

# TILT KIT - POWER RAIL™ P6

## ASSEMBLY INSTRUCTIONS

**step-by-step  
assembly and installation**

# Tilt Kit Power Rail™ P6

## *A Few words about these Assembly Instructions*

### *These instructions:*

- Do not include any information on the selection or installation of attaching hardware to be mounted to the roof substrate. For information on compatible attaching hardware, see our publication titled “Power Rail Design Guidelines”.
- Begin after all roof mounted attaching hardware has been installed and secured to the roof substrate.
- Show the Power Rail Mounting System being installed on the “Power Rail PV Flash” roof attachment system.
- 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 should minimize the risk of any personal injury or damage to components while making the installation an efficient process.

**WARNING:**

Follow the procedures and precautions in these instructions carefully.

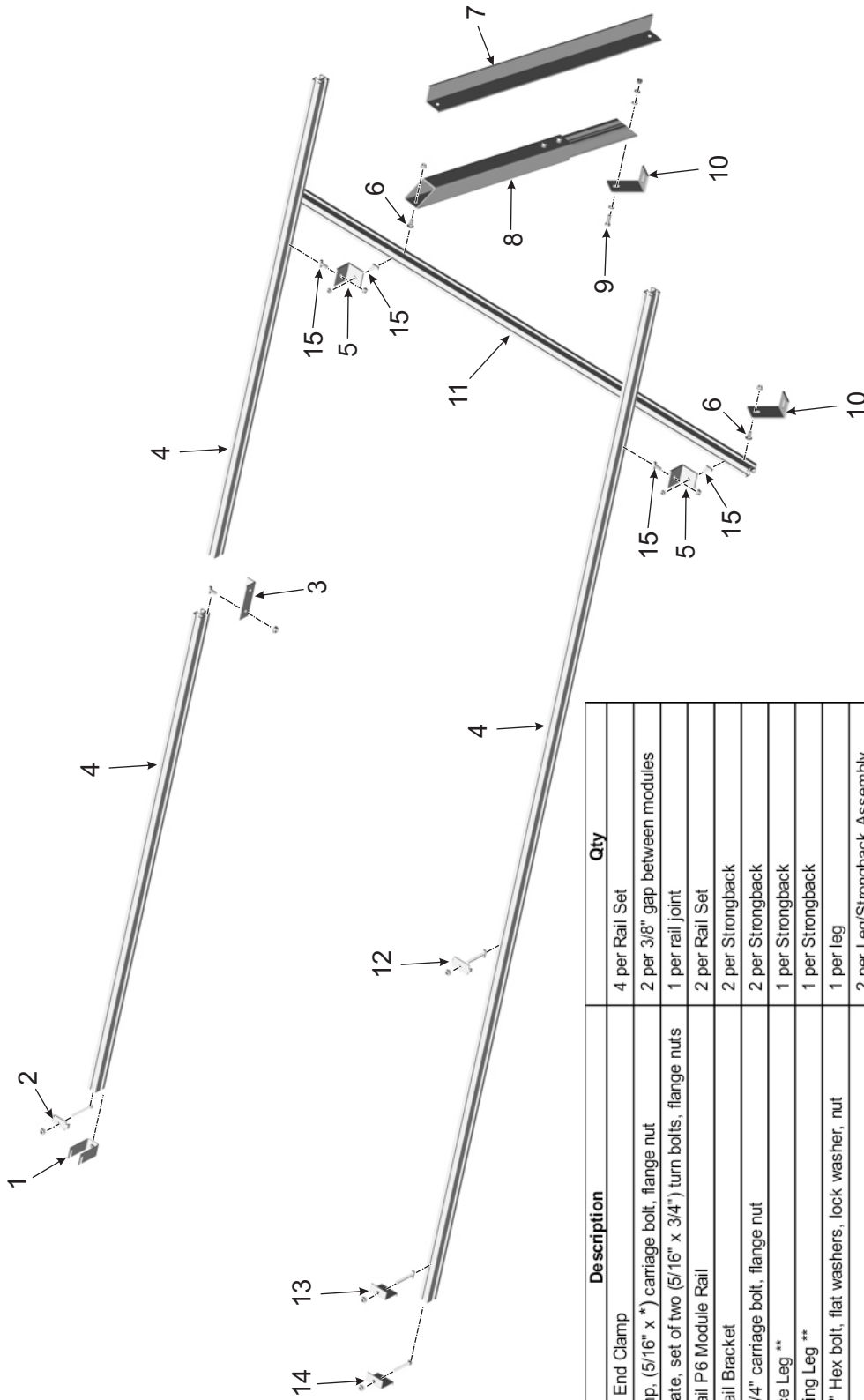
For questions on a specific installation please call us or e-mail us at:

Phone: 800-260-3792

Email: [info@plpsolar.com](mailto:info@plpsolar.com)

### *Required Tools*

- 1/2 inch wrench or socket for 5/16 inch module clamp hardware
- Torque wrench
- Ratchet wrench
- Ratchet extension bar
- Framing square
- Tape Measure



Item	Description	Qty
1	Universal End Clamp	4 per Rail Set
2	Mid Clamp, (5/16" x *) carriage bolt, flange nut	2 per 3/8" gap between modules
3	Splice Plate, set of two (5/16" x 3/4") turn bolts, flange nuts	1 per rail joint
4	Power Rail P6 Module Rail	2 per Rail Set
5	Rail-to-Rail Bracket	2 per Strongback
6	5/16" x 3/4" carriage bolt, flange nut	2 per Strongback
7	One-Piece Leg **	1 per Strongback
8	Telescoping Leg **	1 per Strongback
9	5/16" x 1" Hex bolt, flat washers, lock washer, nut	1 per leg
10	L-Foot	2 per Leg/Strongback Assembly
11	Power Rail P6 Strongback	1 per Leg
12	RAD Mid-Clamp, (5/16" x *) bolt, flange nut	2 per 3/8" gap between modules
13	RAD End-Clamp, (5/16" x *) bolt, flange nut	4 per Rail Set
14	End-Clamp, (5/16" x *) carriage bolt, flange nut	4 per Rail Set
15	5/16" x 3/4" turn bolt, flange nut	2 per Rail-to Rail Bracket
* 2, 2-1/4, 2-1/2, or 2-3/4" bolt. Length is dependent on depth of PV Module frame		
** Leg type is design dependent. One-Piece or Telescoping leg type.		
Notes: 1. Option to install Mid Clamp with carriage bolt or RAD Mid Clamp.		
2. Option to install Universal End Clamp, End Clamp with carriage bolt or RAD End Clamp.		

**Tilt Kit Power Rail P6 Parts Identification**

## Step 1: Install Attaching Hardware

**NOTE:**

L-feet can be attached directly to the roof substrate with the proper hardware. See Power Rail Design Guidelines for more information.

The selection of attaching hardware is dependent on the roof substrate and site design conditions. Please consult the design manual for specifics. Instructions for attaching anchoring hardware to the roof or structure are available on an individual product basis.

Of critical importance in mounting the attaching hardware to the roof substrate is the N-S span between the attaching hardware. The N-S span must be set at 48-inches apart in order to use our pre-calculated tilt angle settings. These settings will set the array at a preferred tilt angle but are only effective when a 48-inch span has been used.

- A. Place the "L" Foot onto the PV Flash hanger bolt, aligning it to the slot of the compression block.
- B. Secure "L" Foot with 5/16" flat washer and hex nut. **Torque to 14-16 ft.-lbs.**

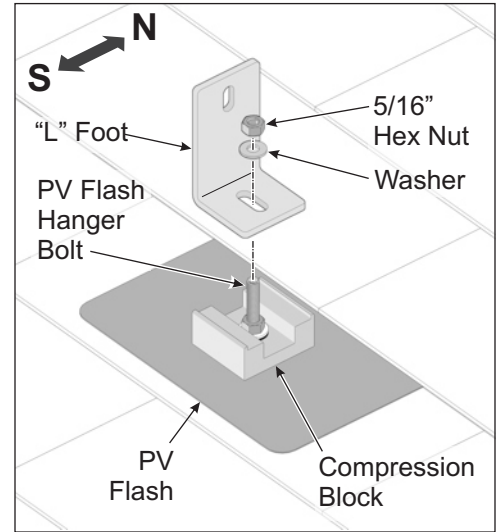


Figure 1-1: Attaching L-foot to the PV Flash

## Step 2: Measure and Mark Attachment Points on Strongback

There are two important attachment points that must be carefully measured and marked on the Strongbacks. One point indicates where the Strongback attaches to the southern "L" Foot and the other indicates where the Leg attaches to the northern end of the Strongback.

- A. Refer to Figure 2-1 for Strongback, profile orientation.
- B. From the southern end of the Strongback, measure and make a mark 1" from the end - this is where the Strongback will attach to the southern "L" Foot.
- C. From the northern end of the Strongback, measure and make a mark 14" from the end - this is where the leg will attach to the Strongback. (See Figure 2-1)

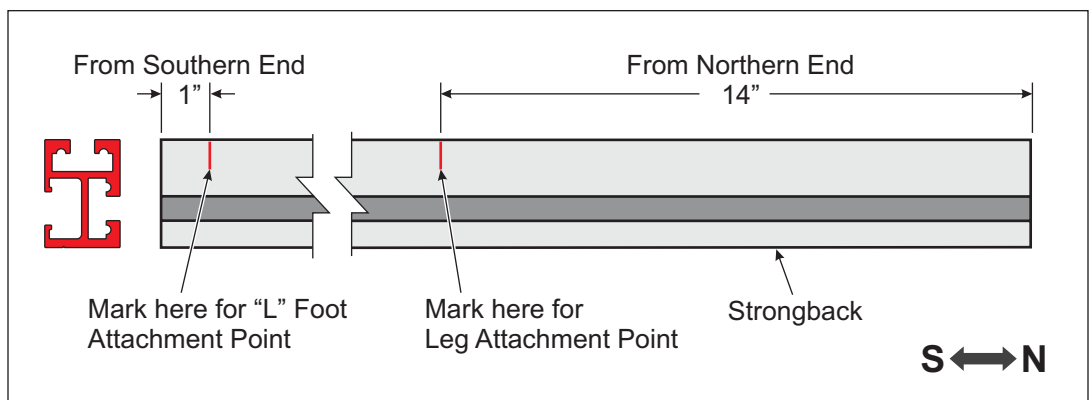


Figure 2-1: Measure and Mark Attachment Points on Strongback

**CAUTION:**

Span dimensions are a design specification. Consult the design manual to match these dimensions to site conditions. It's important to use the unique span dimension specific to the install. Failure to do so could lead to excessive deflection and/or premature system failure.

### Step 3: Attach Leg to Strongback

These instructions cover two types of Legs, the Telescoping and the One-Piece. Both types are secured to the Strongback using 5/16" x 3/4" carriage bolts and flange nuts. Figure 3-1 shows the Telescoping and One-Piece legs.

- A. Slide 5/16" x 3/4" carriage bolt into the Strongback, aligning bolt with the 14" mark previously made on the Strongback.
- B. Align mounting hole of Leg to carriage bolt and secure with 5/16" flange nut. Finger tighten for now.

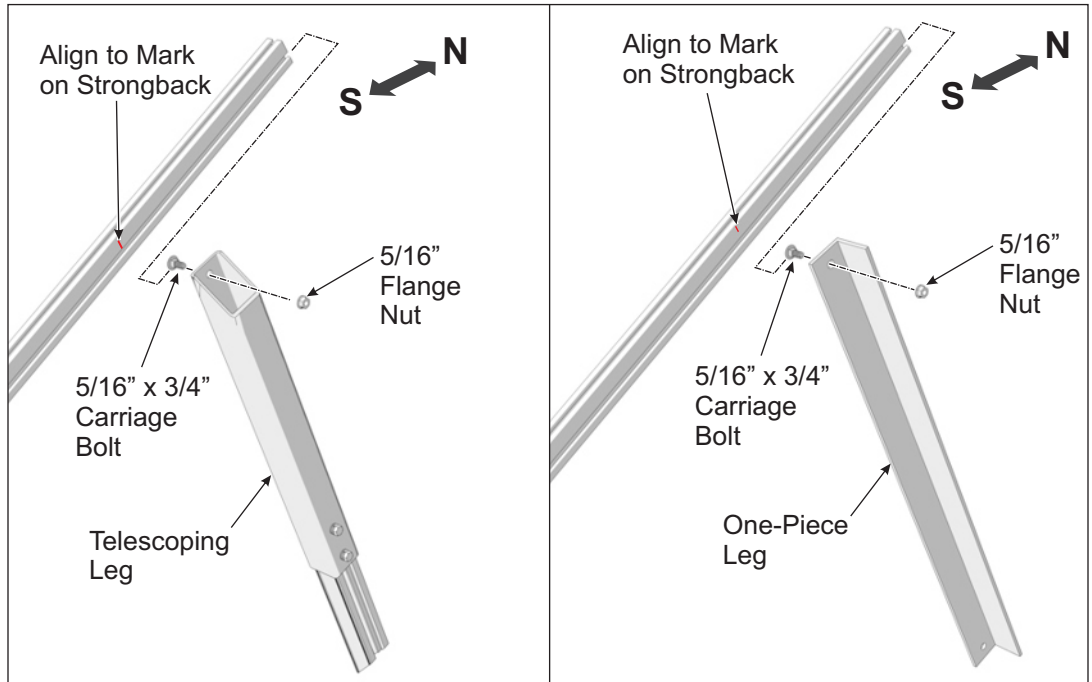


Figure 3-1: Attaching Leg to Strongback

### Step 4: Attach Strongbacks to Southern "L" Feet

The Strongbacks are secured to the "L" Feet using 5/16" x 3/4" carriage bolts and flange nuts. Hardware may vary depending on design-specific requirements. (See figure 4-1)

- A. Slide one 5/16" x 3/4" carriage bolt into the Strongback.
- B. Line up your mark on the Strongback with the center of the southern "L" Foot.
- C. Secure with 5/16" flange nut. Finger tighten for now.

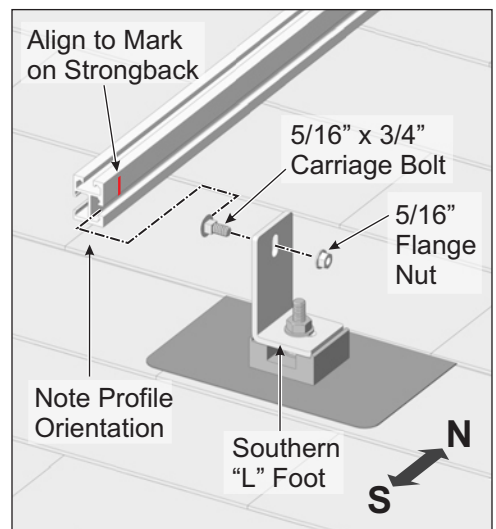


Figure 4-1: Attaching Strongback to Southern "L" Foot

## Step 5: Attach Legs to Northern “L” Feet

**WARNING:**

This is a two person activity. In addition to the difficulties associated with working on a sloped rooftop, the Strongback and Leg assembly is awkward to handle. One person should hold and align the Strongback while a second person secures the leg to the northern “L” Foot. Failure to do so could lead to serious personal injury and/or damaged components.

These instructions cover two types of Legs, the Telescoping and the One-Piece. Both types are secured to the Mounting Foot using a 5/16” x 1” hex bolt and hardware.

If using Telescoping Leg, it may be necessary to loosen the two telescoping lock bolts in order to extend or shorten the leg as needed to align the mounting hole of the leg with the slotted hole of the northern “L” Foot.

- A. Raise northern end of Strongback and align mounting hole of Leg to slotted hole of northern “L” Foot. Secure with 5/16” x 1” bolt, flat washers, lock washer and nut.
- B. Go back and check that the Leg and the “L” Foot position hasn't shifted from their marks on the Strongback. Adjust to align as needed.
- C. Return to tighten and torque hardware as follows:
  - Flange Nuts securing Strongback to “L” Foot Torque to 14-16 ft.-lbs.
  - Flange Nuts securing Leg to Strongback Torque to 14-16 ft.-lbs.
  - Hardware securing Leg to “L” Foot Torque to 14-16 ft.-lbs.
  - Two Telescoping Leg lock bolts Torque to 14-16 ft.-lbs.

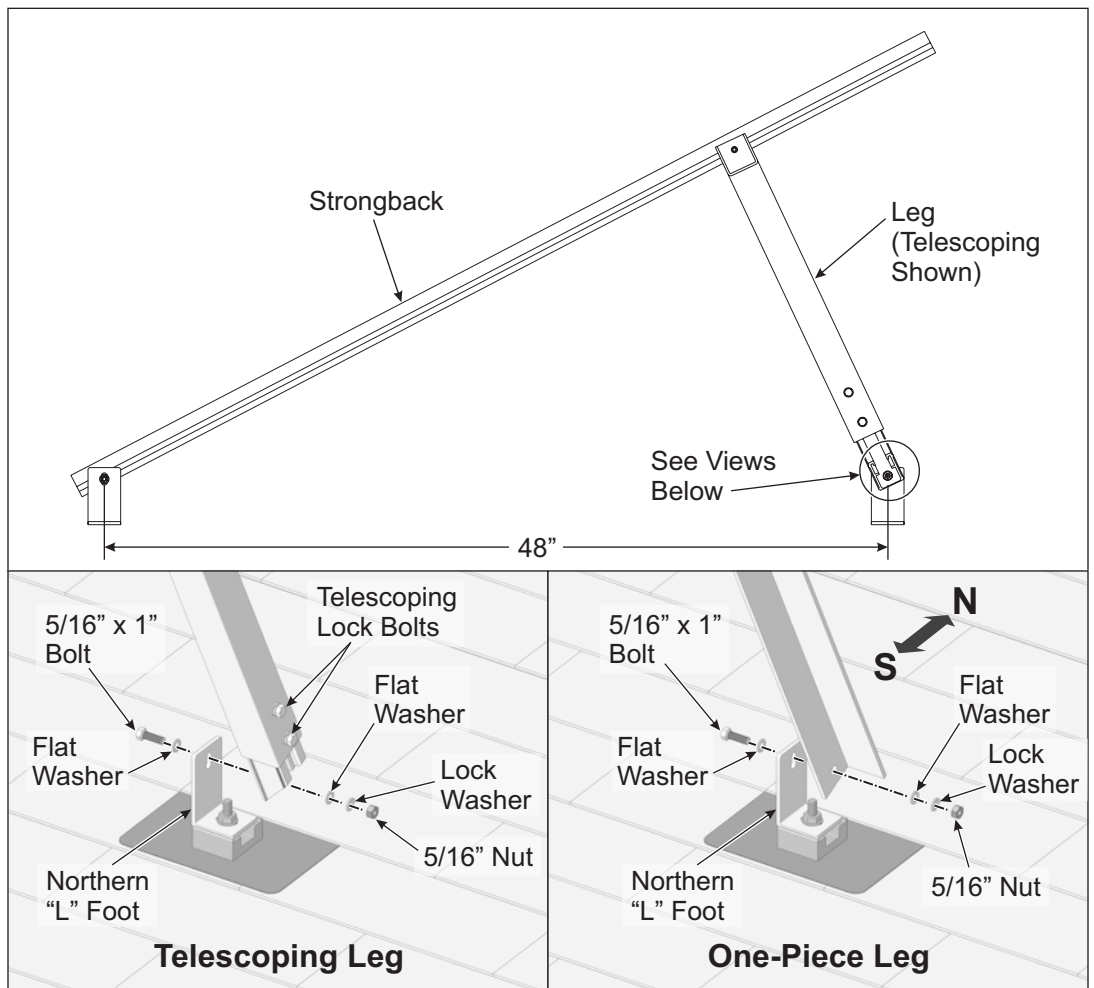


Figure 5-1: Attaching Leg to Northern “L” Foot

## Step 6: Installing Rail-to-Rail Brackets

Power Rails attach to the Strongbacks via Rail-to Rail mounting brackets, 5/16" x 3/4" turn bolts and flange nuts. The N-S span of the Rail-to-Rail brackets on the Strongback is dependent on the type/size of module being used. If the module manufacturer has provided specific clamping locations, use their specifications; if none are specified by the manufacturer, use a factor of 20-percent of the module length to determine the N-S span of the Rail-to-Rail brackets. (See Figure 6-1 below)

Once the span is determined, measure and mark the positions of the Rail-to-Rail brackets on each of the Strongbacks.

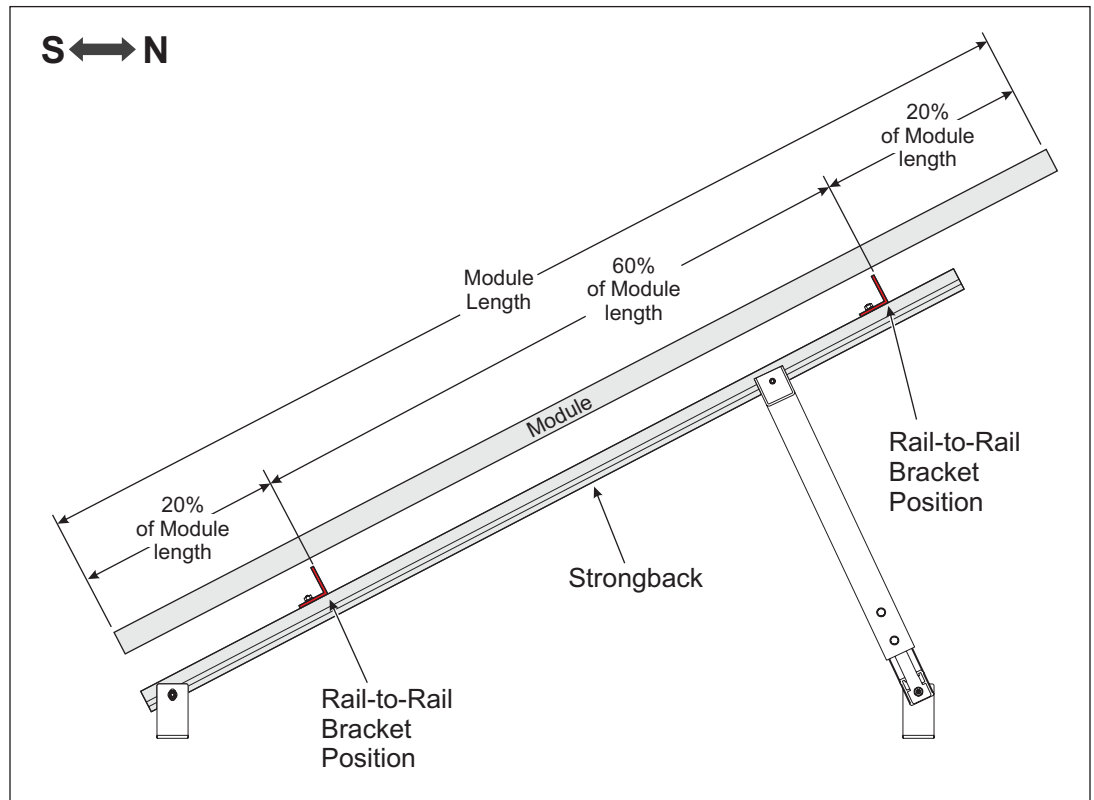


Figure 6-1: Positioning the Rail-to-Rail Brackets on the Strongback

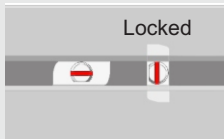
**NOTE:**

Use care in aligning the Rail-to-Rail brackets from one Strongback to the next. This will greatly assist in the installation of the Power Rails.

**NOTE:**

Turn Bolts must be locked into the channel by rotating clockwise 90-degrees. Use the indicator slot on the threaded end to identify whether or not a Turn Bolt has been locked.

Turn Bolt shown in channel of Strongback



Indicator Slot shown in **Red**

Align and install the Rail-to-Rail brackets to the marks made on the Strongback.

- A. Insert 5/16" x 3/4" turn bolt into the Strongback, twist and lock into place.
- B. Align Rail-to-Rail bracket to turn bolt and secure with 5/16" flange nut. Torque to 14-16 ft.-lbs.

Continue in this manner installing all Rail-to-Rail brackets on remaining Strongbacks before moving on to install the Power Rails.

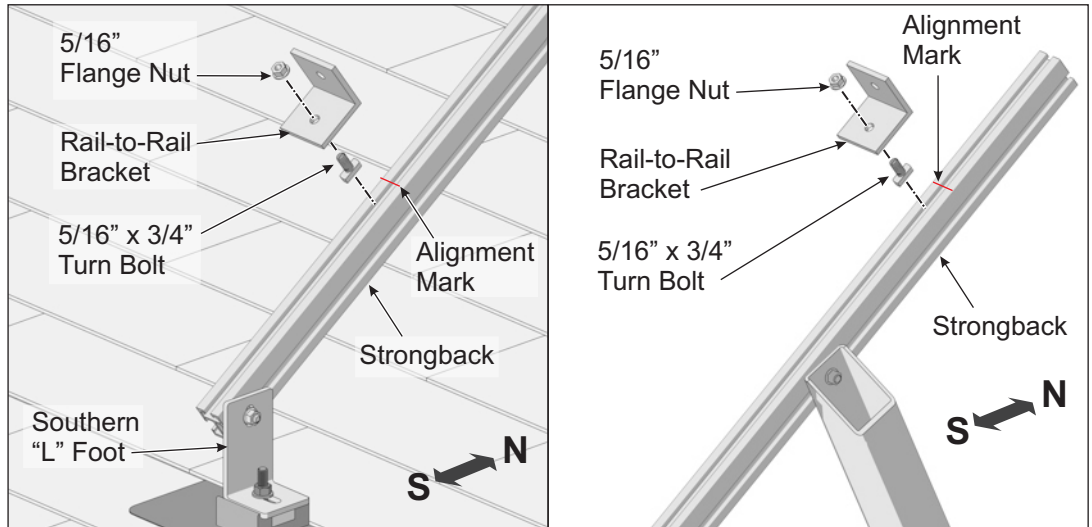


Figure 6-2: Southern & Northern Rail-to-Rail Bracket Installation

### Step 7: Splicing Power Rail with Splice Plates

In some cases, the overall length of a rail set may require the use of a Splice Plate to butt joint two lengths together. Splice Plates get mounted on the sides of the Power Rail. The steps below describe how to install a Splice Plate.

- A. Insert one 5/16" x 3/4" turn bolt into the channel of each Power Rail section to be spliced.
- B. Hold the two ends of Power Rail together.
- C. Position the Splice Plate on the Power Rail and two turn bolts.
- D. Align the Splice Plate so that it's equally divided along the Power Rail butt-joint.
- E. Secure the Splice Plate to Power Rails with two 5/16" flange nuts. Torque to 14-16 ft.-lbs.

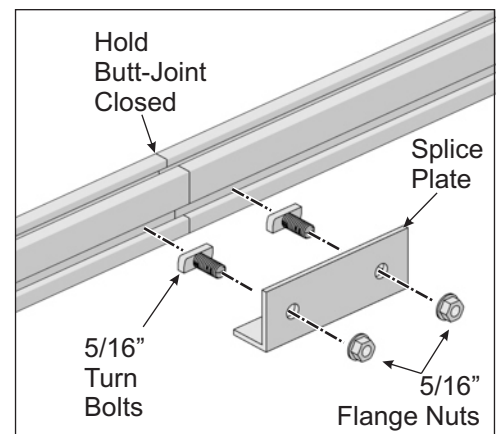


Figure 7-1: Splice Plate Installation



## Step 8: Installing Power Rails

Power Rails attach to the Rail-to-Rail brackets using 5/16" x 3/4" turn bolts and flange nuts. While installing, pay close attention to the orientation between the Power Rail and the Rail-to-Rail brackets. Additionally, refer to the job specific plans for the E-W positioning of the Power Rail along the Strongbacks. In most cases the run of the Power Rail is centered over the Strongbacks.

- A. Position the southern Power Rail to the north side of the Rail-to-Rail brackets with the Power Rail profile in the same orientation shown in Figure 7-1.
- B. Referring to the Power Rail Design Guidelines, set the E-W position of the Power Rail in relation to the Strongbacks by following the maximum allowable spans and cantilevers required for your site conditions.
- C. Insert one 5/16" x 3/4" turn bolt into the Power Rail at each location of the Rail-to-Rail brackets along the Power Rail.
- D. Align each turn bolt to its respective Rail-to-Rail bracket and secure with 5/16" flange nuts. Torque all at 14-16 ft.-lbs.

Install the northern Power Rail in the same manner. (See Figure 8-1)

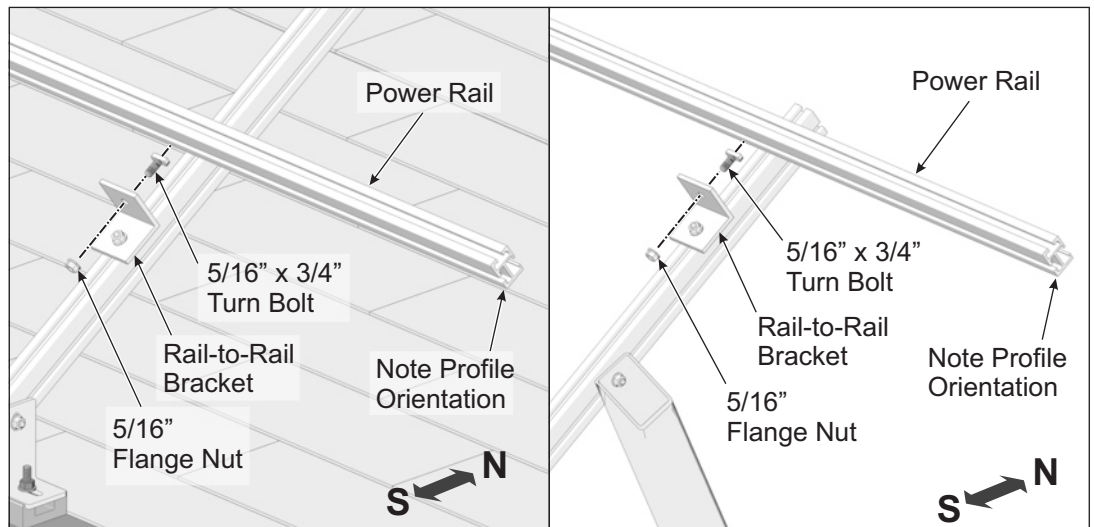


Figure 8-1: Installing Southern and Northern Power Rails

**WARNING:**

This is a two person activity. In addition to the difficulties associated with working on a sloped rooftop PV Modules are heavy. One person should hold and align the modules while a second person secures modules with clamping hardware. Failure to do so could lead to serious personal injury and/or damaged components.

**Step 9: Installing PV Modules to Power Rails with Module Clamps**

PV Modules are secured to the Power Rail using Mid Clamps (Standard or RAD) and End Clamps (Standard, RAD or Universal), along with the appropriate attaching hardware.

Attaching hardware includes Carriage Bolts or RAD Bolts for Mid Clamps and End Clamps, while the Universal End Clamp includes a preassembled Hex Bolt.

**The importance of correctly installing End and Mid Clamps:**

There is only one correct method of installing End Clamps and Mid Clamps. Failure to follow the correct method could lead to personal injury, structural failure, and/or damaged components. See Figure 9-1 for proper method of installation for an End Clamp and Figure 9-2 for the Mid Clamp. Refer to these figures during the installation of the Modules to prevent any undue problems associated with an improper installation.

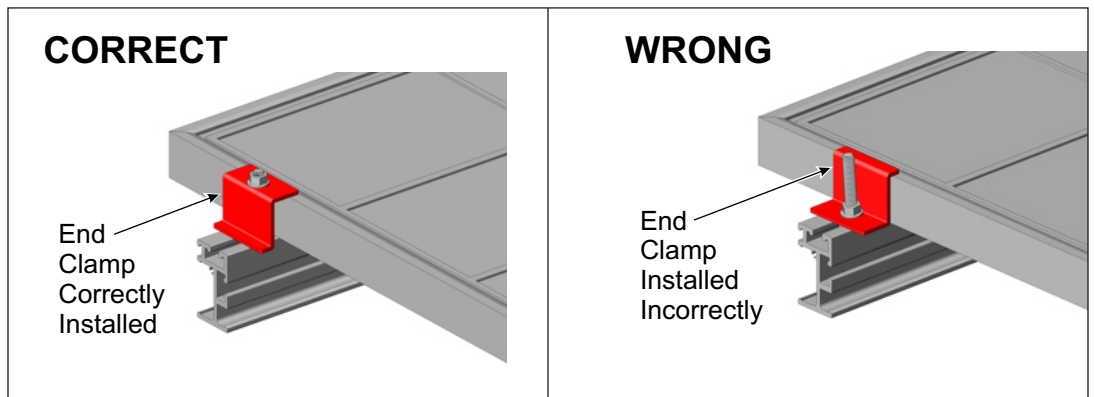


Figure 9-1: Correct and Wrong methods of installing Standard End-Clamp (using Carriage or RAD Bolts)

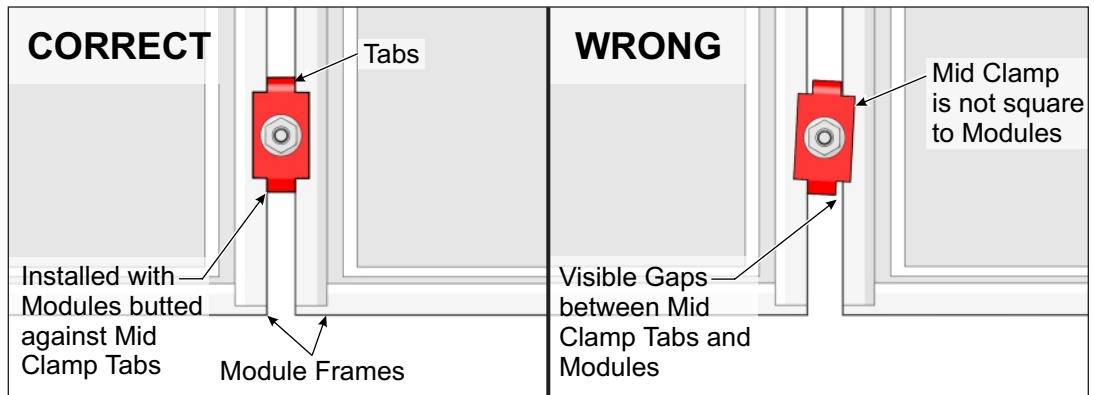


Figure 9-2: Correct and Wrong methods of installing a Mid Clamp (using Carriage or RAD Bolts)

### Installing Modules using Standard End and Mid Clamps:

Start with exterior Module and End Clamps.

- A. Place Module on two Power Rails, centering it lengthwise. Use a square to square-up the Module to the Power Rails.
- B. Insert one 5/16" x 2, 2-1/4, 2-1/2 or 2-3/4" carriage bolt into the top slot of the Power Rail. Push the bolt against the side of the module frame. Install End Clamp onto bolt and secure with 5/16" flange nut. **Torque to 14-16 ft.-lbs.** (See Figures 9-1 and 9-3)

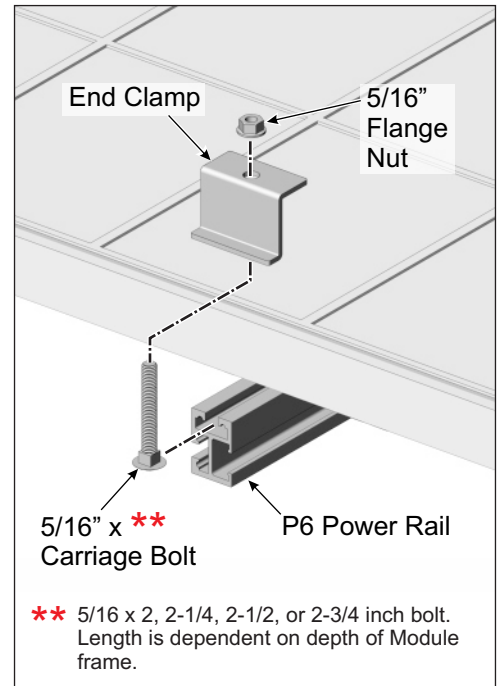


Figure 9-3: Installing Modules using Standard End-Clamp

Now install the next in-line Module using Mid Clamps.

- C. Before placing the interior Module onto the Power Rails, first insert 5/16" x 2, 2-1/4, 2-1/2, or 2-3/4" carriage bolts (bolt length is dependent on depth of Module frame) into the Module Rail, sliding the bolts inward next to the previously installed exterior Module. (See Figure 9-4)

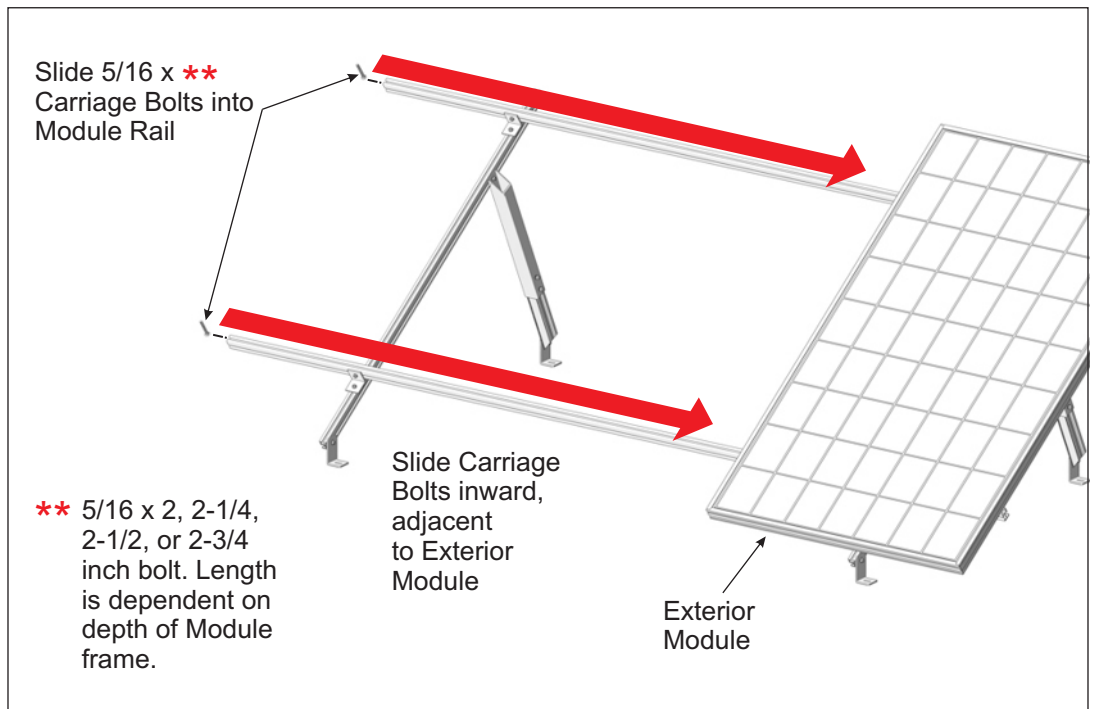


Figure 9-4: Inserting Mid Clamp Hardware into Power Rail

**WARNING:**  
Modules must be held in place until they are secured at all four points with clamping hardware. Failure to do so could lead to serious personal injury and/or damaged components.

**NOTE:**  
If using standard 5/16" carriage bolts for Mid Clamps, they must be inserted into Power Rail before installing interior Modules.

If using RAD hardware, they can be inserted anytime at any position along the Power Rail.

- D. Install a Mid Clamp onto each carriage bolt making certain that the Mid Clamp tabs rest between the two modules.
- E. Push Modules against Mid Clamp tabs and secure Mid Clamp with 5/16" flange nut. **Torque to 14-16 ft.-lbs.** (See Figures 9-2 and 9-5)

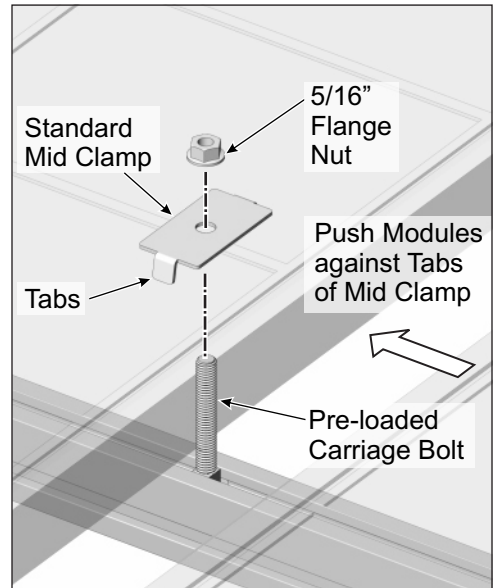


Figure 9-5: Installing Modules using Standard Mid Clamp

### Installing Modules using RAD End and Mid Clamps:

Start with exterior Module and End Clamps.

- A. Place Module on two Power Rails, centering it lengthwise. Use a square to square-up the Module to the Power Rails.
- B. Insert one 5/16" x 2, 2-1/4, 2-1/2 or 2-3/4" RAD bolt into the top slot of the Power Rail. Push the bolt against the side of the module frame and twist to lock in place. Install End Clamp onto bolt and secure with 5/16" flange nut. **Torque to 14-16 ft.-lbs.** (See Figures 9-1 and 9-6)

Install next in-line Module using Mid Clamps.

- C. Insert one 5/16" x 2, 2-1/4, 2-1/2, or 2-3/4" RAD bolt (bolt length is dependent on depth of Module frame) into each Rail, next to the previously installed exterior Module. Twist RAD bolt to lock in place. (See Figure 9-7)

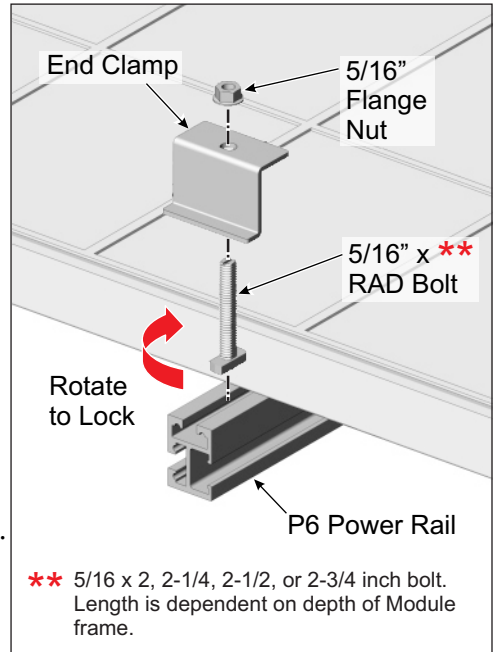


Figure 9-6: Installing Modules using RAD End Clamp

**WARNING:**  
Be certain that all Flange Nuts on End and Mid Clamps are tightened and torqued to the stated values. Failure to do so could lead to serious personal injury and/or damaged components and property.

- D. Place next Module onto Rails.
- E. Install a Mid Clamp onto each RAD bolt making certain that the Mid Clamp tabs rest between the two modules.
- F. Push Modules against Mid Clamp tabs and secure Mid Clamp with 5/16" flange nut. **Torque to 14-16 ft.-lbs.** (See Figures 9-2 and 9-7)

**Installing Modules using Universal End Clamps:**

- A. Place Module on two Power Rails, centering it lengthwise. Use a square to square-up the Module to the Power Rails.
- B. Position Universal Clamp underneath the module with notches facing the outside edge of the module, and rail centered between 'forks' of the clamp. Slide clamp notches towards the module flange until the flange bottoms out in the notches. Tighten 5/16" bolt on bottom of universal end clamp. **Torque to 14-16 ft.-lbs.** Repeat for both end clamps. (See Figure 9-8)

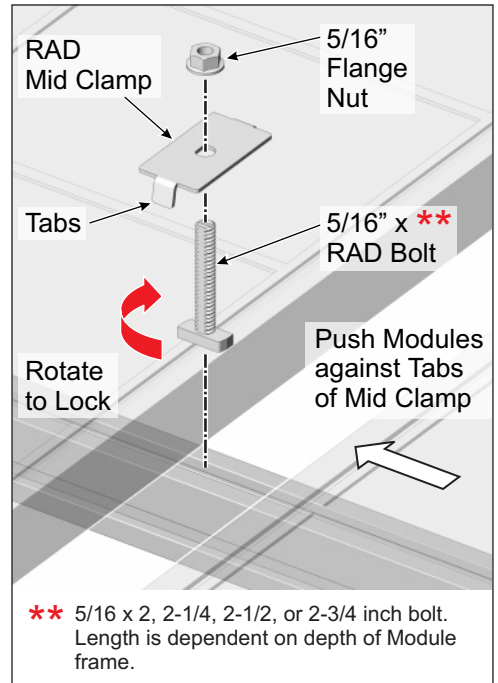


Figure 9-7: Installing Modules using RAD Mid Clamp

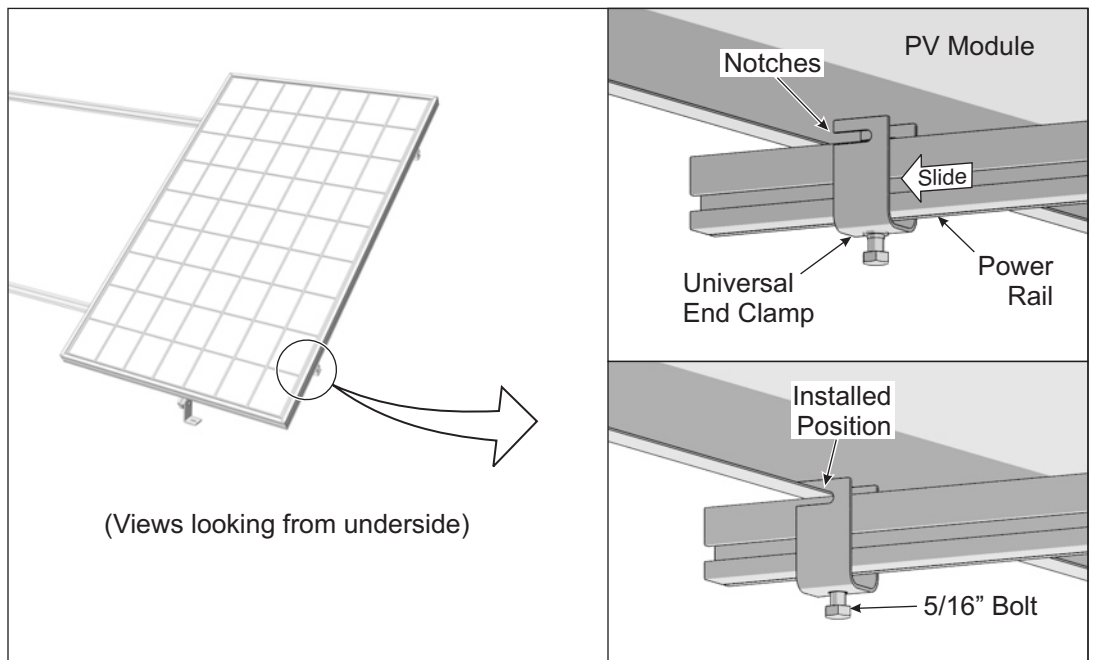


Figure 9-8: Installing PV Modules using Universal End Clamp

## Step 10: Adjusting Tilt Angle with Telescoping Legs

The Telescoping legs are designed to easily adjust the tilt angle of an array. It is recommended that this procedure be done by a minimum of two people. After loosening specific hardware, the full array pivots from the southern “L” Feet.

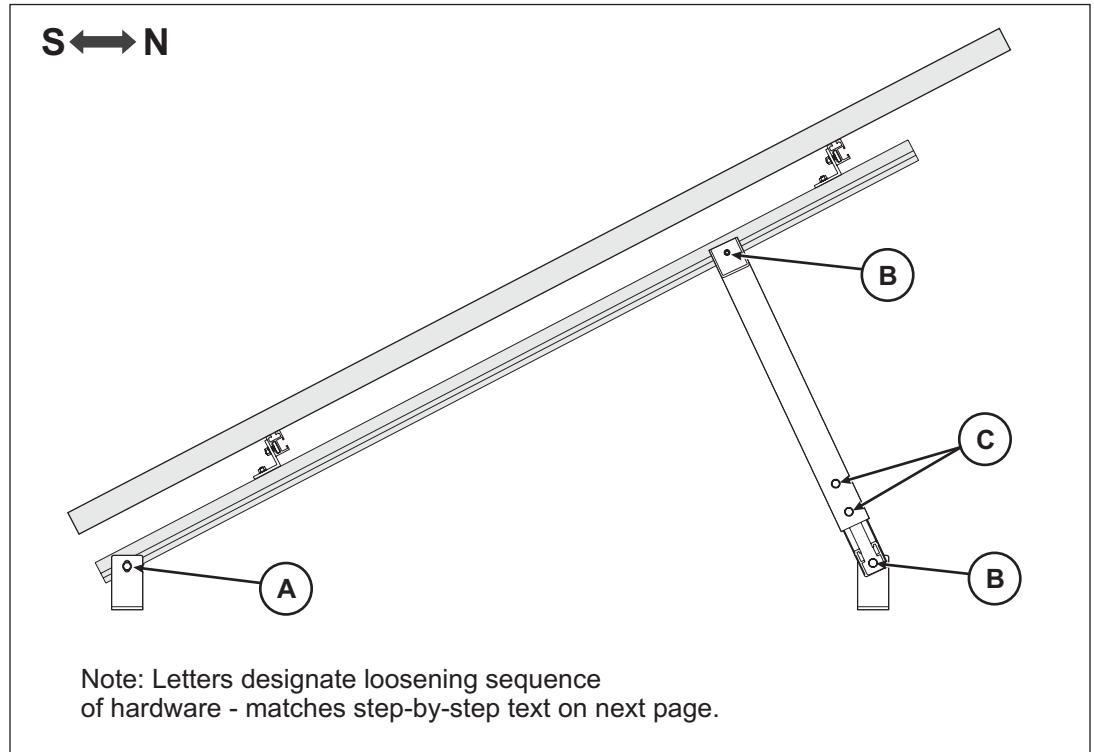


Figure 10-1: Adjusting Tilt Angle

### WARNING:

It's very important to support the weight of the array during this procedure. A minimum of two people should be used to hold and support the array while a third person loosens and re-tightens the hardware. Failure to do so could lead to serious personal injury and/or damaged components and property.

Use caution when loosening hardware to avoid disengaging from their locations. Loosen just enough to allow components to rotate freely (See Figure 10-1).

- A. Begin by loosening the hardware attaching the Strongbacks to the “L” Feet.
- B. As two people hold and support the array from the backside, the third person loosens the hardware at both ends of the Telescoping legs.
- C. Now loosen the Telescoping leg lock bolts.
- D. Lift/push the array to the desired tilt angle and hold in place.
- E. Re-tighten and torque hardware as follows (See Figure 10-2):
  1. Two Telescoping Leg lock bolts: **Torque to 14-16 ft.-lbs.**
  2. Flange Nuts securing Legs to Strongback: **Torque to 14-16 ft.-lbs.**
  3. Hardware securing Legs to “L” Feet: **Torque to 14-16 ft.-lbs.**
  4. Flange Nuts securing Strongbacks to “L” Feet: **Torque to 14-16 ft.-lbs.**

**WARNING:**  
Be certain that all hardware has been re-tightened and torqued to the stated values. Failure to do so could lead to serious personal injury and/or damaged components and property.

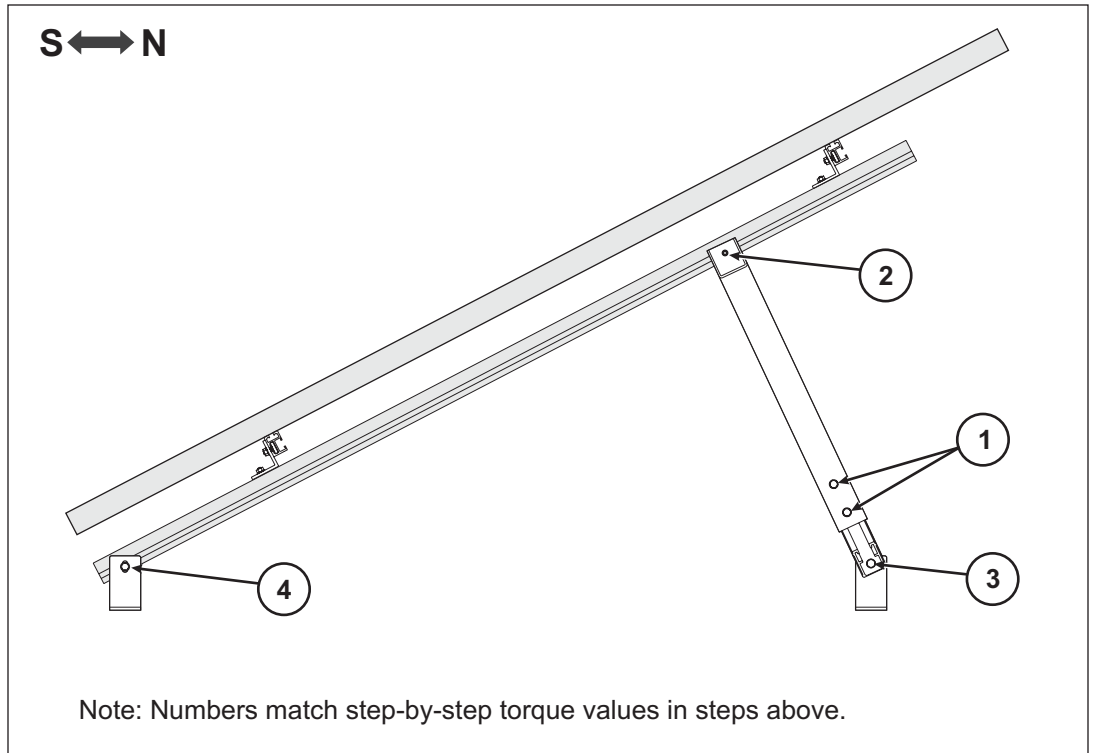


Figure 10-2: Re-tighten and Torque Hardware



## **PREFORMED** LINE PRODUCTS

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