R dimension is found in the Racking Construction Set. See Sheet Title: **Typical Array Dimensions**

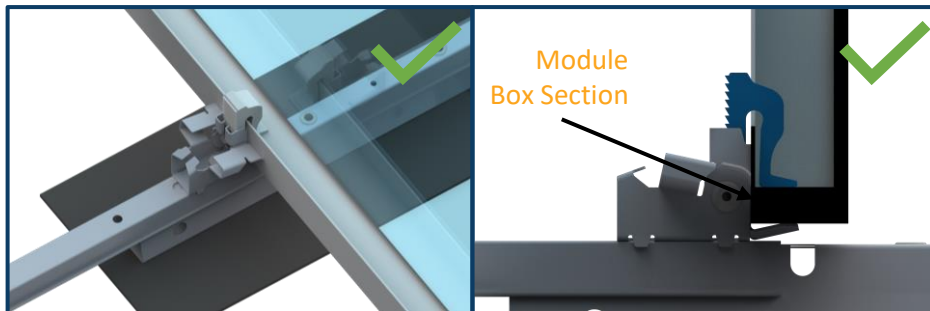
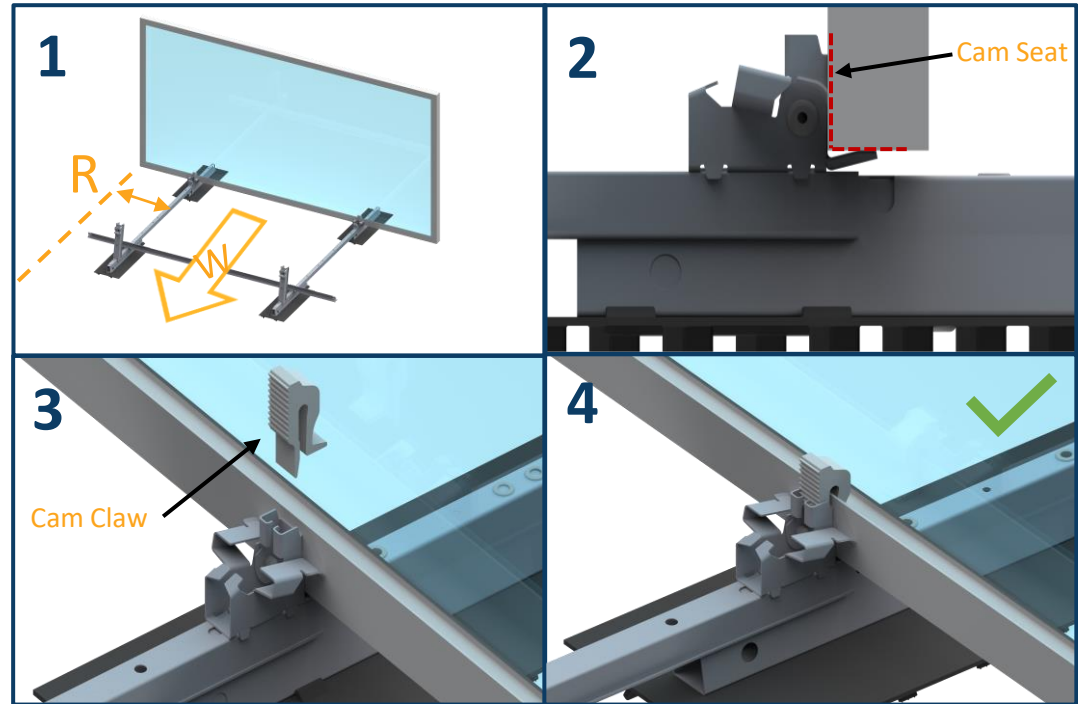
7.2 Ensure the module is vertical and flush against the back of the Cam Seat

7.3 Place Cam Claw over module flange. Apply a small downward force to ensure Cam Claw is fully engaged with the PV Module.

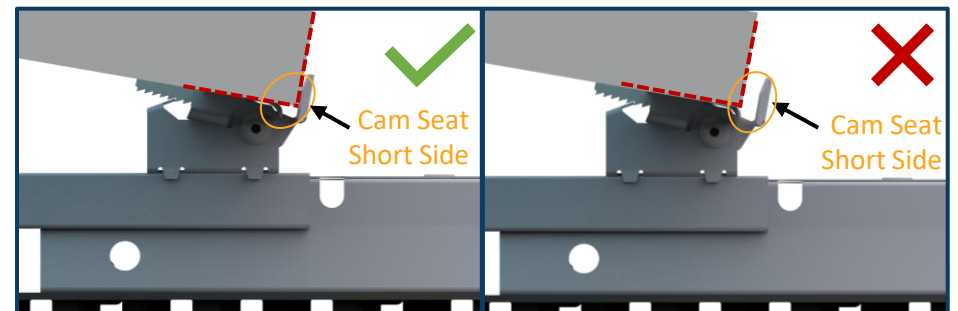
**ALERT:** After installation, Cam Claw should be in contact with the box section of the module flange.

**ALERT:** Do not leave modules in vertical position, go immediately to next installation step (high side install).

**ALERT:** When forecasted wind gusts exceed 25% of the wind speed listed in the Site Criteria Table of the Racking Construction Set, all mounted modules must be complete pairs (Domes) to avoid system damage.



Example of a good installation of the Cam Claw. Cam Claw is straight and is in contact with the inside of the Module frame



After module installation, the module frame should contact the Cam Seat Short Side as shown.

# 8. Install Module High Side

## Module Installation

- 8.1 Rotate the module down and rest the module frame on top of the Tilt Arms.
- 8.2 Support the module carefully while rotating the Tilt Arm just enough to rest the module frame on the extended portion of the Tilt Arm.
- 8.3 Pull the Tilt Arm forward until the Tilt Arm is firmly in place against the module frame. This ensures the Lock Claw is fully engaged.

**Tip:** Use two hands when installing the Tilt arm.



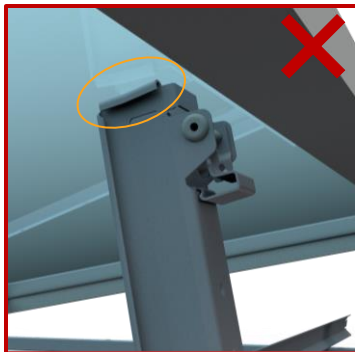
## Module Removal

- 8.4 To uninstall the module press up on the bottom flange of the Lock Claw and rotate the Lock Claw out.
- 8.5 Rotate the Tilt Arm off the module.

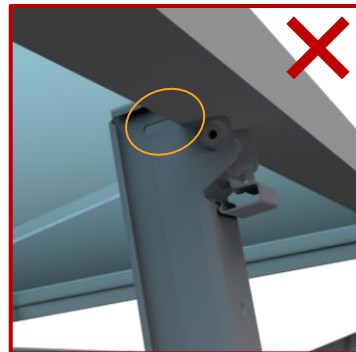
## Module Reinstall (Lock Claw Reset)

- 8.6 To reinstall the module reset the Lock Claw by pressing it back into the Tilt Arm and repeat module installation steps.

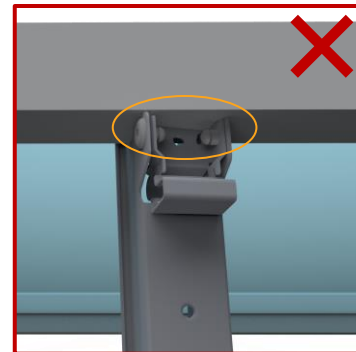
**ALERT:** Failure to reset the Lock Claw will compromise system performance



DO NOT REST ON BACKSHEET



TILT ARM NOT FULLY ENGAGED



TILT ARM UNEVENLY ENGAGED

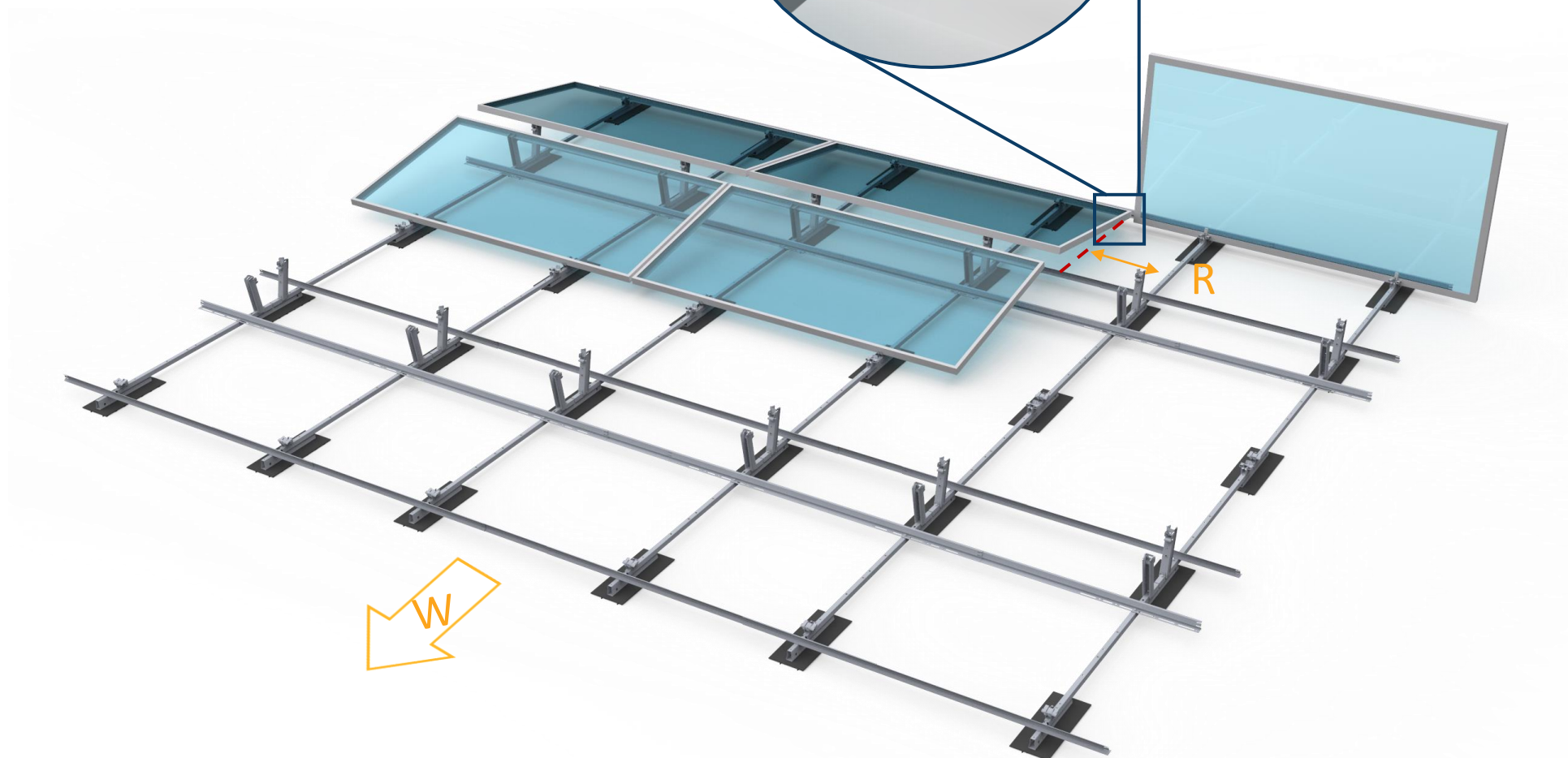


LOCK CLAW NOT INSTALLED

## 9. Continue Installing Modules

9.1 Starting with the East array edge continue to install modules following Steps 7-8. Use the Cam Claw to set the spacing between modules, approximately 3/4" which corresponds to the width of the Cam Claw.

**ALERT:** Check the R dimension every 5<sup>th</sup> module and adjust spacing between modules as needed.



# Electrical Grounding

## Grounding Overview

The PowerCap Dual Tilt 10 Degree system can be used to ground and/or mount a PV module complying with ANSI/UL 1703 or ANSI/UL 61730 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

PowerCap components within the array are required to be electrically bonded to the Fault Current Ground Path via the use of appropriately sized Cu wire and a UL 467 listed Tyco Solarlok grounding assembly, part number **2106831-1**. The conductor size should be selected in accordance with NEC 690.45 and NEC 250.122.1.

Please consult with national and local building code(s) for complete grounding requirements for your installation.

A list of approved modules can be found in the PanelClaw “clawFR/clawFRplus UL 2703 List of Ratings and Compatible Modules and MLPEs”. The most recent version can be found on the PanelClaw website ([www.panelclaw.com/ul-2703](http://www.panelclaw.com/ul-2703)).

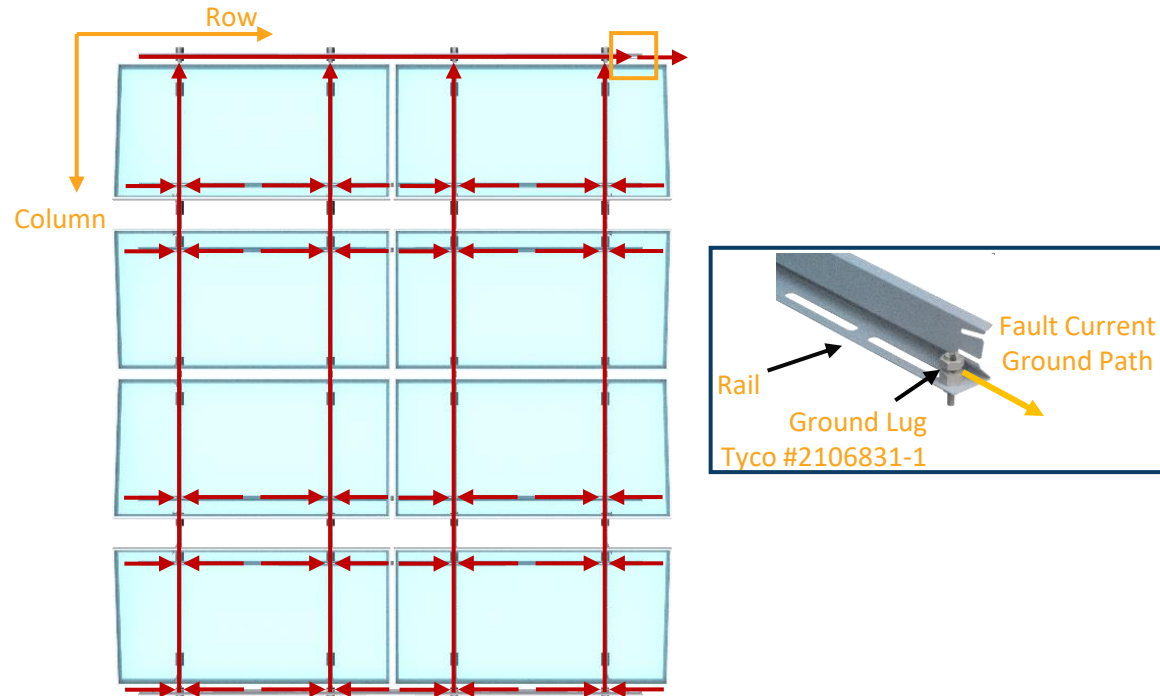
**ALERT:** During grounding and bonding ensure there is separation between bare copper and aluminum or coated steel components.

**ALERT:** Every sub-array must include at least one grounding device/lug.

**Note:** During maintenance and servicing where module removal is required, adjacent modules maintain the bond path to the Ground Lug and therefore module jumpers are not required to be installed.

## System Ground Path

The path to ground is established throughout the array by electrically bonding the PV module through the module frame connections on the Module Connector Tilt Arms and Cam Connections. The Module Connectors are bonded to the Rail where the Tyco Grounding lug is installed, as shown below. All other accessible metallic parts are also electrically bonded to the Fault Current Ground Path.



## Tyco Grounding lug attachment:

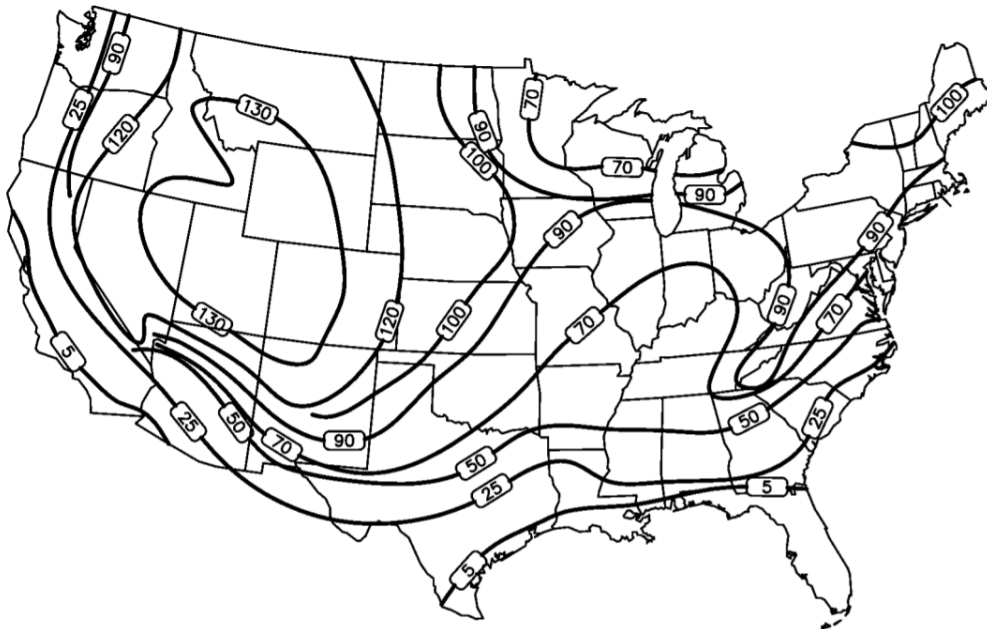
To attach the Tyco grounding device/lug to the Rail, the mounting hex washer and threaded post end should be installed to the specified hole in the Rail and torqued to **2.08 ft-lb (25 in-lb)**. Once the grounding device/lug has been attached to the Rail, a copper grounding wire must be installed to the wire slot end and torqued to **3.75 ft-lb (45 in-lb)**. Refer to the Tyco Electronics instructions sheet (document number 408-10262) via their website [www.te.com](http://www.te.com) for additional instructions.



# Appendix A: Ballast Blocks

PanelClaw/WG does not provide the ballast blocks required to construct the system in accordance with the Racking Construction Set drawings.

Ballast blocks for any ballasted system shall conform to ASTM C1491 or C1884 where applicable. Under these standards, ballast blocks **MUST** be manufactured and tested for freeze-thaw durability. In locations where the quantity of freeze-thaw cycles is less than 25 (see figure below), ASTM C90 standard ballast blocks may be used. Please note the additional block specifications below which may be more stringent than the ASTM specification. It is strongly recommended that installers weigh several blocks on-site to ensure block weights match what is specified on the Racking Construction drawings.



Approximate Number of Freeze-Thaw Cycles Per Year

Minimum Ballast Block Specification		
ASTM Standard	C1491 & C1884	C90
Min. Compressive Strength	2500 psi	2000 psi
Min. Density	125 pcf	125 pcf
Max. Water Absorption	13 psf	13 psf



Ballast Block Description	Nominal Weight* lb [kg]
BLOCK, CONCRETE, 2"X 8"X 16"	14.6 [6.6]
BLOCK, CONCRETE, 3"X 8"X 16"	23.6 [10.7]
BLOCK, CONCRETE, 4"X 8"X 16"	32.6 [14.8]

\*Tolerance = ± 5% Nominal Weight

# Appendix B: MLPE Installation

Part Number: 5000619

## Tools Required:

Drill with In-Line Torque Limiter or torque wrench

Various sockets (see table)

### ALERT: NO IMPACT DRIVERS

Torque Setting*	Fastening Operation
3 ft-lb (4.1 Nm)	MLPE Bracket to PowerCap system components
6 ft-lb (8.1 Nm)	MLPE to MLPE Bracket and as specified

\* +/-4% allowable during installation

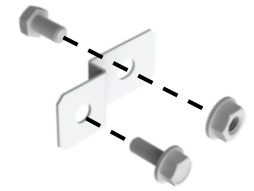
Socket sizes	Fastening Operation
10 mm Magnetic	Used with M6 bolts
1/2"	Used with 5/16" bolts

**ALERT:** 5/16" bolts are used for MLPE installation. Check MLPE installation manual for specific instructions.

Module Level Power Electronics (MLPE) provide a host of benefits to solar arrays. The MLPE bracket offers a convenient solution for mounting MLPEs to PowerCap *Dual Tilt* 10 Degree system.

Each **MLPE Bracket Kit** includes the following items (sufficient for mounting 100 MLPEs to PowerCap)

- 100 - MLPE Bracket
- 100 - 5/16" Flange nut
- 100 - 5/16" Bolt
- 100 - M6 Bolt



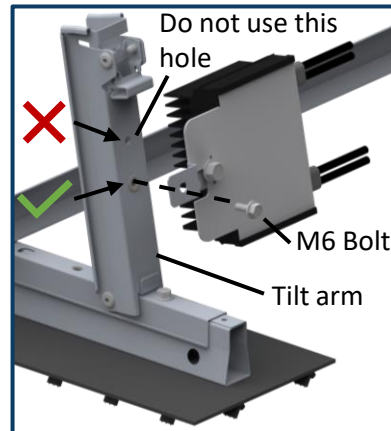
The **MLPE Bracket** is UL 2703 approved for bonding. A specific list of compatible MLPEs can be found in the "clawFR /clawFRplus UL 2703 List of Ratings and Compatible Modules and MLPEs" document. The most recent version is available on the PanelClaw website ([www.panelclaw.com/ul-2703](http://www.panelclaw.com/ul-2703)).

**Installation:** Attach MLPE to Tilt Arm using M6 bolts. Torque to **3 ft-lb**. Attach MLPE Bracket to MLPE Mounting Plate using 5/16" bolt and Torque to **6ft-lb**.

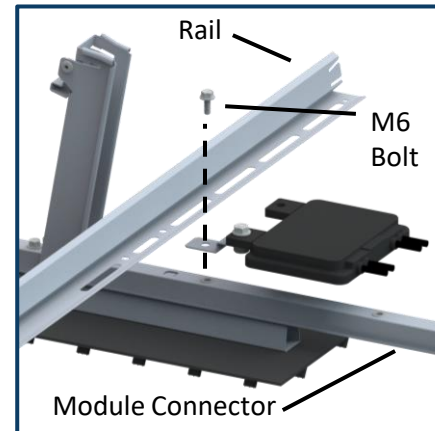
**ALERT:** See next page for acceptable installation locations for each brand.

**Tip:** Preassemble the MLPE Bracket to the MLPE prior to attaching to the system.

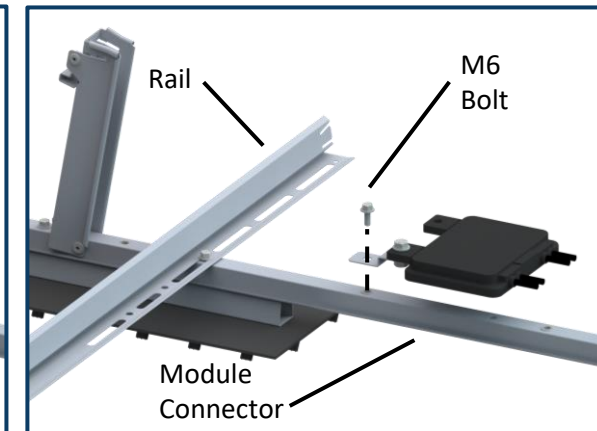
**Tip:** Install MLPE to Tilt Arm before installing the module.



Location A



Location B

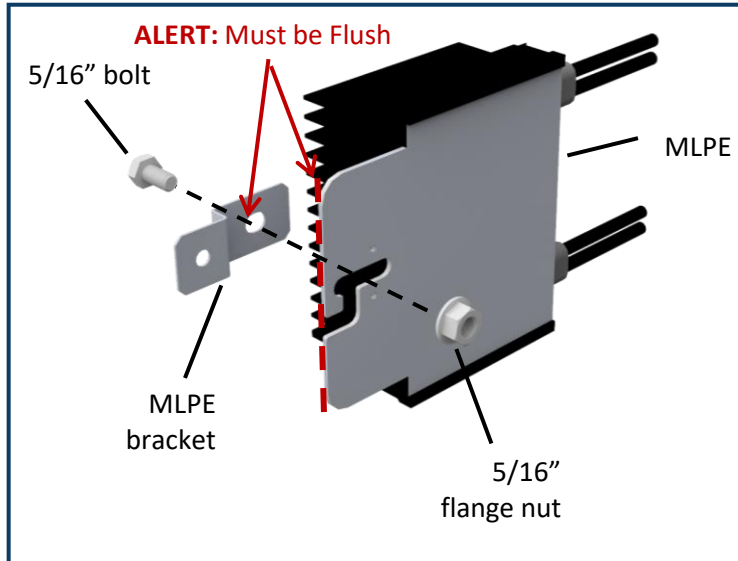


Location C (may or may not have rail)

# Appendix B (Continued)

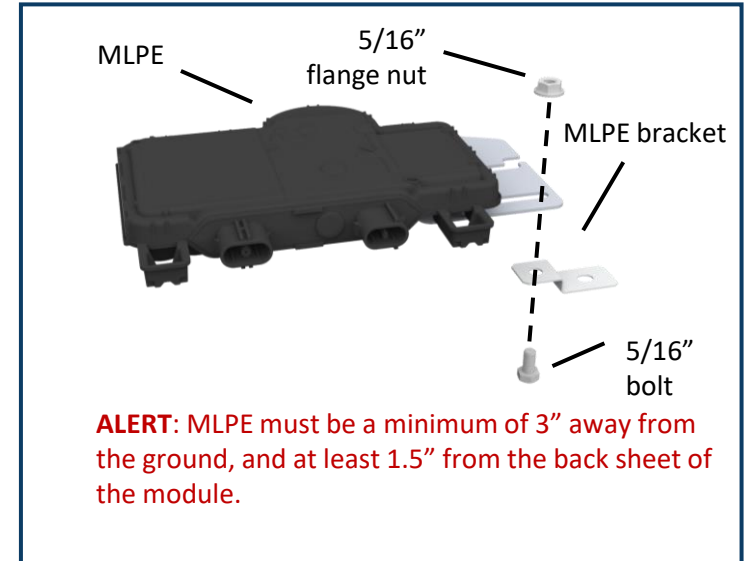
Part Number: 5000619

## Solar Edge Installation



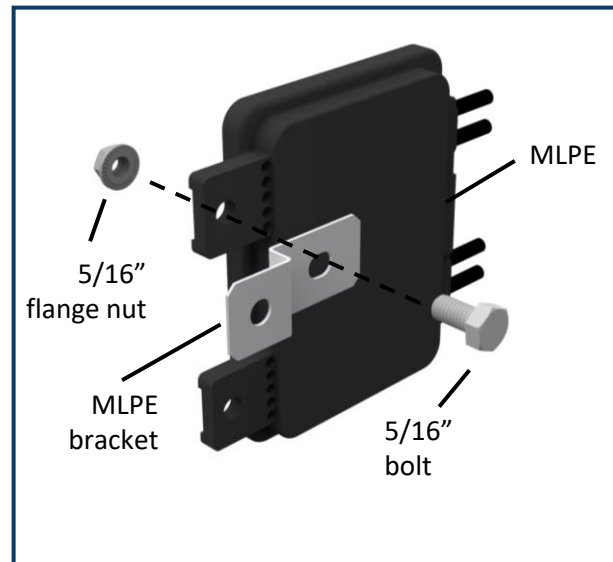
Solar Edge Allowed Installation Locations: A

## Enphase Installation



Enphase Allowed Installation Locations: B, C

## Tigo Energy Installation



Tigo Allowed Installation Locations: A, B, C

# Appendix C: Safety

This section does not claim to address or support all safety concerns that may arise during the installation of PowerCap mounting systems or any other aspect of the work being performed. Before beginning work, installers should refer to all local and federal safety, health, and regulatory requirements to assure compliance. Refer to OSHA Part 1926 and its related Subparts for federal construction related regulations and standards.

The subsections below outline some of the obvious / major hazards that could exist during the installation or O&M of PowerCap products and are divided to bring a level of clarity to such hazards. Some sections may not apply to all PowerCap product lines and such exclusions are noted within each section.

**Electrical Hazards:** PowerCap products are purely mechanical and do not contain any electrically live parts. When a photovoltaic module is exposed to sunlight it is electrically live and cannot be turned off. As soon as modules are installed using a PowerCap system, an electrical shock hazard is present. All personnel on site should coordinate to ensure that such electrical hazards are clearly communicated. It is advised, at a minimum, that all personnel utilize caution and proper Personal Protective Equipment as outlined in that section. Only electrically qualified personnel should perform PV module installation. Refer to OSHA Part 1926 Subpart K – Electrical and NFPA 70E for additional information.

**Environmental Hazards:** Look for hazards associated with water and snow loading if observed upon entry into the array area. Standing water increases the likelihood of electrical shock if the PV electrical system is compromised in any way. Severe snow loads can result in module and/or racking damage and, in extreme cases, electrical hazards.

**Fall Hazards:** This section only applies to PowerCap products installed on locations six feet or higher above grade. Proper fall protection should be in place at all work sites. There are many fall protection solutions readily available to help reduce exposure to fall hazards. These may include personal fall arrest systems, safety nets, guardrails, and flagged setbacks from all slope edges as outlined in OSHA Part 1926 Subpart M – Fall Protection.

**Trip Hazards:** All PowerCap arrays have elevated components that are installed above grade. Such hazards should be identified and caution should be taken to avoid tripping over such components. Refer to the Fall Hazards section specifically if working with the PowerCap product line. Make sure to pick up and not drag your feet when working on site, and always pay attention to your path of movement to note any obstructions that could create a trip hazard.

**Lifting Hazards:** The PowerCap installation process involves lifting of heavy items that could lead to personal injury and damage to property. All personnel should be trained in the proper procedures for manually lifting. Evaluate an object's size and weight prior to lifting, and follow these general guidelines for lifting:

1. Assess the lift and know the object weight.
2. Bend at the knees and get a good grip.

3. Keep back straight and lift straight up with legs without twisting. It is important to lift with the legs and not the back.
4. If an object is too large or heavy, ask for help and do not attempt to lift by yourself. In the case that mechanical assistance (e.g., crane, forklift, etc.) is required to complete the lifting operations, all machine operators of such devices should be licensed and trained.

**Material Handling:** All PowerCap parts and components are made of aluminum and steel alloys and utilize stainless steel assembly hardware. These materials are considered non-toxic and require no special handling procedures. Metal components may have sharp edges, so be sure to handle with care and utilize proper personal protection equipment, especially gloves, during handling. Refer to OSHA Part 1926 Subpart H – Materials Handling, Storage, Use, and Disposal for additional information.

**Personal Protective Equipment (PPE):** All personnel should utilize and implement proper PPE per OSHA requirements. Refer to OSHA requirements for proper use and implementation of PPE. The following items are suggested as a minimum to avoid injury based on the installation procedure outlined in this manual:

1. Appropriate work clothing
2. Electrically insulated hard hat
3. Protective eyewear
4. EH rated safety boots
5. Gloves
6. High-visibility safety vest
7. Hearing protection

If any PPE appears to be defective, stop the use of such equipment immediately, and ensure it is replaced before work continues. Refer to OSHA Part 1926 Subpart E – Personal Protective and Life Saving Equipment for additional information.

**Hand and Power Tools:** Access to all hand and power tools should be regulated and controlled at all times on site to prevent improper use and related injuries. When not in use, all equipment should be stored in a secured location. Only personnel who have been properly trained in the safe operation of any potentially dangerous tool should be allowed access. All required tools to perform the installation of PowerCap racking are outlined in the installation procedure. All tools should be inspected daily and before use by the operator. If any tool appears to be defective, stop the use of such equipment immediately, and ensure it is replaced before work continues. Electrical power tools should follow proper lock-out tag-out procedures per OSHA requirements. Refer to OSHA Part 1926 Subpart I – Tools – Hand and Power for additional information.