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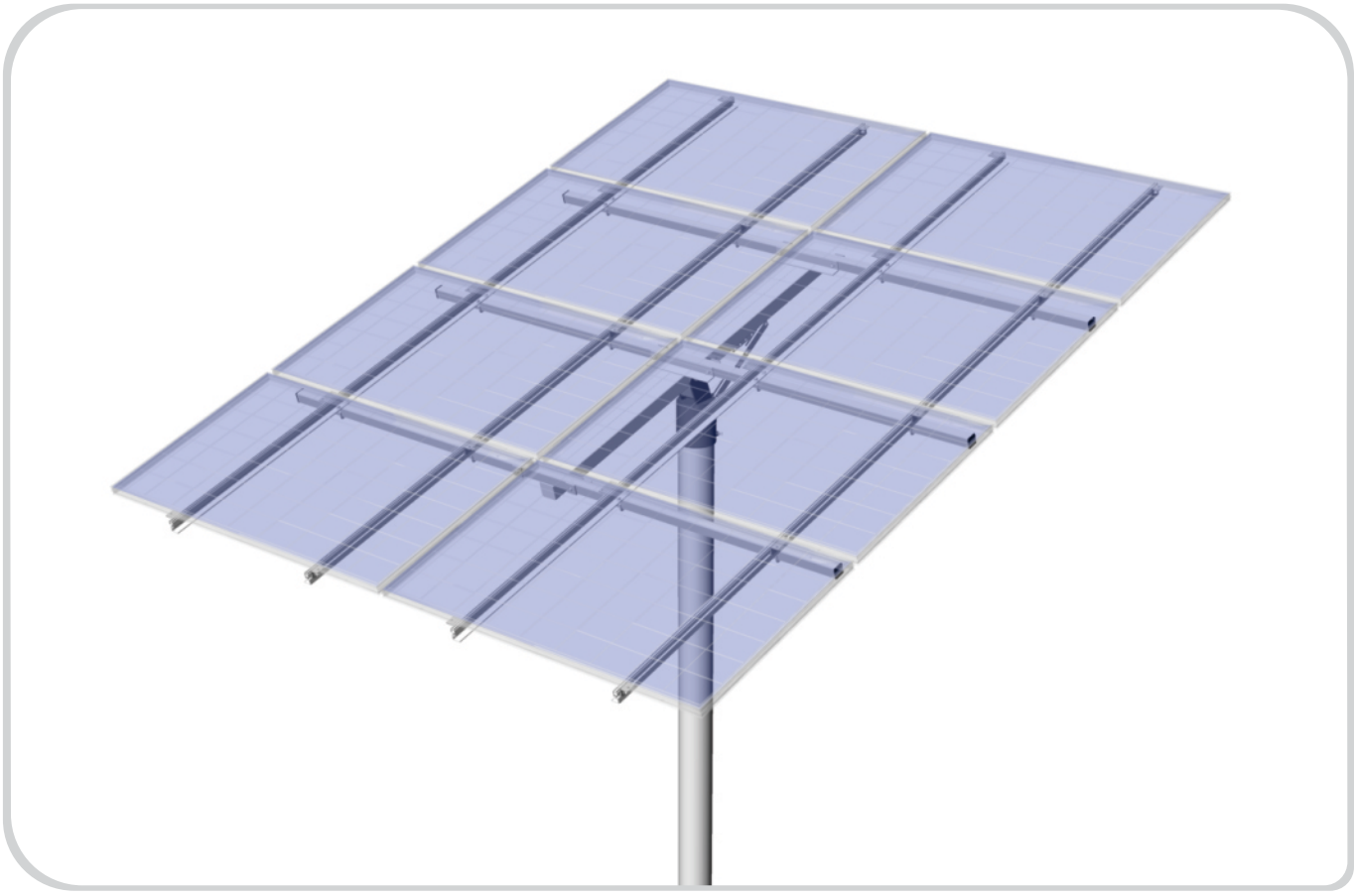


Universal Top-of-Pole Mount 8 Modules (UTPM8) Module Type G

Assembly Instructions

step-by-step assembly and installation

Version 1, Rev A
PCN 022714-1

Universal Top-of-Pole Mount 8 Modules (UTPM8) for Module Type G

A few words about the product

The Universal UTPM8 for Type G modules is designed for a wide range of Module sizes; from any combination of 37-42” in width to 61-67” in length. The Universal Top-of-Pole (UTPM) support structure mounts on 6 inch SCH40/80 galvanized steel pipe (installer supplied).

Pipe size and foundation requirements are based on several factors including the array surface area, maximum design wind speed, exposure category, soil type, steepest expected tilt angle and above-ground clearance.

For foundation and pipe size recommendations on a specific installation, please contact us at:

Phone: 800-260-3792

Email: info@power-fab.com

About these Assembly Instructions

These instructions...

WARNING: Follow the procedures and precautions in these instructions carefully.

- Are intended to be used by individuals with sufficient technical skills for the task. Knowledge and use of hand tools, measuring devices and torque values is also required.
- Include various precautions in the forms of Notes, Cautions, and Warnings. These are to assist in the assembly process and/or to draw attention to the fact that certain assembly steps may be dangerous and could cause serious personal injury and/or damage to components. Following the step-by-step procedures and these precautions are designed to minimize the risk of any personal injury or damage to components while making the installation safe and efficient.

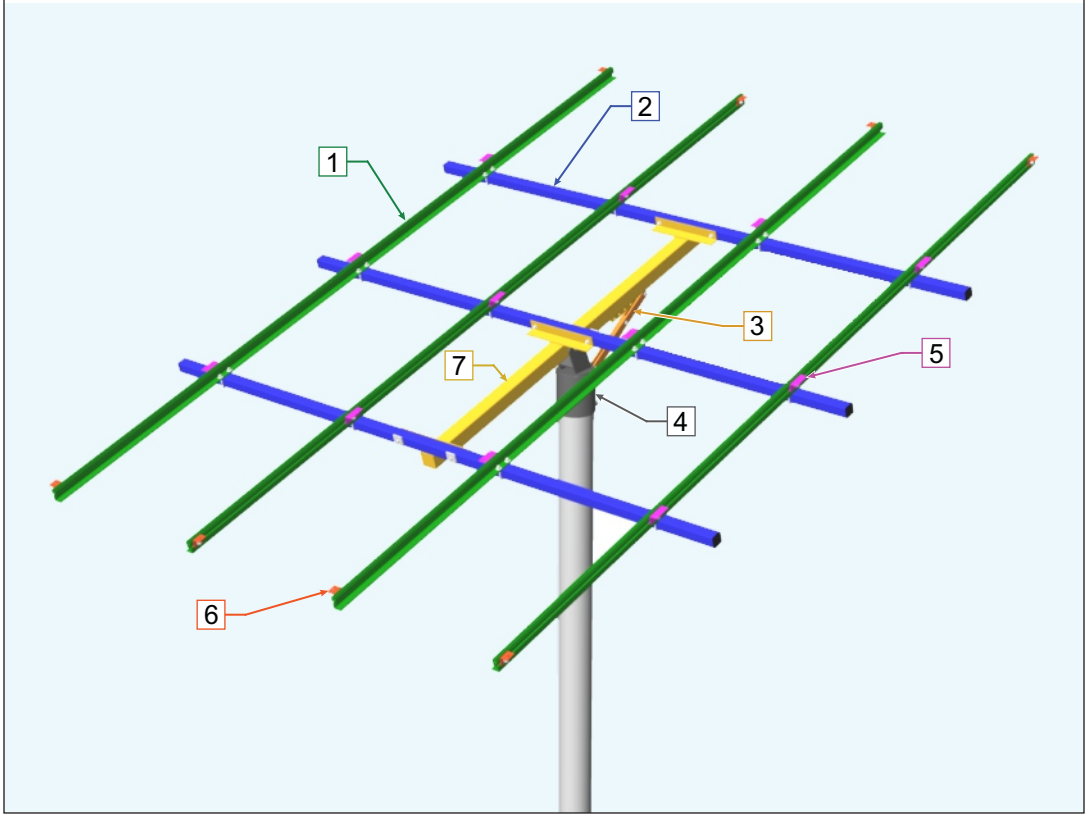
Required Tools ☑

- ☐ 7/16 inch wrench or socket for 1/4 inch module hardware
- ☐ 9/16 inch wrench or socket for 3/8 inch hardware
- ☐ 3/4 inch wrench or socket for 1/2 inch hardware
- ☐ 1-1/8 inch wrench or socket for 3/4 inch Pivot Bolt hardware
- ☐ Torque wrench
- ☐ Ratchet wrench
- ☐ Ratchet extension bar
- ☐ 3 to 6 foot level
- ☐ Tape Measure
- ☐ Square

Main Structural Components

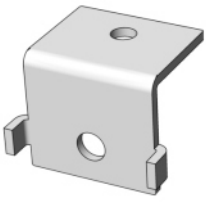
1. Module Rails
2. Cross-Bars
3. Support Bar
4. Mounting Sleeve
5. Double Hole Slide Plate
6. Single Hole Slide Plate
7. Strongback

NOTE:
Knowing the main structural components makes for easy assembly.

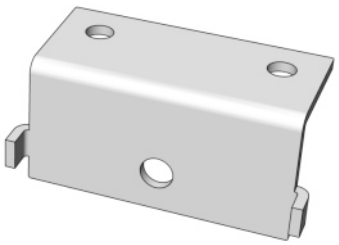


The Two Types of PV Module Slide Plates

Single Hole Slide Plate

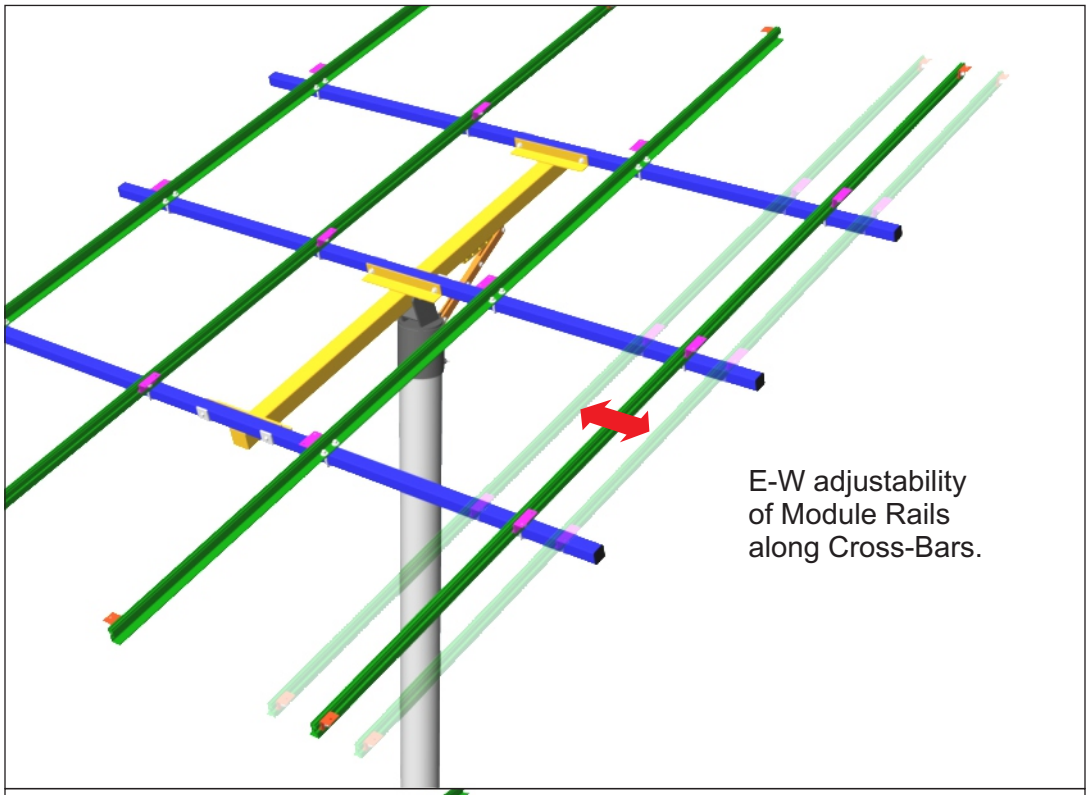


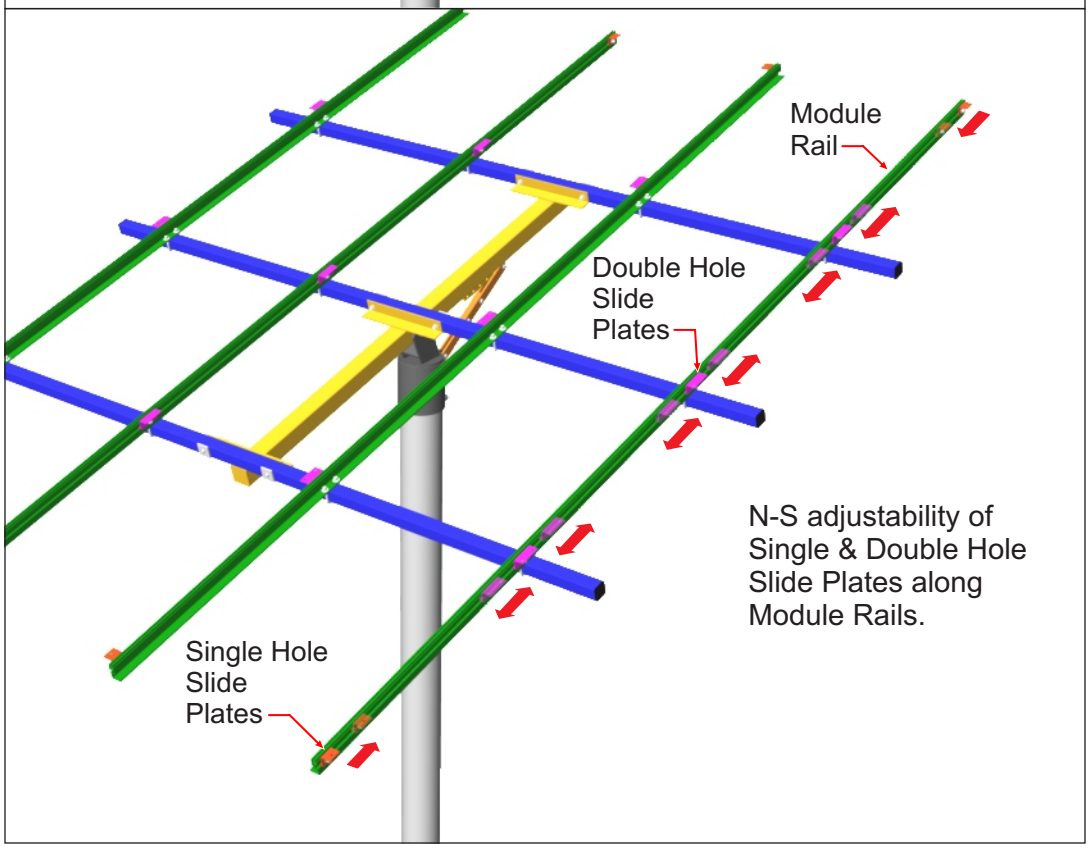
Double Hole Slide Plate (secures two adjacent Modules)

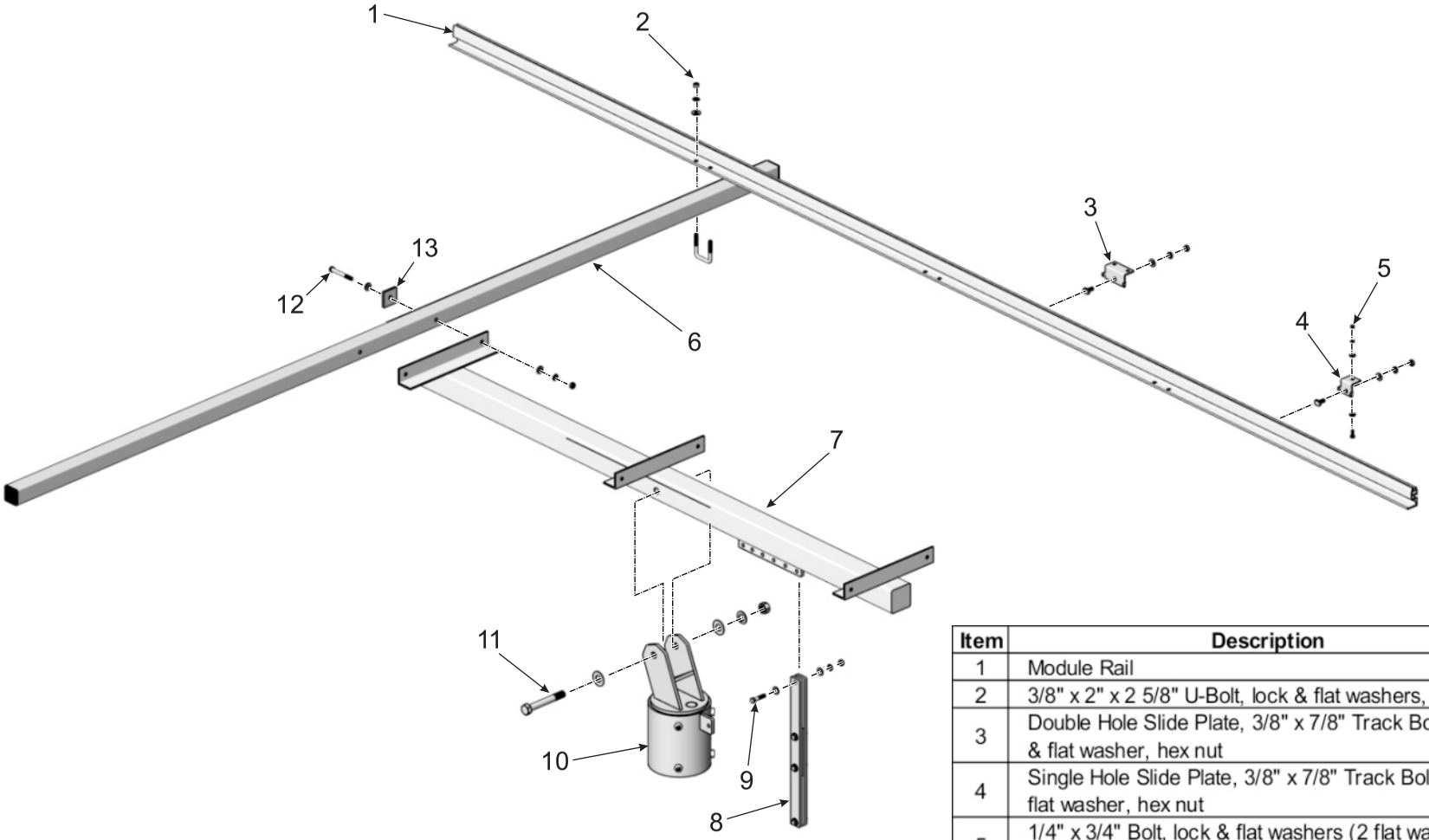


What makes it Universal?

Adjustability to accommodate a range of PV Module sizes.







Item	Description	Qty
1	Module Rail	4
2	3/8" x 2" x 2 5/8" U-Bolt, lock & flat washers, hex nut	12 sets
3	Double Hole Slide Plate, 3/8" x 7/8" Track Bolt, lock & flat washer, hex nut	12 sets
4	Single Hole Slide Plate, 3/8" x 7/8" Track Bolt, lock & flat washer, hex nut	8
5	1/4" x 3/4" Bolt, lock & flat washers (2 flat washers), secures PV Module	32 sets
6	Cross Bar	3
7	Strongback	1
8	Support Bar	1
9	3/8" x 1-3/4" Bolt, lock & flat washers (2 flat washers)	2 sets
10	Mounting Sleeve	1
11	3/4" x 5-1/2" Pivot Bolt, lock & flat washers (2 flat washers)	1 set
12	3/8" x 3 1/4" Bolt, lock & flat washers (2 flat washers)	6 sets
13	3/8" Square washer	6

Universal Top-of-Pole Mount for 8 Modules, Module Type G, Parts Identification

Step 1: Calculate the Required Site Specific Dimensions

In order for the UTPM to be a universal racking system that accepts a wide range of PV modules (various manufacturers, various mounting hole patterns and locations), it is necessary to complete a few simple calculations based on the site specific PV Modules before assembly begins.

These calculations result in the measurements needed to accurately and precisely position and install the Module Rails and the Slide Plates. The end result will be components which align perfectly to the PV Modules mounting holes.

Select the Set of PV Module Mounting Holes & Note Dimensions

PV Modules typically have several mounting hole patterns within their frames. Evaluate the site specific Modules and select the mounting hole(s) set to be used in this installation. Once selected, measure (or refer to the PV Modules spec sheet) the hole span dimensions and note these dimensions in figure 1-2 for later use.

Keep the following in mind during this step:

- PV Modules will be mounted in landscape orientation as shown in figure 1-1.
- Most PV Modules have multiple sets of mounting holes that run along their long dimension, or in this case the D factor shown in Figure 1-2. Any set may be used so long as the holes accept the 1/4" mounting hardware.
- Two dimensions will be used to calculate and establish the exact placement of components. They are identified as B and D in Figure 1-2.

Now fill in the blank fields B and D on Figure 1-2.

NOTE:
PV Modules vary in the number of holes and patterns of holes, figure 4-1 is a typical example of mounting holes and used for illustration purposes only.

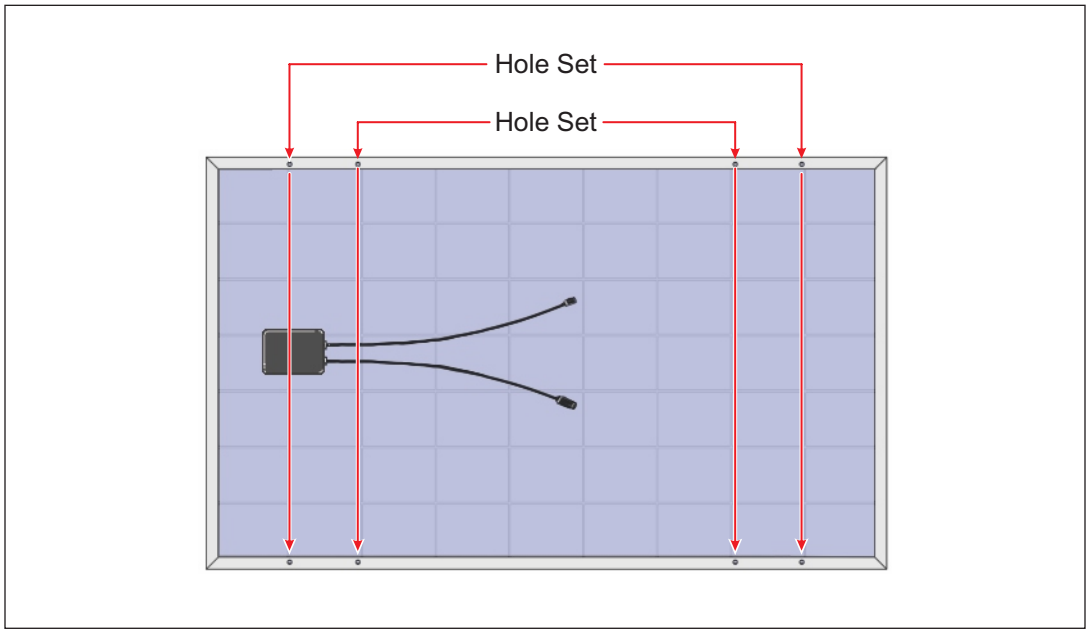


Figure 1-1: Bottom View of a Typical PV Module in Landscape Orientation Showing an Example of Mounting Hole Sets

NOTE:
When selecting a set of holes, make certain that the hole diameters accept 1/4" hardware as it will be used to secure the PV Modules to the system.

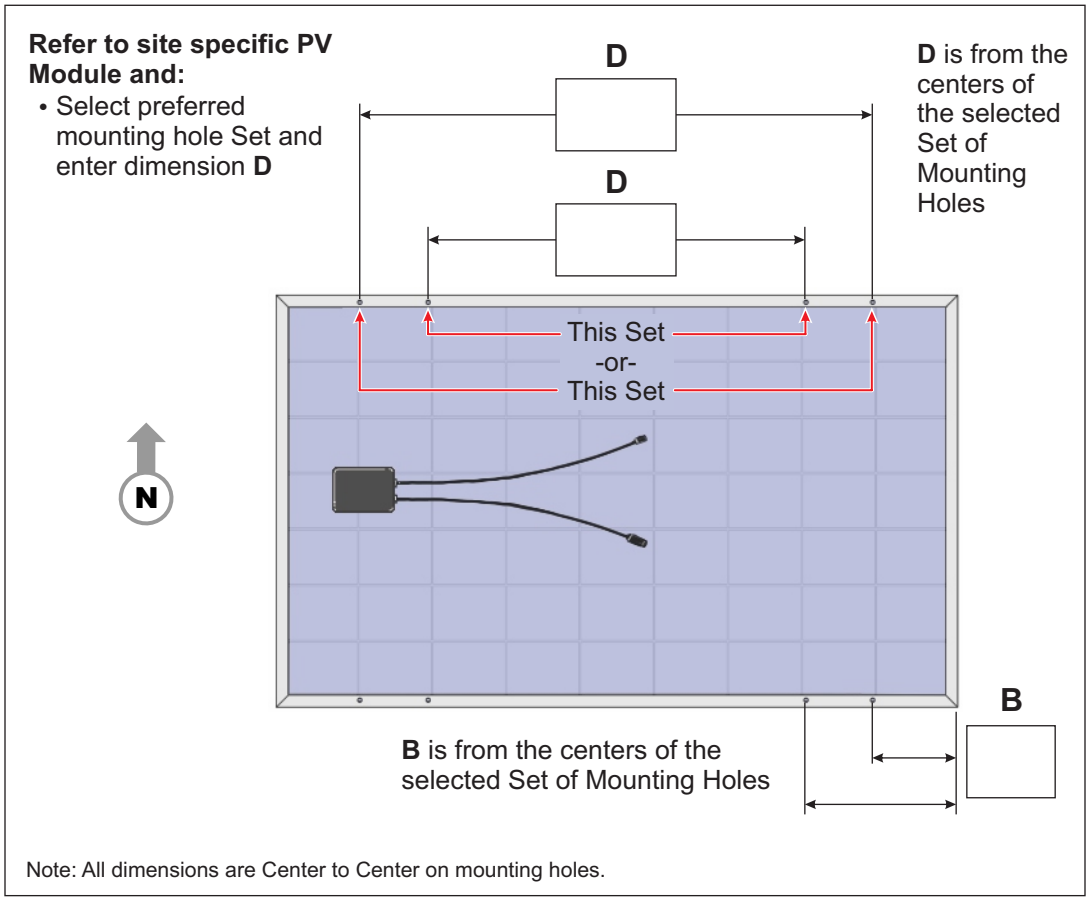


Figure 1-2: Select PV Module Mounting Hole Set, Record Dimensions B and D

Step 2: Calculate & Mark the Rail Positions on Cross-Bars

The following instructions provide information on precisely calculating, measuring and marking the Module Rail positions on the three Cross Bars. Figure 2-2 indicates where the markings (defined here as positions “I” and “O”) are located on the Cross-Bars. These marks facilitate the precise E-W positioning of the Rails.

Using the Module Rail Positioning Calculator

A. Enter dimensions B and D from figure 1-2, into their respective fields of the Module Rail Positioning Calculator. (Figure 2-1)

B. Complete the two equations resulting in factors I and O. These factors are the dimensions used to mark the Rail positions on the Cross Bars as shown in Figure 2-2.

Module Rail Positioning Calculator: Locate positions I & O

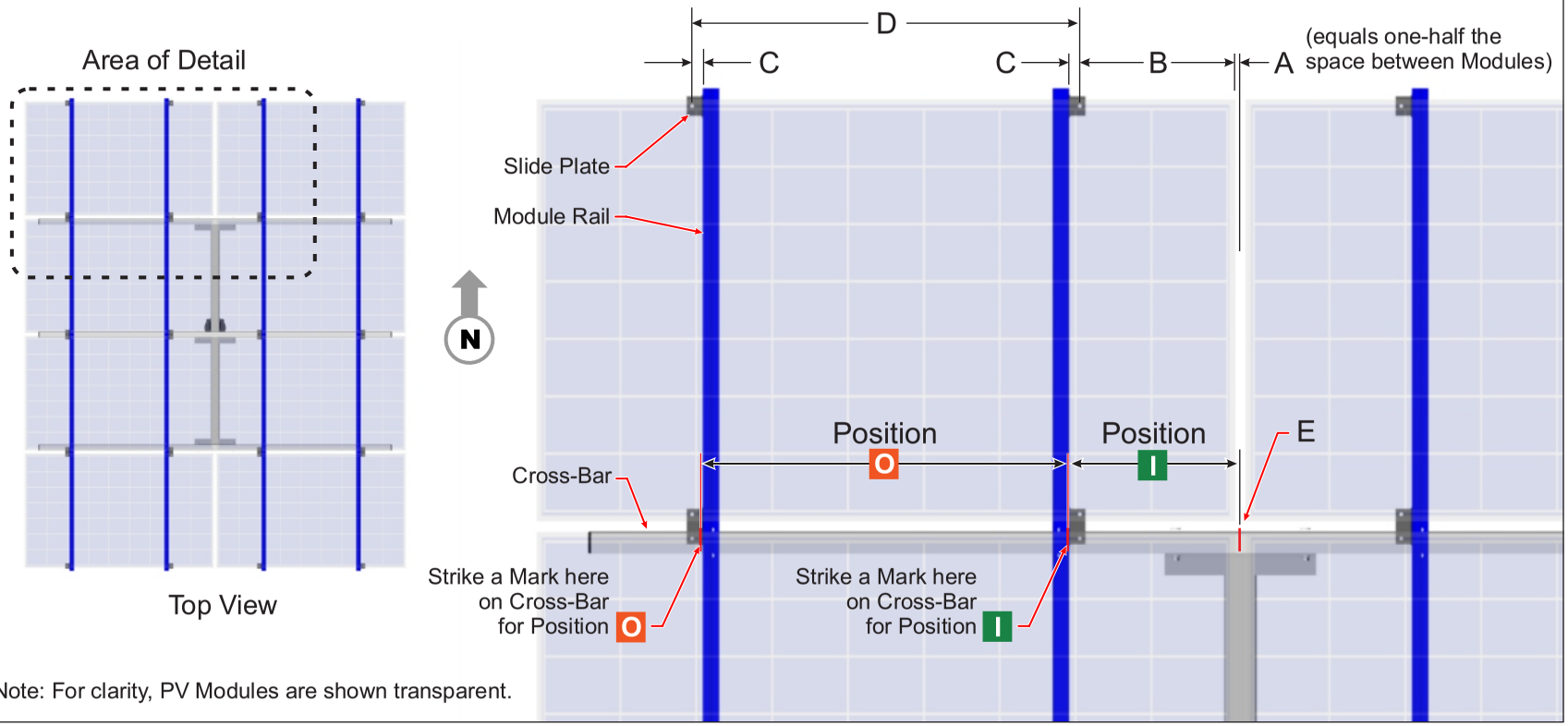
Factor	Description
A	.25" or one-half of the .50" space between Modules.
B	Insert factor B from Figure 4-2 (Module edge to Module mounting hole).
C	1.0" distance from Module Rail to center of Slide Plate mounting hole.
D	Insert factor D from Figure 4-2 (Distance between Module mounting holes).
E	Center mark on Cross Bars. Divide Cross-Bar length by .5 and mark.
I	Distance from center of Cross-Bar to edge of inboard Module Rail.
O	Distance from edge of inboard Power Rail to edge of outboard Module Rail.

Calculate Position

.25"	+		+	1.0"	=	
A		B		C		Position I

Calculate Position

	–	2.0"	=	
D		C x 2		Position O



Note: For clarity, PV Modules are shown transparent.

Figure 2-1: Module Rail Positioning Calculator

Mark the Cross Bars

NOTE:
To accommodate the site specific PV Modules the Module Rails must be carefully positioned/spaced E-W along the Cross-Bars.

NOTE:
Be precise in marking the components, this will prove beneficial as the assembly progresses.

Collect the three Cross Bars and prepare to mark them by setting them side by side with their ends aligned and their mounting holes oriented as shown in Figure 2-2.

A. Measure the Cross Bar lengthwise, divide by .5 and mark their center points.

B. Using calculations I and O from figure 2-1, measure from the center point outward and mark positions I and O on each of the three Cross Bars as shown below.

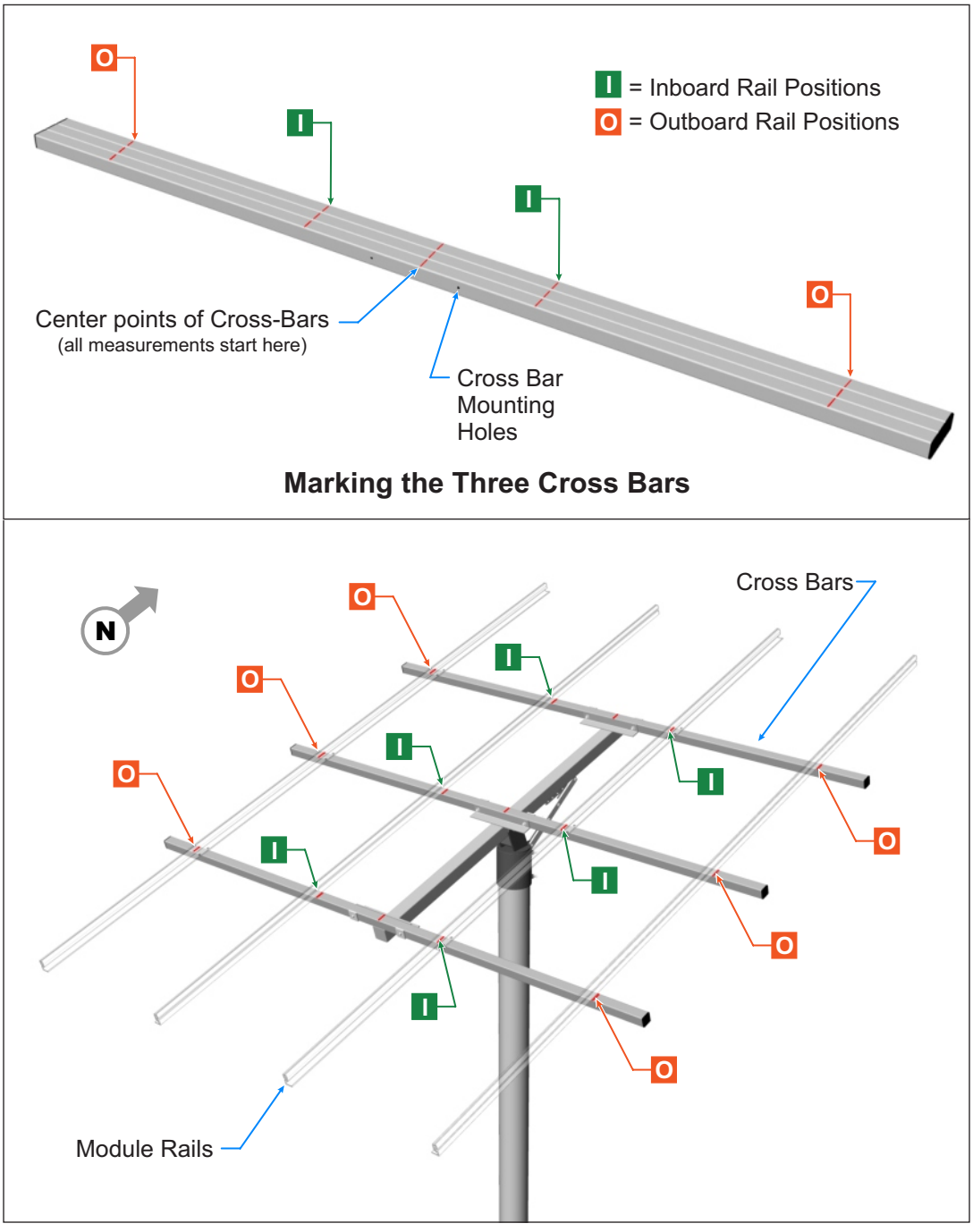


Figure 2-2: Marking the Cross-Bars for Module Rail Positioning

Step 3: Calculate & Mark Slide Plate Positions on Module Rails

NOTE:
Be precise in marking the components, as his will prove beneficial as the assembly progresses.

In this array of eight modules, it's necessary to calculate the position of the four Double Hole Slide Plates running down the N-S center position of the Rails. After the center row of Double Hole Slide Plates are installed all remaining Slide Plate positions become obvious as the PV Modules are put into position. As will be illustrated later, the remaining Slide Plates are simply shifted into alignment with the PV Module mounting holes as all other Modules are installed.

Mark the Module Rails

Measure and mark the positions of the four Double Hole Slide Plates on the four Module Rails.

A. Collect the four Module Rails. Align and orient as shown in Figure 3-2.

B. Measure the Rails lengthwise, divide by .5 and mark their center points.

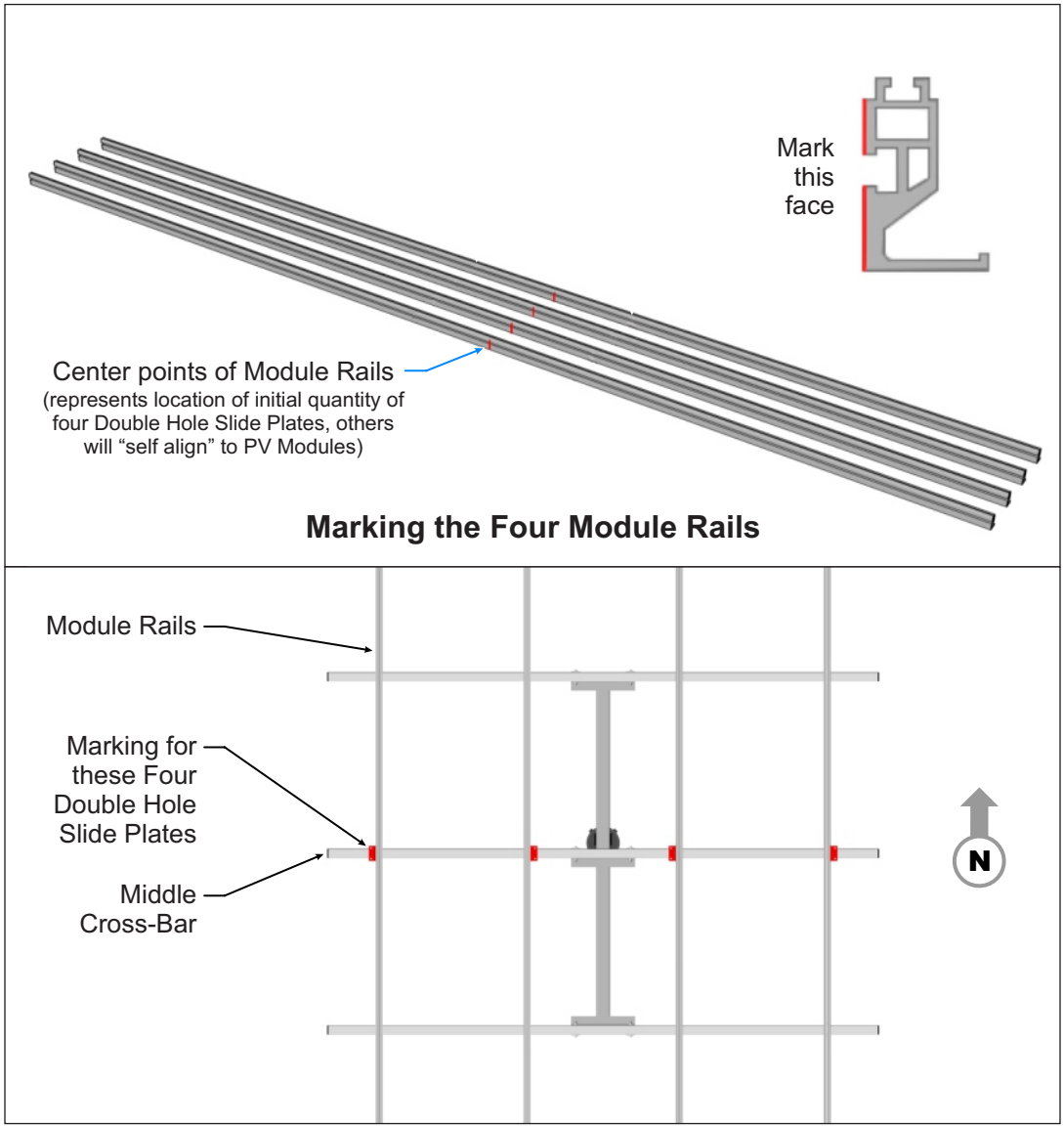


Figure 3-2: Marking the Module Rails for Double Hole Slide Plate Positioning

Step 4: Attach Slide Plates to Module Rails

Slide Plates are secured to the Module Rails using 3/8" x 7/8" Track Bolts and hardware. There are two types of Slide Plates: a Single Hole and a Double Hole.

Single Hole Slide Plates are used on the ends of the Module Rails and secure those PV Modules on the outer corners of the array. Double Hole Slide Plates are used along the Module Rails to secure two adjacent PV Modules.

In this step, all of the Slide Plates will be installed on the Rails, starting with the eight double hole Slide Plates that align to the marks made previously. While these eight will be aligned and secured to the Rails, the others will be roughly positioned and hand tightened with their final positions determined as the Modules are installed.

Pre-assemble Slide Plates

Collect all the Slide Plates (single and double hole) as well as the attaching hardware shown in figure 4-1. Loosely assemble all of the Plates in preparation for attaching them to the Module Rails. Do not tighten the hardware at this time, as it should be left loose for ease of sliding the Plates into the Module Rails.

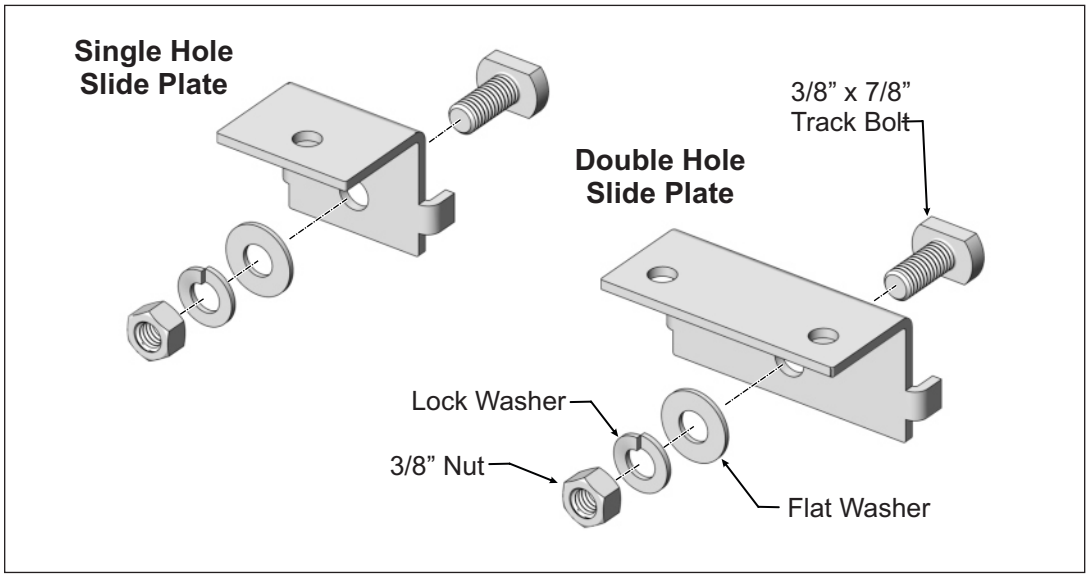


Figure 4-1: Pre-assembly of the Slide Plates

Install the Four Double Hole Slide Plates

These are the initial four (one per Rail) Double Hole Slide Plates that align to the marks made previously.

A. Align the tabs of the Double Hole Slide Plate and the head of the Track Bolt with the channel of the Rail, and slide toward alignment mark. (See Figure 4-2)

B. Center Slide Plate over alignment mark and tighten securely. T**orque at 32-34 ft.-lbs.**

C. Continue in this manner installing the remaining three Double Hole Slide Plates and ending with one Slide Plate per Rail.

NOTE:
Be precise in the alignment of components, as this will prove beneficial as the assembly progresses.

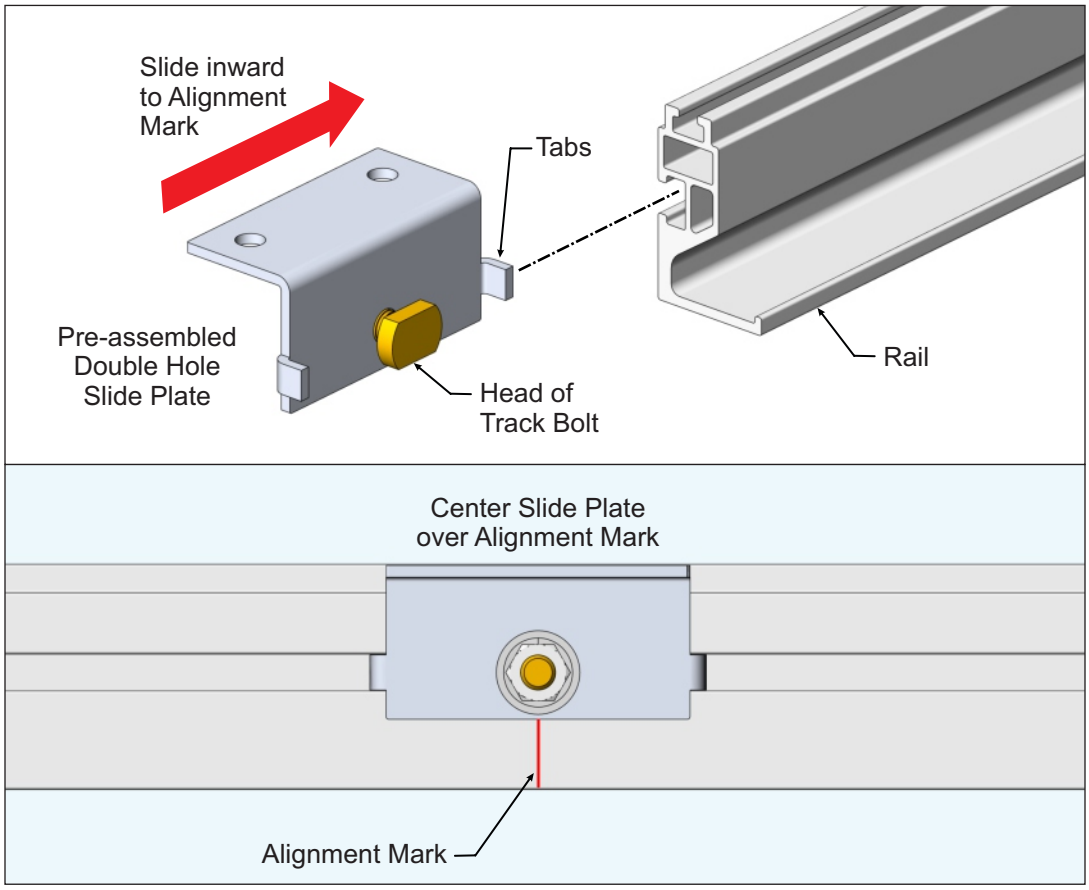


Figure 4-2: Installing and Aligning a Double Hole Slide Plate

Install the Remaining Slide Plates (Single & Double Hole)

Because the positions of these Slide Plates on the Rail are not important at this time, they may be positioned anywhere along the Rail.

A. As done previously, align the Slide Plate tabs and the head of the Track Bolt with the channel of the Rail, slide inward. Hand tighten to keep them from sliding off of the Rail during handling. (See Figure 4-2)

B. Continue in this manner while installing the remaining Slide Plates. Upon completion, the Rails should look like the one in Figure 4-3 below.

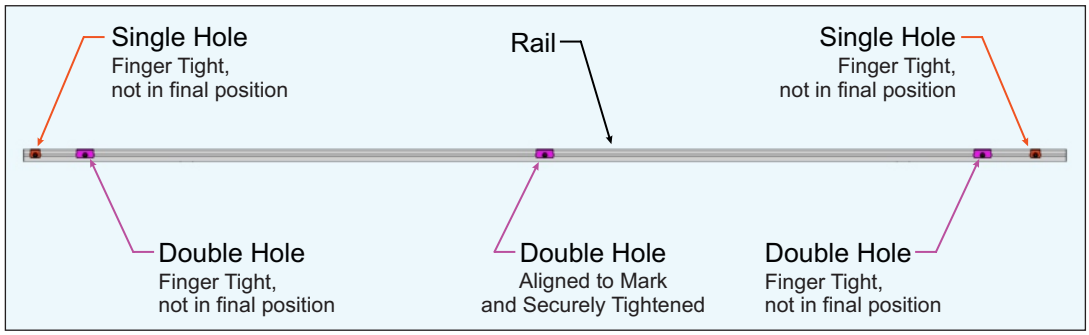


Figure 4-3: Slide Plate Positions

CAUTION:
Use care while working around the structure during assembly. There could be components that create hazards or obstruct free movement causing serious bodily injury. Many are at head/eye level.

Step 5: Install the Mounting Sleeve on Vertical Pipe

Before installing the Mounting Sleeve, verify that the Mounting Pole is plumb to the ground and hasn't shifted or leaned while the concrete footing has cured.

The Mounting Sleeve slips on top of the Mounting Pole and has four 1/2” Set Bolts which are used to secure it to the Mounting Pole. (See Figure 5-1)

A. Slip the Mounting Sleeve on top of Mounting Pole and slide it down until it rests on top of Mounting Pole.

B. Rotate the Mounting Sleeve so that the Support Bar Pivot Tab is pointing north and the Strongback Vertical Towers are leaning south.

C. Secure the Mounting Sleeve by tightening the four 1/2” Set Bolts. **Torque each Set Bolt to 55-60 ft.-lbs.**

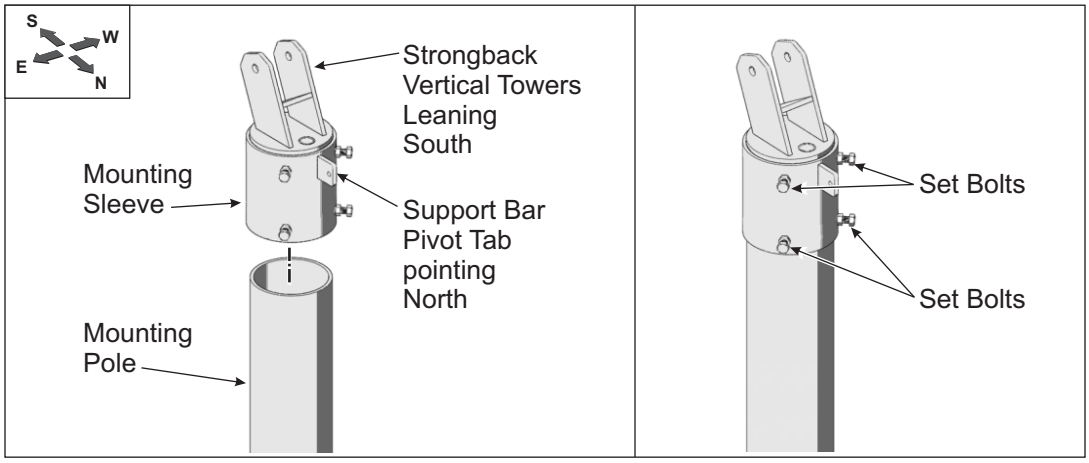


Figure 5-1: Installing the Mounting Sleeve

CAUTION:
This is a two person activity. The Strongback must be held in place by one person while the second person aligns it and secures it to the Mounting Sleeve using the Pivot Bolt and the 1/2” hardware. Failure to do so could lead to serious personal injury.

Step 6: Install the Strongback to the Mounting Sleeve

The Strongback is attached to the Mounting Sleeve using the Pivot Bolt that passes through its two Vertical Towers and the Support Bar. The Support Bar is attached to the Strongback on one end and the Support Bar Pivot Tab of the Mounting Sleeve on the other end using 3/8” hardware.

A. Remove the Support Bar from the Strongback and re-install in the 15° elevation set point. Secure with the 3/8” hardware and finger tighten. (See Figure 6-1)

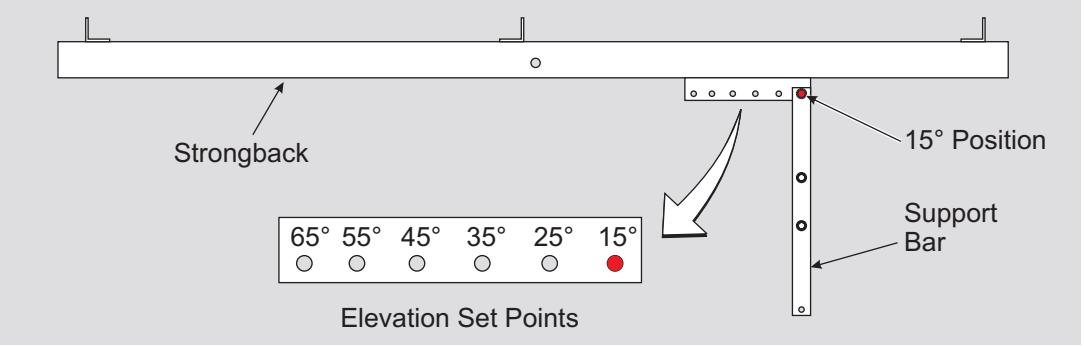


Figure 6-1: Positioning Support Bar

NOTE:
Although this system offers six elevation set points, for ease of assembly, set the angle to its lowest setting of 15-degrees. Optimum tilt setting of the rack will take place later in these instructions.

B. Remove the Pivot Bolt from the Mounting Sleeve and also collect the 3/8” x 1-3/4” bolt, flat washers and lock washer needed to secure the Support Bar to its Pivot Tab on the Mounting Sleeve. (See Figure 6-2)

C. Orient the Strongback to the Mounting Sleeve with its Lower Support Bar positioned on the same side of the Mounting Sleeve as the Support Bar Pivot Tab.

D. Slide the Strongback between the two vertical mounting tabs, aligning the thru-hole of the Strongback with the holes of the two Vertical Towers.

E. Insert the Pivot Bolt along with one flat washer through the one Vertical Tower and the Strongback exiting the second Vertical Tower on the opposite side. Secure with the remaining flat washer, lock washer and hex nut. For now, finger tighten only to allow movement for the next step.

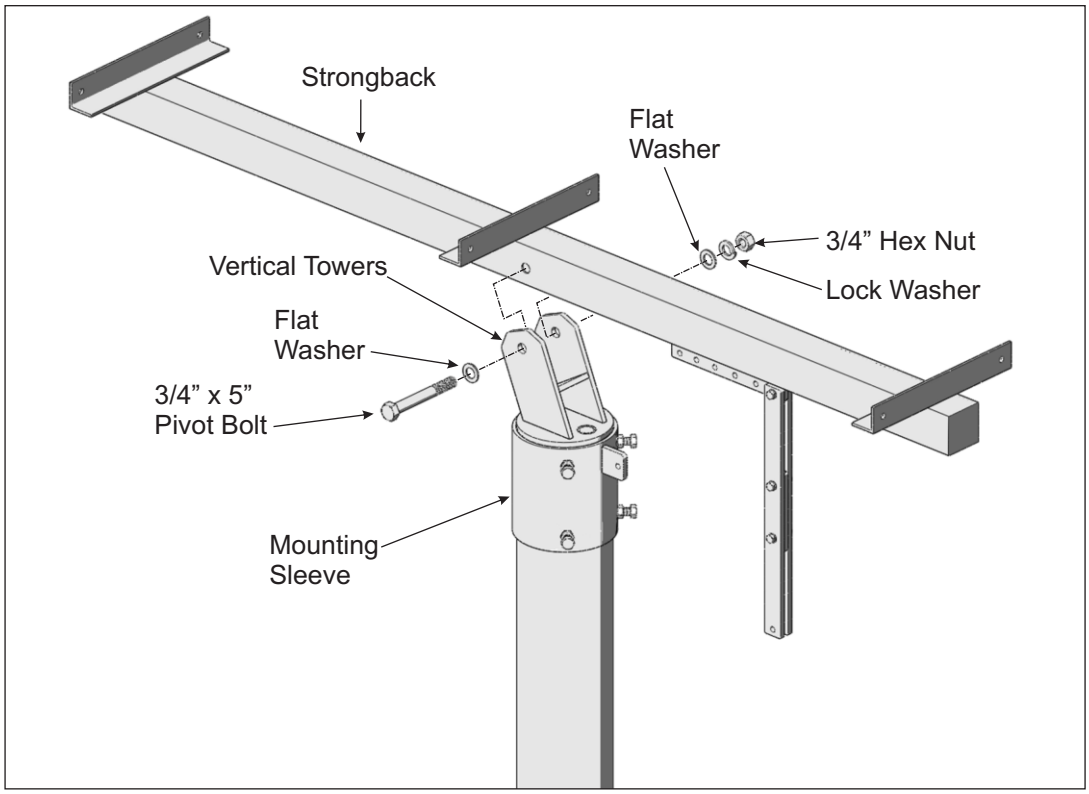


Figure 6-2: Installing the Strongback

F. Pivot the Strongback and the Support Bar to align the mounting holes of the Support Bar with its Pivot Tab on the Mounting Sleeve. Slide the Support Bar over the Pivot Tab. Insert the 3/8” x 1-3/4” bolt and one flat washer through the Support Bar and Mounting Tab and secure it with the remaining flat washer, lock washer and hex nut. **Torque hardware on both ends of Support Bar at 32-34 ft.-lbs.** (See Figure 6-3)

G. Return and tighten the Pivot Bolt. The Pivot Bolt cannot be left loose - the Mounting Sleeve Vertical Towers must be firmly clamped to the sides of the Strongback eliminating any gaps between the Vertical Towers and the Strongback. **Torque to 125-150 ft.-lbs.** (See Figure 6-4)

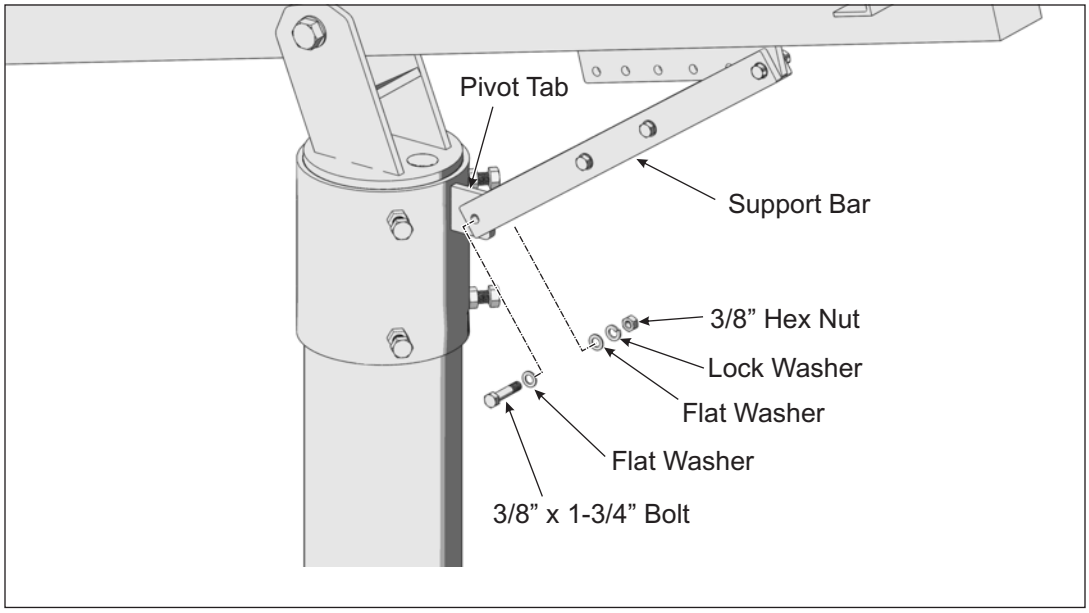


Figure 6-3: Securing Support Bar to Mounting Sleeve

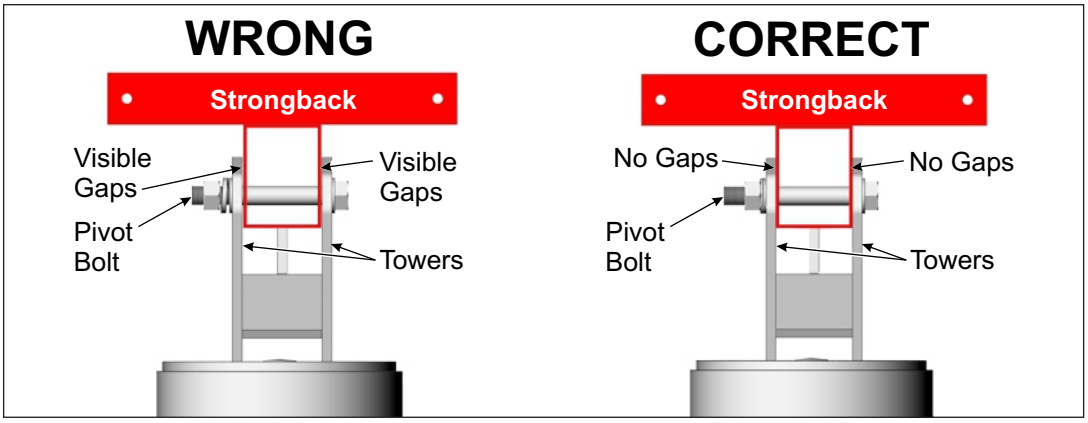


Figure 6-4: Tighten and Torque the Pivot Bolt

Step 7: Install the Cross-Bars to the Strongback

Cross-Bars run in an E-W direction and are secured to the mounting angles (welded to the Strongback) using 3/8” square flat washers along with 3/8” x 3-1/4” bolts and hardware.

Cross-Bars are mounted to the outside of the Strongback mounting angles (these are welded to the Strongback); they are not nested into the Mounting Angles. (see Figures 7-1 and 7-2)

Installing the Cross-Bars.

A. Position the Cross-Bar on the outside of the center mounting angle of the Strongback. Align the mounting holes and secure using 3/8” flat and square washers along with the 3/8” x 3-1/4” bolts and lock washer placing the square flat washer against the Cross-Bar. Tighten hardware and **Torque to 30-32 ft.-lbs.**

CAUTION:
This is a two person activity. Cross-Bars are long and unstable before they are fully secured to the Strongback. Cross-Bars must be held in place by one person while the second person aligns and secures them to the Strongback. Failure to do so could lead to serious personal injury.

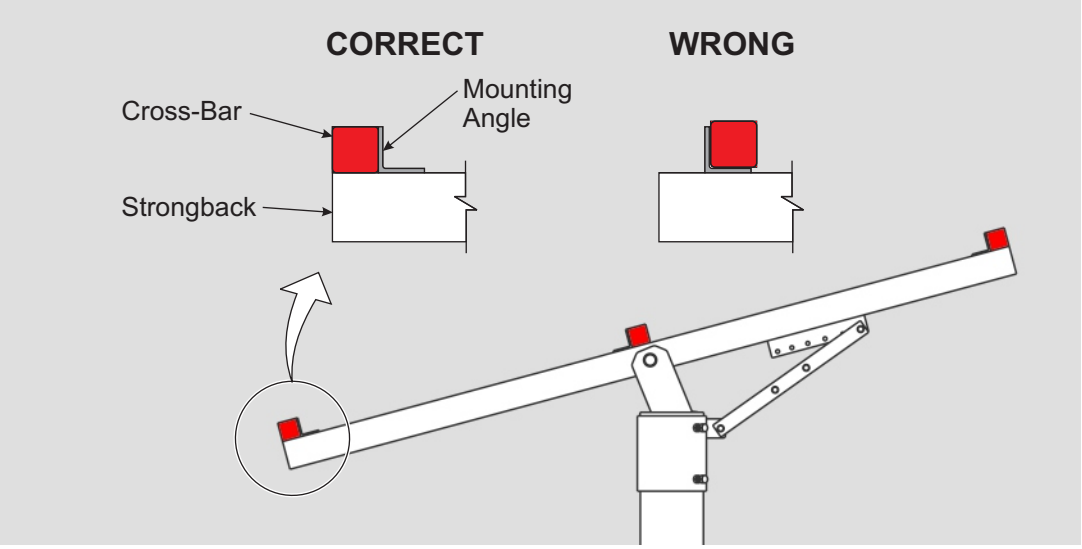


Figure 7-1: Cross-Bar Positioning relative to Mounting Angles

WARNING:
Be sure to place the 3/8” square washers on the surface of the Cross-Bar and not the Mounting Angles of the Strongback. Failure to do so will damage the surface of the Cross-Bar when the attaching hardware is tightened.

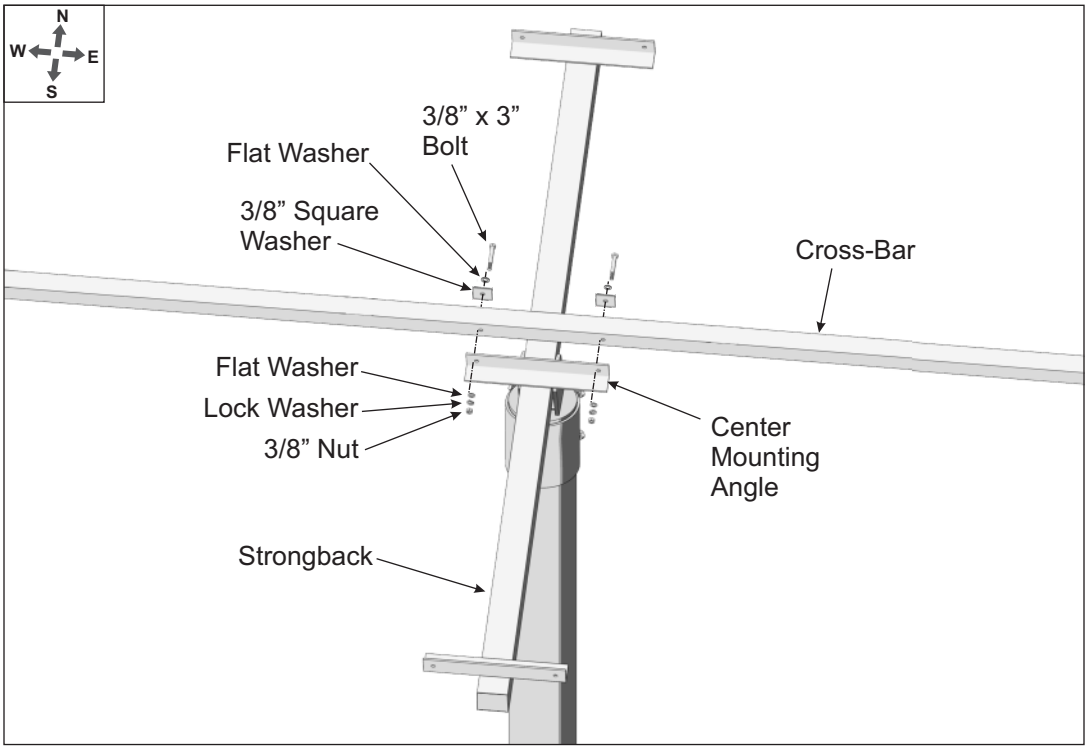


Figure 7-2: Installing Cross-Bars on the Strongback

B. Continue in this manner and install the opposite Cross-Bar to the Strongback. Refer to Figure 7-1 as needed for proper positioning.

Step 8: Attach the Module Rails to the Cross-Bars

Start by attaching the inboard Module Rails first and work outward.

Referring to Figure 8-1 for orientation of the Module Rails, position and align the Module Rails with the marks made in previous step. Straddle the two sets of mounting holes with the Cross-Bars and secure with 3/8" x 2" x 2-5/8" U-Bolts and hardware. Finger-tighten for now.

CAUTION:
This is a two person activity. Module Rails are unstable before they are fully secured to the Cross-Bars. Module Rails must be held in place by one person while the second person aligns and secures them to the Cross-Bars. Failure to do so could lead to serious personal injury.

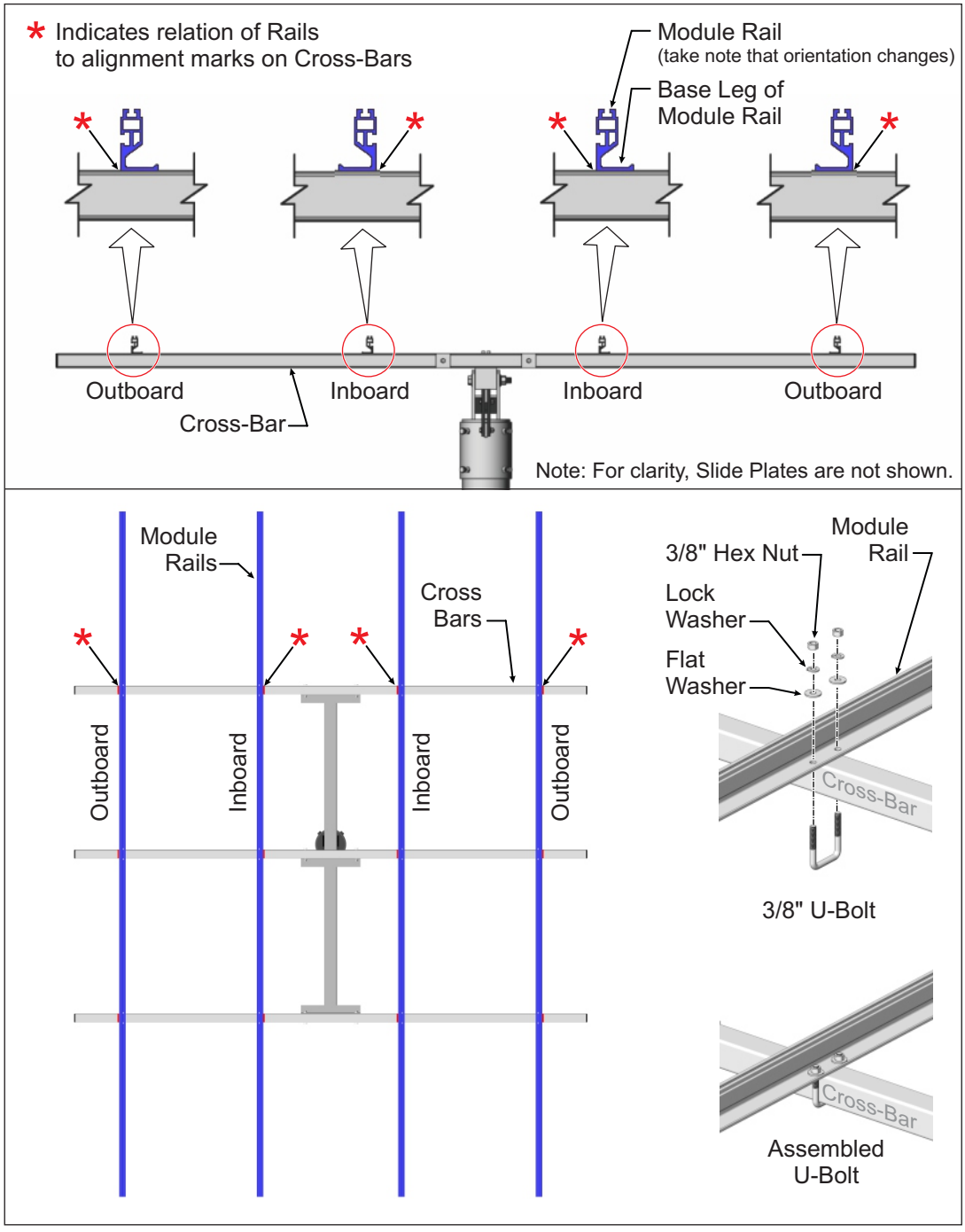


Figure 8-1: Aligning and Attaching Module Rails to Cross-Bars

NOTE:
Finger-tighten the Module Rails to the Cross-Bars while installing. When all Module Rails are installed, re-tighten to specified torque values.

CAUTION:
This is a two person activity. PV Modules are heavy and unstable before they are fully secured to the Module Rails. PV Modules must be held in place by one person while the second person aligns and secures them to the Module Rails. Failure to do so could lead to serious personal injury and damaged components.

Step 9: Installing PV Modules to Sliding Plates

In this step, the two interior rows of PV Modules are installed and secured to the four previously-installed Double Hole Slide Plates, after which the next in-line N-S Double Hole Slide Plates will be shifted and secured to these Modules. This process is repeated for the outer two rows of Modules that are then secured to the Single Hole Slide Plates on the outer edges of the array. All PV Modules are secured to the Sliding Plates using 1/4” x 3/4” bolts and hardware.

Secure the first four PV Modules to the four Double Hole Slide Plates

These four Modules represent the two center E-W rows of Modules. They are aligned and attached to the four pre-set and secured Double Hole Slide Plates.

A. Align one of the PV Modules to a set of the secured Double Hole Slide Plates mounting holes. Secure with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figures 9-1 and 9-2)

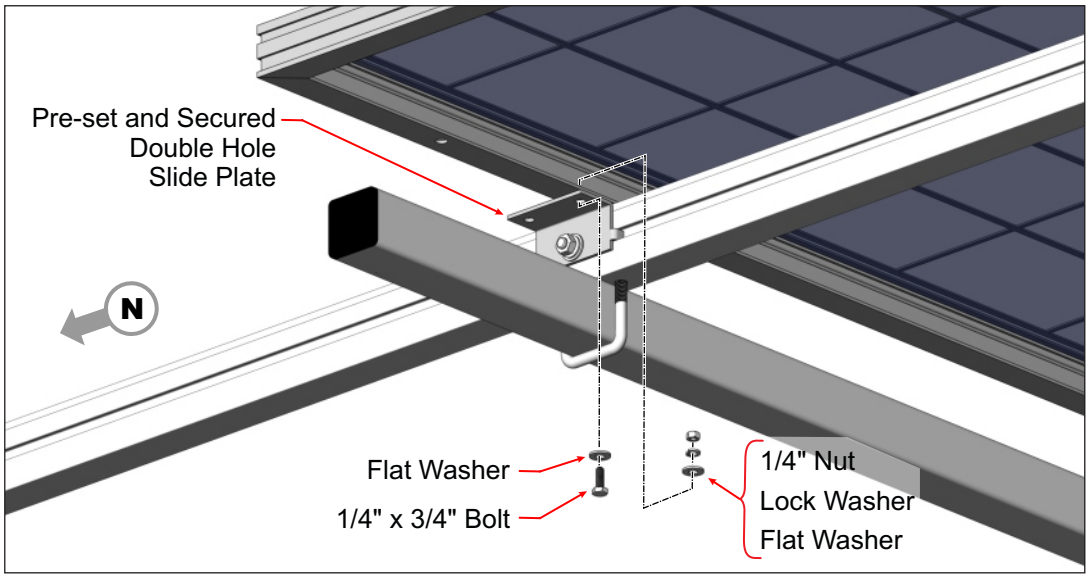


Figure 9-1: Installing first row of PV Modules to the Double Hole Slide Plates

B. Locate the two next-in-line Double Hole Slide Plates (one on each Rail), loosen the hardware enough so that the Slide Plates will move, and slide their mounting holes into alignment with the just-installed-Module. Secure the Module with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figure 9-3)

C. Continue in this manner and install the adjacent E-W Module, securing it as described above.

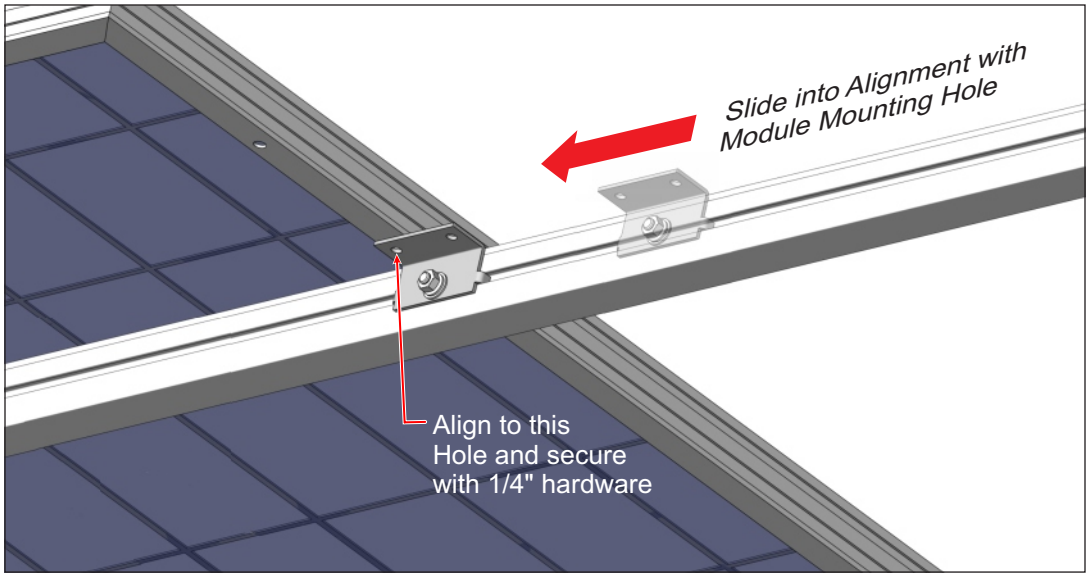


Figure 9-2: Aligning the Double Hole Slide Plate with PV Module Mounting Hole

Install the Remaining Modules

Working to the north or south of the previously installed row of Modules, install and secure the next row of PV Modules to the two Double Hole Slide Plates.

A. Place the next in-line PV Module, aligning it with the mounting holes of the two Double Hole Slide Plates. Secure with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figure 9-3)

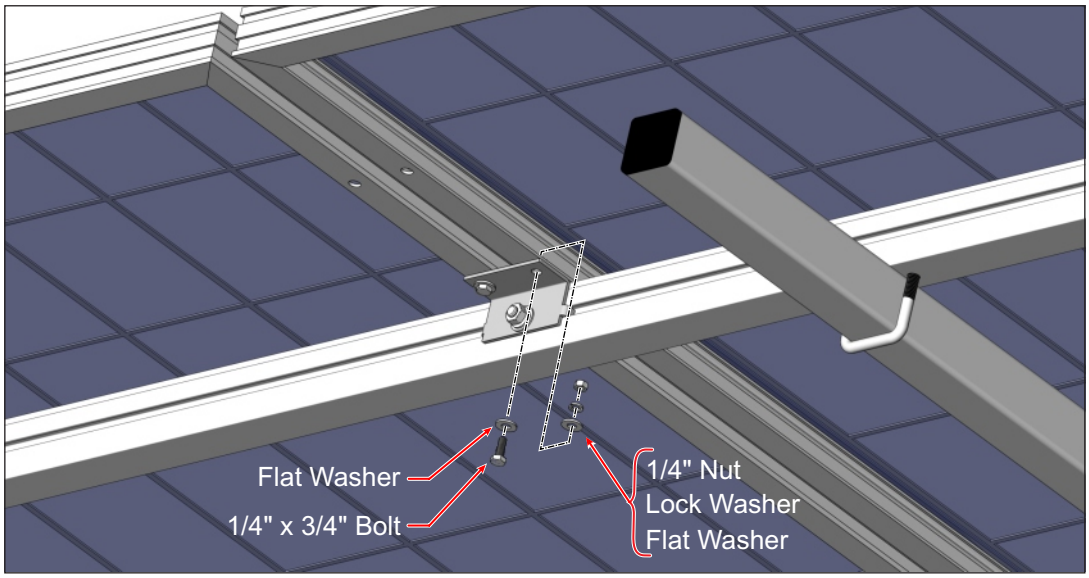


Figure 9-3: Securing the next Row of PV Modules, to the Double Hole Slide Plate

Install the next two rows of Modules to the north and south as described above, except for the use of the Single Hole Slide Plates on the four corners of the array. They are installed as follows.

Working to the north or south of the previously installed rows of Modules, install and secure the outermost rows of PV Modules.

A. Align the next in-line PV Module to the mounting holes of the two previously aligned Double Hole Slide Plates. Secure with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (reference Figure 9-3)

B. Locate the Single Hole Slide Plate, loosen the hardware enough so that the Slide Plate will move, and slide its mounting holes into alignment with the just-installed-module. Secure the Module with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figures 9-4 & 9-5)

C. Continue in this manner and install the adjacent E-W Module, securing it as described above.

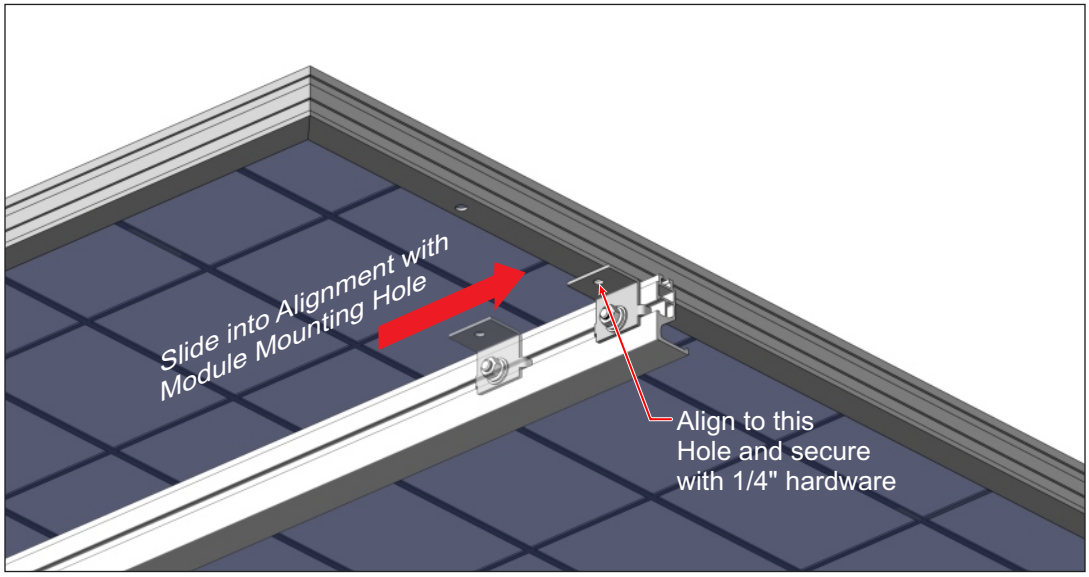


Figure 9-4: Aligning the Single Hole Slide Plate with PV Module Mounting Hole

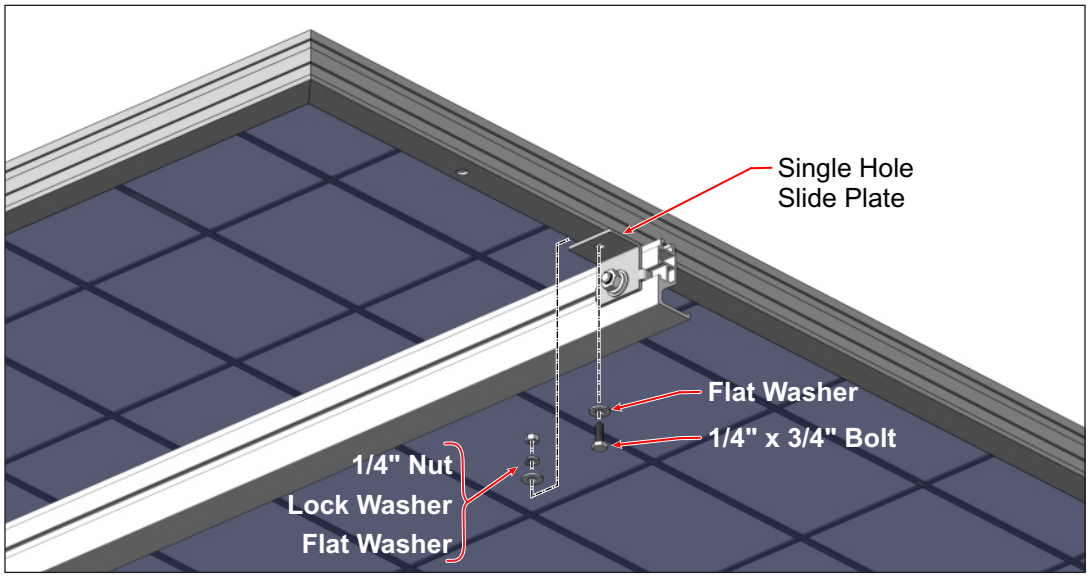


Figure 9-5: Securing PV Modules to the Single Hole Slide Plates

CAUTION:
Be certain to re-tighten all Module Rail and PV Module mounting hardware and torque to the specified values. Failure to do so could lead to structural failure, damaged components and/or serious personal injury.

WARNING:
Use great care in this procedure as it can be dangerous if the procedure is not completed as described with a minimum of two people.

CAUTION:
This is a two person activity. As the Pivot Bolt is loosened and the Support Bar hardware is removed, the rack is heavy and unstable. The rack must be held in place by one person while the second person loosens and removes the hardware and then re-installs/tightens the hardware back in place. Failure to do so could lead to serious personal injury and damaged components.

Step 10: Square and Align the Array

Using a square and visual references, ensure that the array is aligned to the mounting structure. Confirm that the PV Modules are square and have consistent even spaces all around. Adjust if necessary.

Step 11: Now Return and Tighten Mounting Hardware

A. Return and tighten each set of the 3/8” U-bolts, securing the Module Rails to the Cross-Bars. **Torque all at 32-34 ft.-lbs.**

B. Return and tighten each of the 3/8" hardware securing all of the Slide Plates (Single and Double Hole) to the Module Rails. **Torque all at 32-34 ft.-lbs.**

C. Return and tighten each set of 1/4” mounting hardware, securing the PV Modules to the Slide Plates. **Torque all at 6-8 ft.-lbs.**

Step 12: Adjust the Tilt Angle of the Rack

To adjust the tilt angle, loosen the Pivot Bolt hardware and remove the Support Arm upper hardware attaching the Support Arm to the Strongback.

A. While one person holds the south edge of rack, the other loosens the Pivot Bolt and removes the upper 3/8” hardware attaching the Support Bar to the Strongback. (See Figure 12-1)

B. Tilt the rack to the desired elevation angle (15°, 25°, 35°, 45°, 55° or 65°) and re-attach the Support Bar to the Strongback, placing the 3/8” hardware in the appropriate hole matching the desired elevation. **Torque at 32-34 ft.-lbs.** (See Figure 12-2)

C. After changing the tilt angle and tightening the Support Bar hardware, the Pivot Bolt must be re-tightened. The Mounting Sleeve Vertical Towers must be firmly clamped to the sides of the Strongback eliminating any gaps between the Vertical Towers and the Strongback. **Torque to 125-150 ft.-lbs.** (See Figure 12-3)

CAUTION:
Do not attempt to remove the Pivot Bolt during tilt adjustments! Removal could lead to serious personal injury or death. Adjustments are made with the Pivot Bolt hardware loosened but in place.

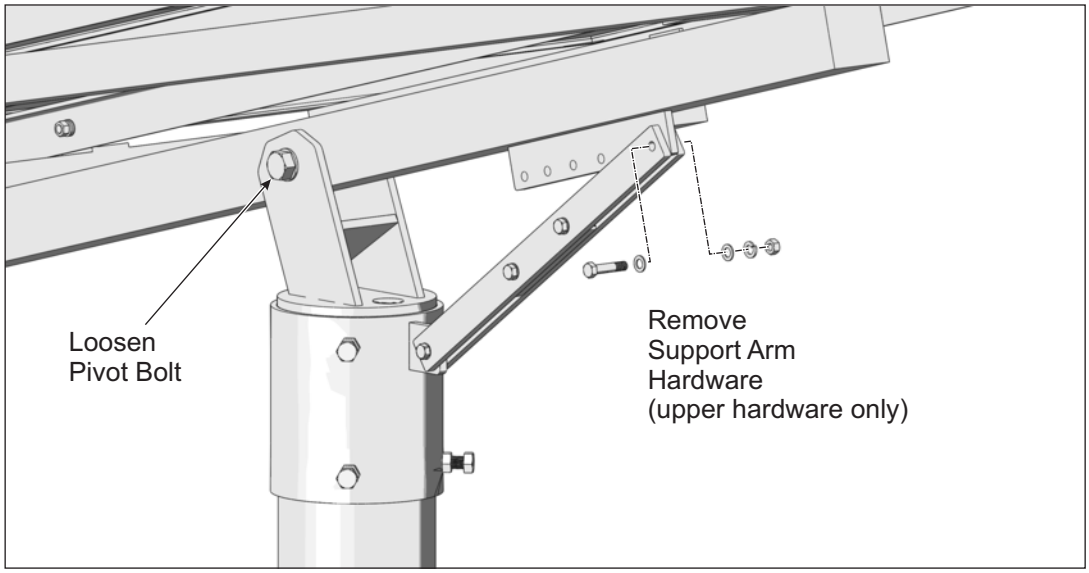


Figure 12-1: Preparing to Adjust the Tilt Angle

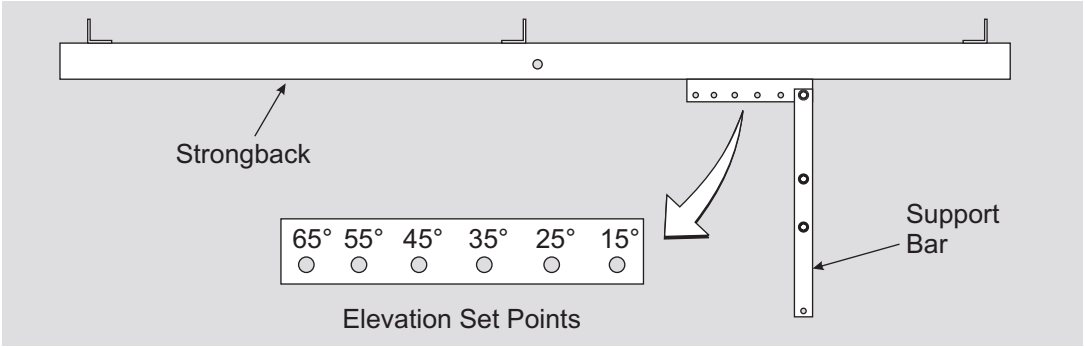


Figure 12-2: Setting the Tilt Angle

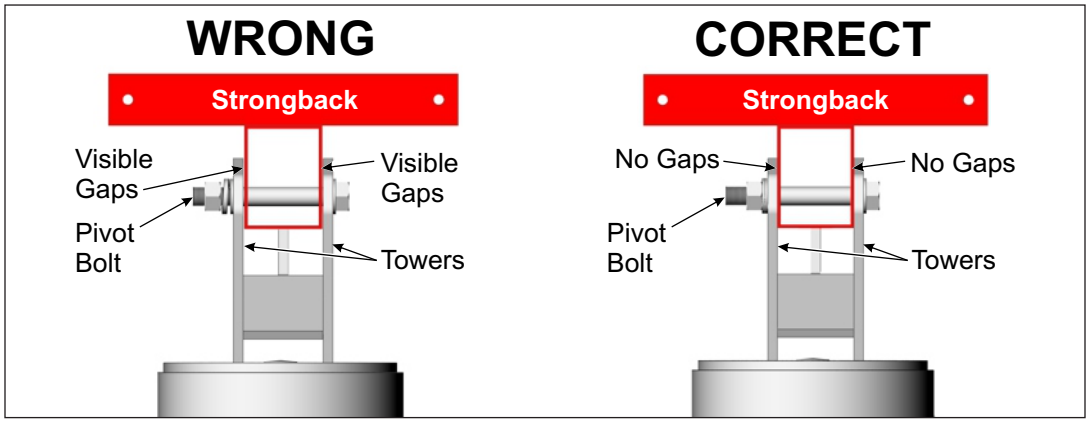


Figure 12-3: Tighten and Torque the Pivot Bolt

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