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1. Safety

Basic Safety Considerations

The following basic safety instructions and the warning notes are an essential part of this manual and are of fundamental importance for handling the product.

Warnings and Symbols



Denotes a potential hazard which may lead to physical injury and/or property damage



Denotes cardinal orientation relative to north



Denotes connection type



Denotes hand tighten fasteners



Denotes that fasteners torque per specifications is required



Denotes that adjustment or positioning can be performed



Denotes that leveling and/or alignment required

Responsibilities of the Installer

Read installation manual in conjunction with construction drawings. It is the responsibility of the installer to ensure all applicable safety measures are strictly adhered to while installing this PV Racking system. Any modifications are to be performed only by authorized personnel and must be approved by Polar Racking prior to implementation. The installer must have adequate skill and knowledge with any materials and tools used to install this system. Furthermore, the installer must be able to recognize any possible dangers, whether they are stated in this manual or not. Every person installing this system must read, and fully understand, every section of this manual prior to working on the system.

IMPORTANT NOTE: Due to the inherent properties of mating steel components, please ensure the limiting speed of cordless drivers (RPM) is set to the lowest setting (torque, vs. drill setting), for the fastening of all provided 5/16" Nuts. All fasteners provided by Polar Racking have been pre-treated to prevent material Galling (or cold welding), however, this is highly dependent upon the speed at which they are fastened.

Responsibilities of the Operator

It is the responsibility of the operator to ensure all scheduled maintenance is performed on time. The operator must ensure that the installation of the system is performed only by qualified personnel with adequate skill and knowledge. The operator must ensure a copy of this manual is available to any installer and/or maintenance person as it is part of the overall system. A replacement manual may be obtained by contacting Polar Racking using the contact information provided on the back of this manual, and/or downloading and printing a copy from the company website at www.polarrracking.com.

2. Tools and Hardware



Power Drill



Laser Level



Sockets:

- 3/4" (for 1/2" Hex Bolt / Nut)
- 9/16" (for 3/8" Hex Bolt / Nut)
- 1/2" (for 5/16" Hex Bolt / Nut)



String Line



Tape Measure



Torque Wrench



Level



Compass

Connection A

- 1/2–13 Serrated Flange Bolt, 1.5" Length, Grade 5, Magni 560 Coated
- 1/2–13 Serrated Flange Nut, Grade 5, Magni 560 Coated

Connection B

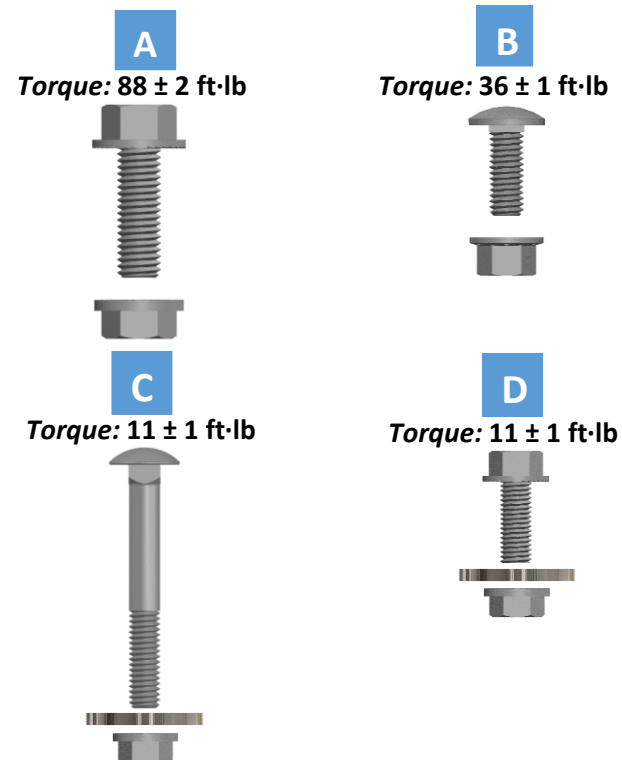
- 3/8–16 Carriage Bolt, 1" Length, Grade 5, Magni 560 Coated
- 3/8–16 Serrated Flange Nut, Grade 5, Magni 560 Coated

Connection C

- 5/16–18 Carriage Bolt, 2.5" Length, Grade 5, Magni 560 Coated (PV Height: 26-40mm)
- 5/16–18 Carriage Bolt, 3" Length, Grade 5, Magni 560 Coated (PV Height: 41-50mm)
- 5/16 Washer, Flat, 1"OD, Magni 560
- 5/16–18 Serrated Flange Nut, Grade 5, Magni 560

Connection D

- 5/16–18 Serrated Flange Bolt, 1.0" Length, Grade 5, Magni 560 Coated
- 5/16 Washer, Flat, 1"OD, Magni 560
- 5/16–18 Serrated Flange Nut, Grade 5, Magni 560 Coated



3. Storage, Handling and Maintenance

The following conditions must be met for proper onsite handling and storing of the product to ensure no damage to product or property before product is installed:

- All boxes and components delivered to site should be kept dry and under cover
- Do not stack anything on racks or pallets of components
- Stage racks on level ground
- Contractors are responsible to make sure all OSHA guidelines and/or local guidelines are followed including the state regulations.
- Any and all parts removed from packaging must be visually inspected for any damage or before its use in installation
- Installer is not to use any damaged parts on the installation site. Any and all damage must be reported immediately to project owner.

The maintenance work described below must be performed once every year from the date of installation and after storms with severe winds.

- Inspect all fasteners and component connections. Observe for any deformation, cracks or other visible defects on the PRU components and replace.
- Check bolts and all hardware for specified torque and retighten if required (ensuring solar modules are seated correctly).
- Annual inspections must be done for mechanical movement due to any reason including torque values, thermal expansion or contraction and rectified.

4. Racking Overview

1 - Post

2 - Top Bracket

3 - Bottom Bracket

4 - North-South Beam

5 - Brace

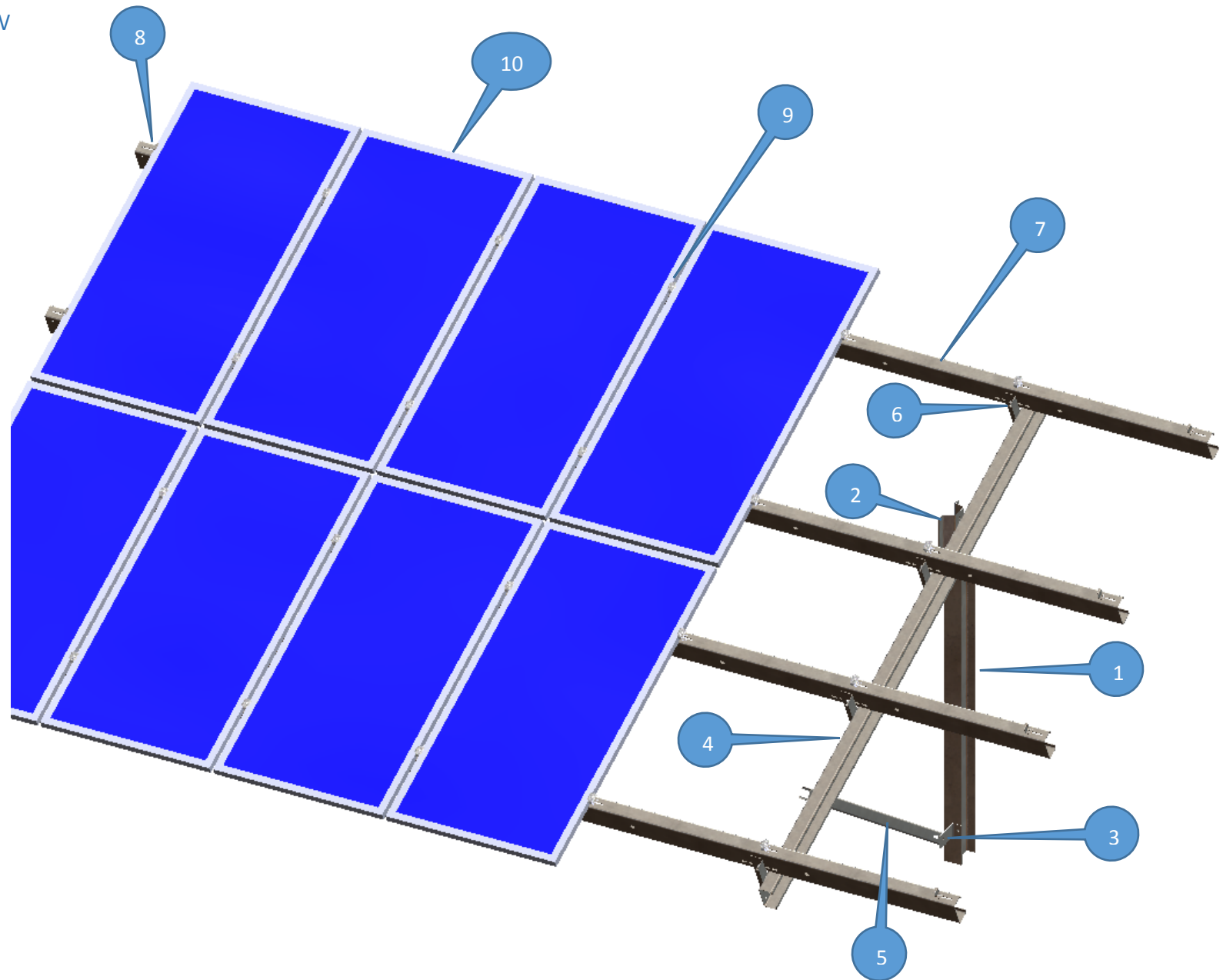
6 - East-West Bracket

7 - East-West Beam

8 - End-Clamps

9 - Mid-Clamps

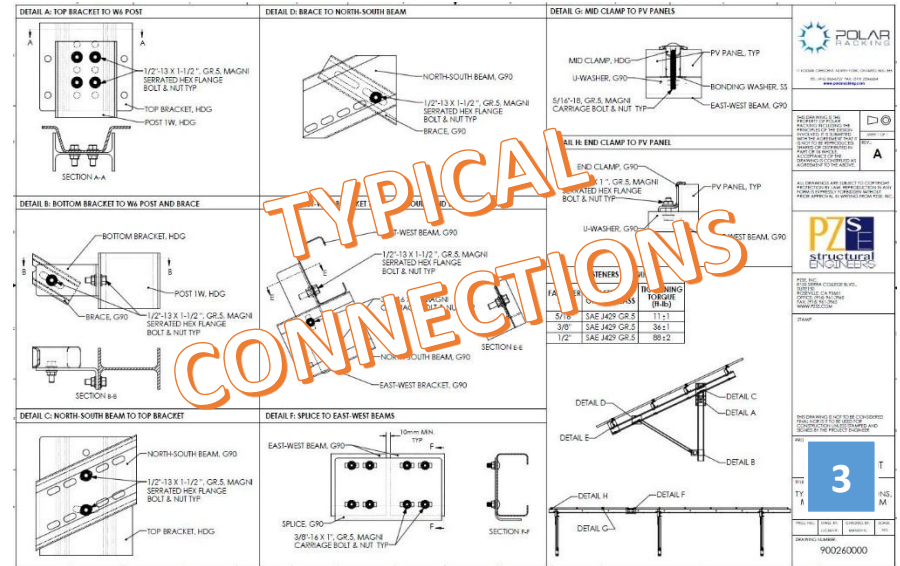
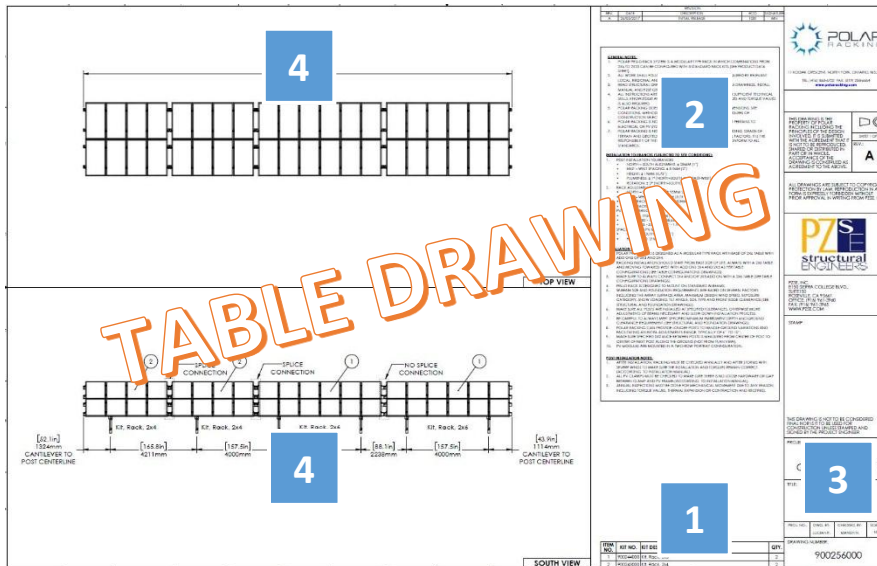
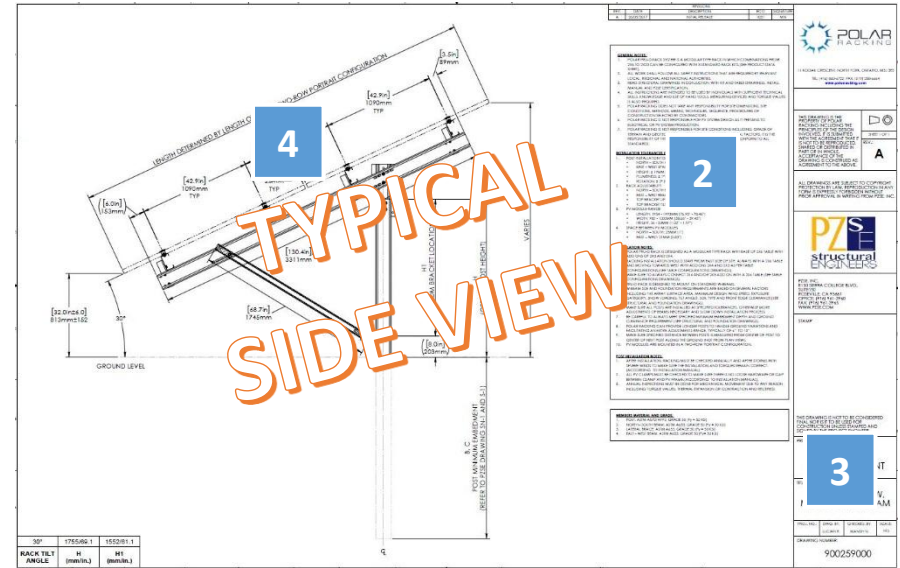
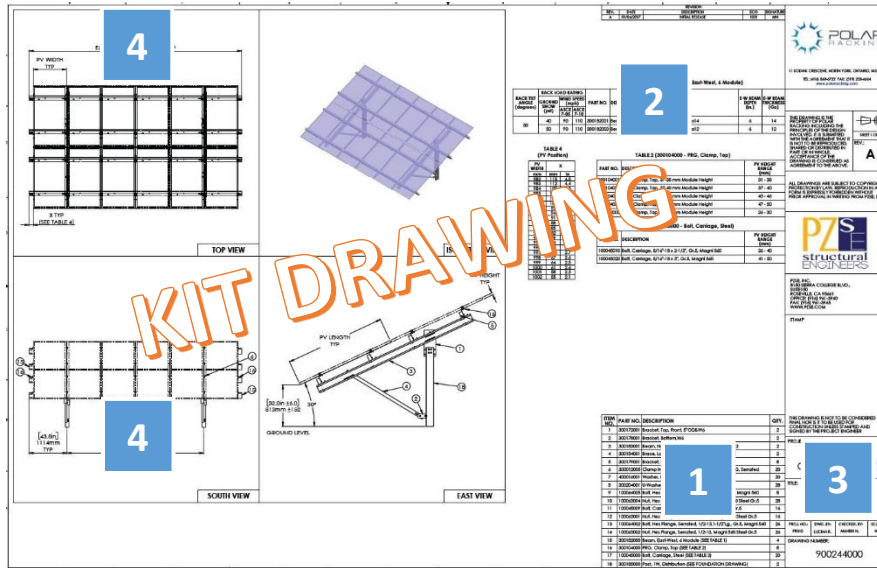
10 - Solar Panels



Drawing Map PRU-D

- 1 Bill of Materials
- 3 Project Details / Names / Titles

- 2 Project and Configuration Specific Notes
- 4 Racking Dimensions



Foundation Options

Foundation options (Refer to PZSE drawing SN-1 and S-1, Project No. 2017-02134):

- Driven Post
- Cast-In-Place concrete pier

If any other foundation type is required please contact Polar Racking for more information.



Driven Post



Cast-In-Place
Concrete Pier

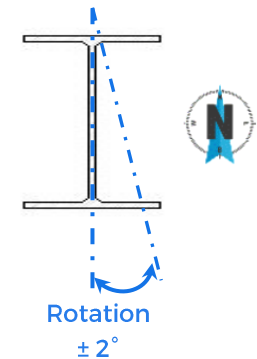
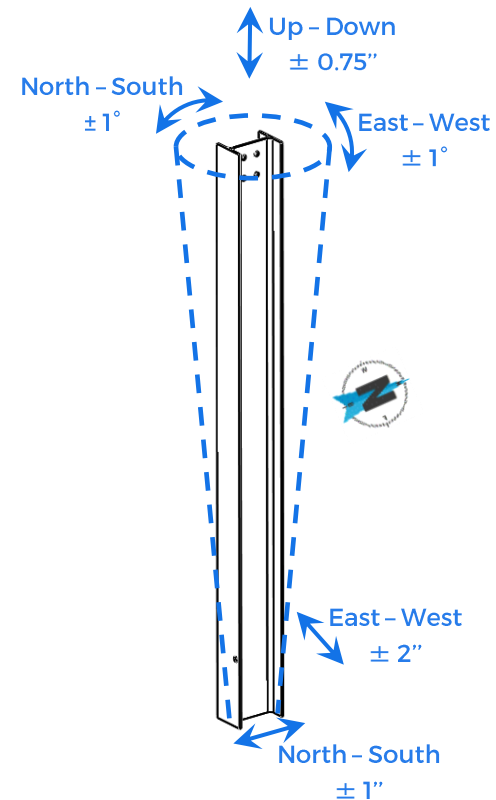
Post Installation Tolerances

Note: Make sure all posts are installed at the specified tolerances.

Contact Polar Racking if a deviation is required.

Polar Racking can provide longer posts to handle ground variations and facilitate an expanded adjustment range of 6" to 10".

- North – South Alignment: ± 1 inches (25 mm)
- East – West Spacing: ± 2 inches (51 mm)
- Height: ± 0.75 inches (19 mm)
- Plumbness: $\pm 1^\circ$
- Rotation: $\pm 2^\circ$



Racking Tolerances and Adjustability

- Top Bracket Up – Down: ± 1.25 inches (32 mm) (Fig. 4-1)
- Top Bracket Tilt Angle: $15^\circ - 35^\circ$ (Fig. 4-2)
- North – South Beam: ± 3.75 inches (95 mm) (Fig. 4-3)
- East – West Beam: ± 3.75 inches (95 mm) (Fig. 4-4)
- East – West Bracket: ± 0.75 inches (19 mm) (Fig. 4-5)
- PV Module Range (Fig. 4-6):
 - Length: 76.93 – 78.74 inches (1954 – 2000 mm)
 - Width: 38.66 – 39.45 inches (982 – 1002 mm) 2x3, 2x4, 2x6 Kits
38.66 – 39.13 inches (982 – 994 mm) 2x8 Kit
 - Height: 1.02 – 1.97 inches (26 – 50 mm)

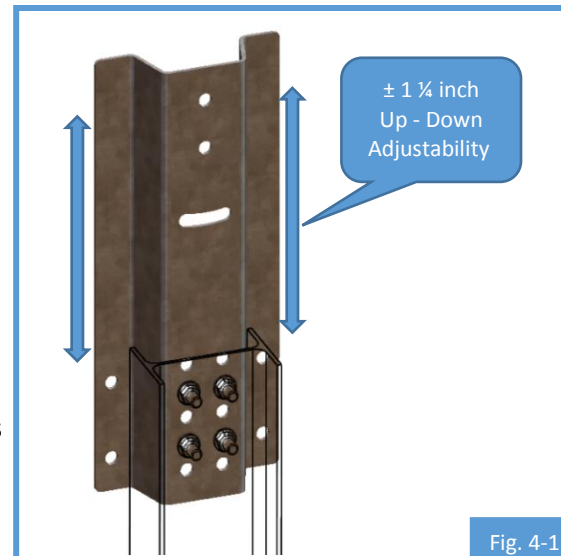


Fig. 4-1

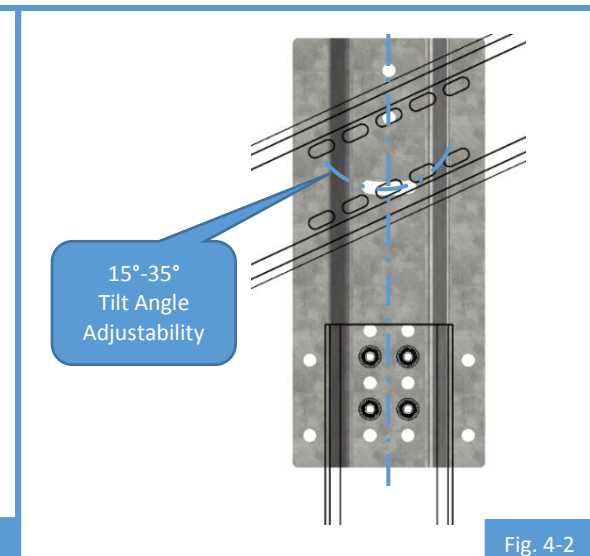


Fig. 4-2

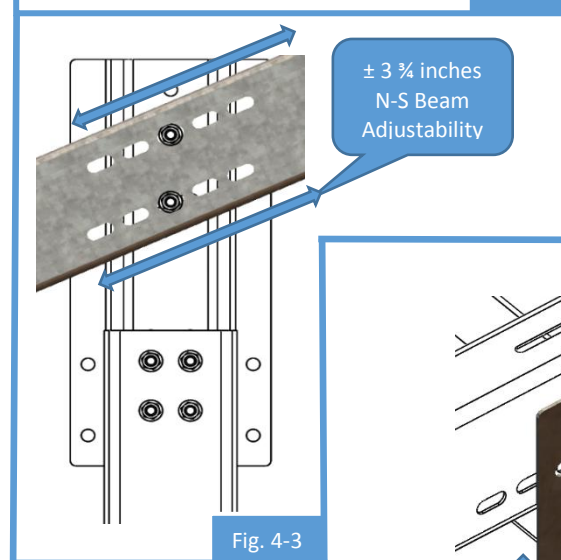


Fig. 4-3

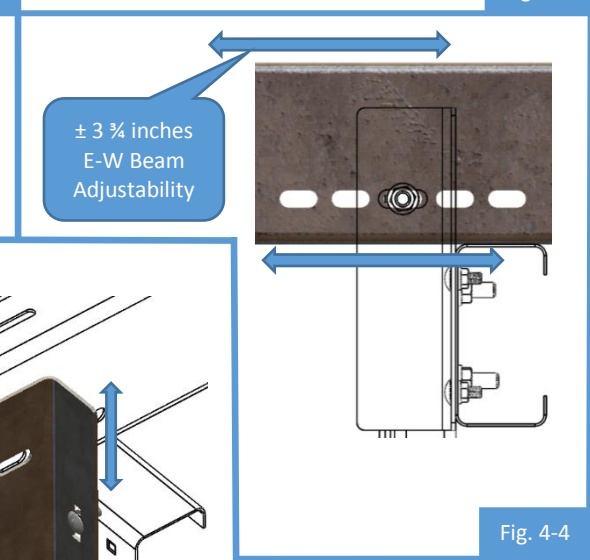


Fig. 4-4

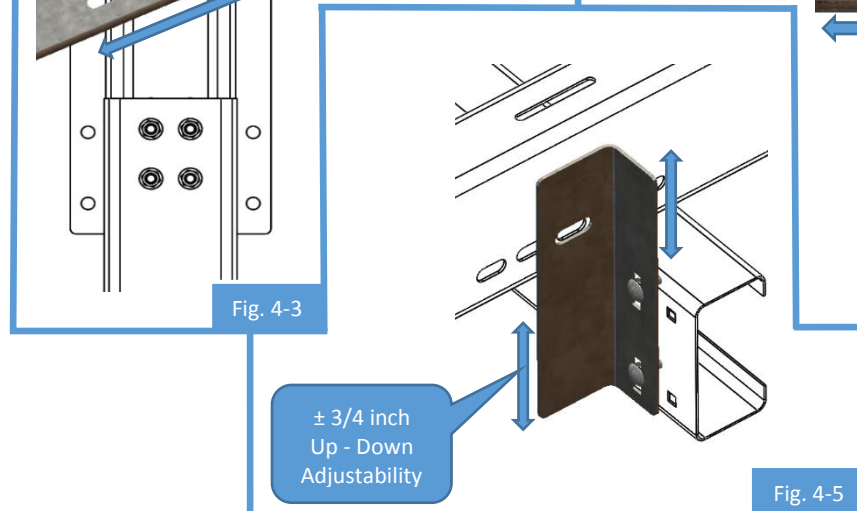


Fig. 4-5

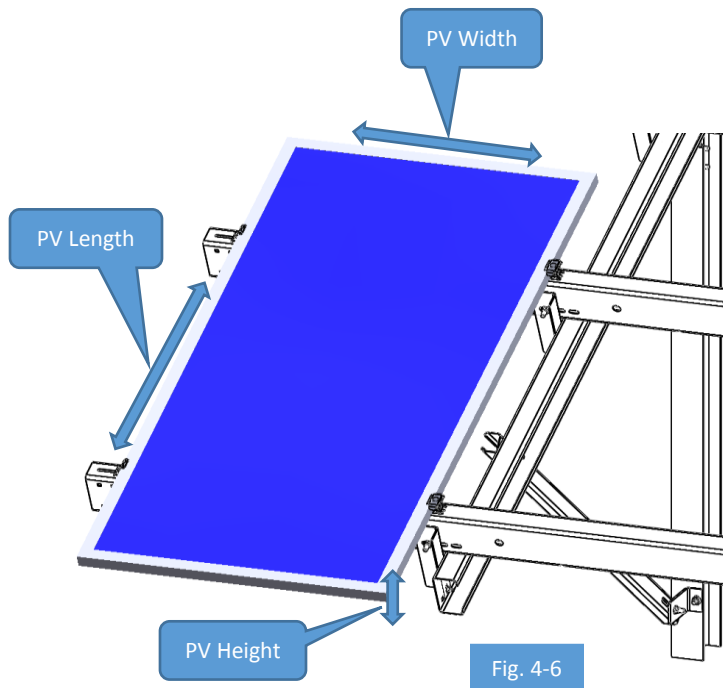


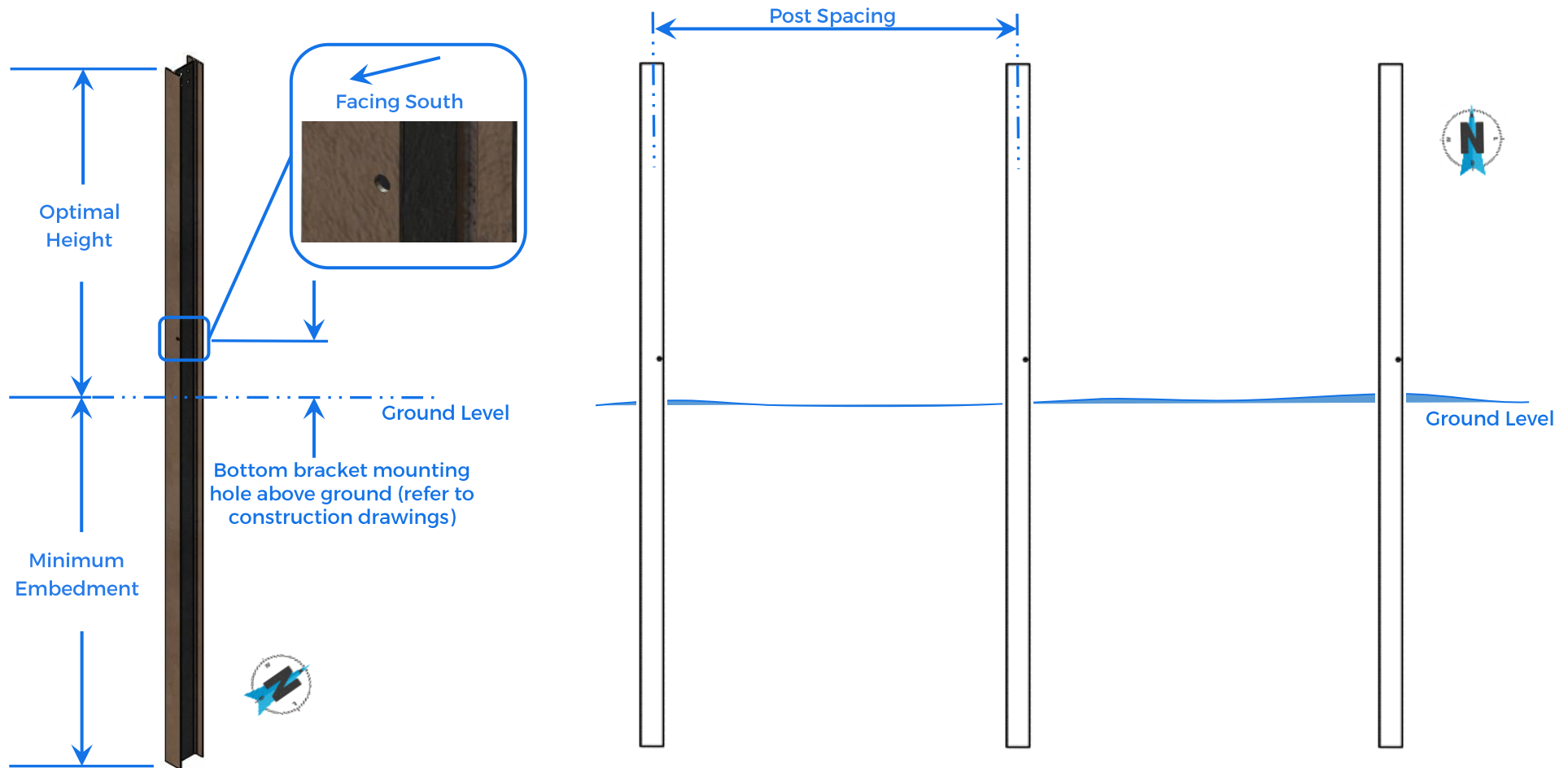
Fig. 4-6

5. Installation Instructions

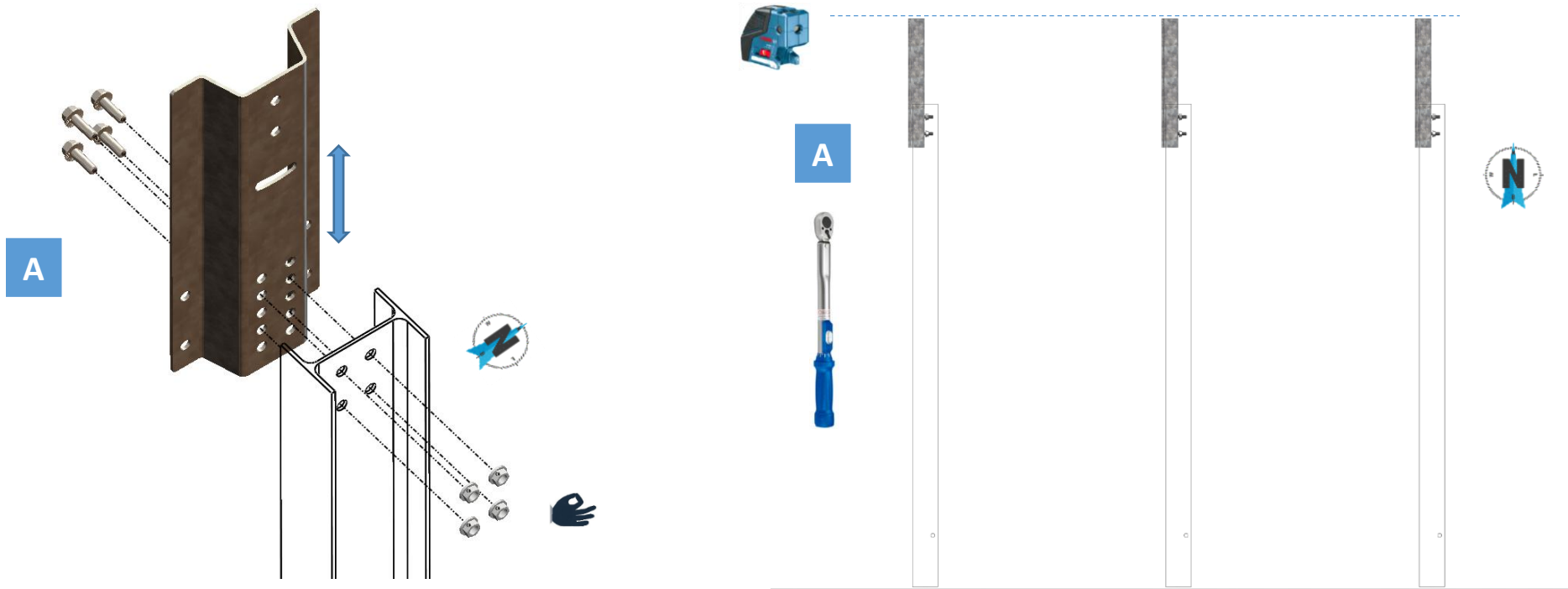
a. A-Frame Construction

Note: Refer to Polar Racking drawings and PZSE drawings for Post size, optimal height, minimum embedment and spacing. Make sure Post Spacing is measured from center of post to center of next post along the ground. In some cases, a cast-in-place concrete pier maybe required. (Refer to PZSE drawing SN-1 and S-1).

Step One Install first Post to the optimal height with mounting hole for Bottom Bracket facing south. Make sure next Posts are installed to specified tolerances.



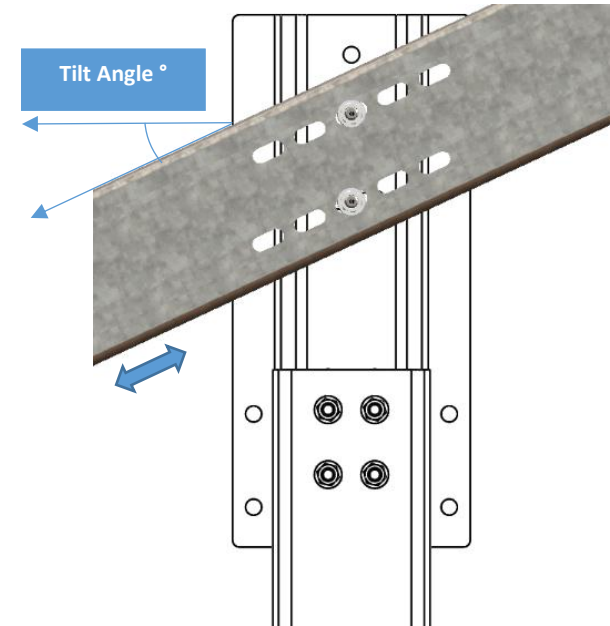
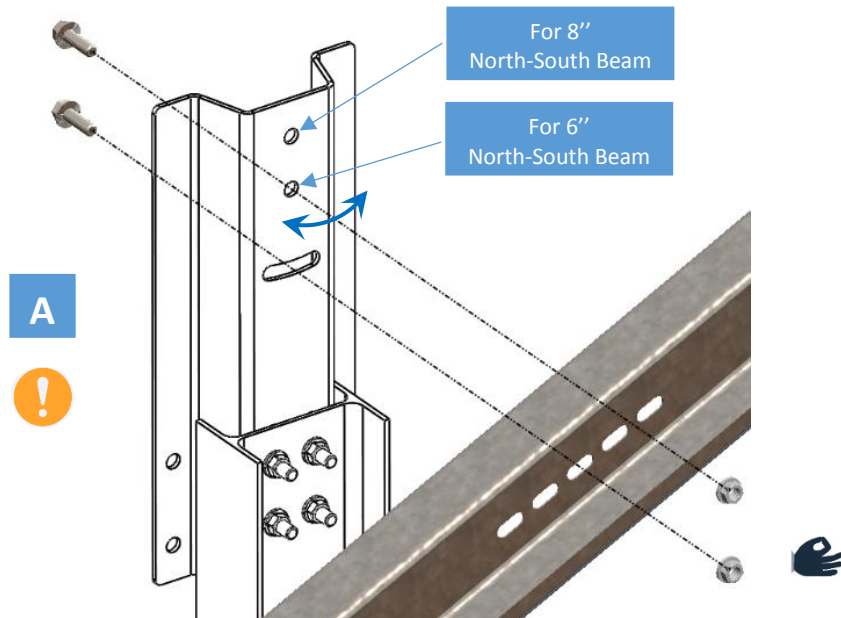
Step Two Install Top Brackets on W Posts with opening facing west. Ensure all Top Brackets on each table are aligned to one another. Torque fasteners as per specification shown in Section (2.)



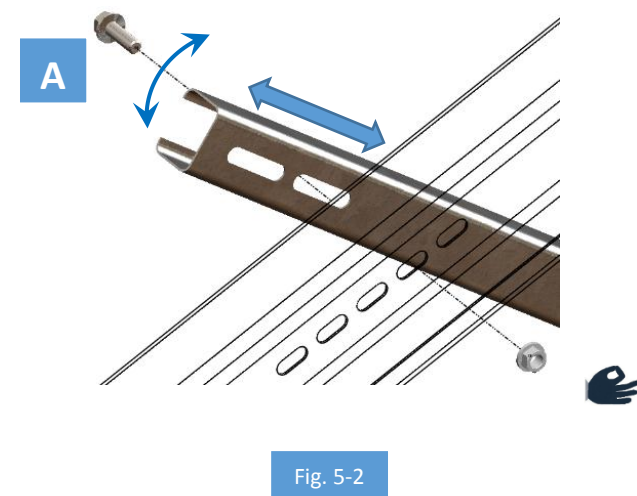
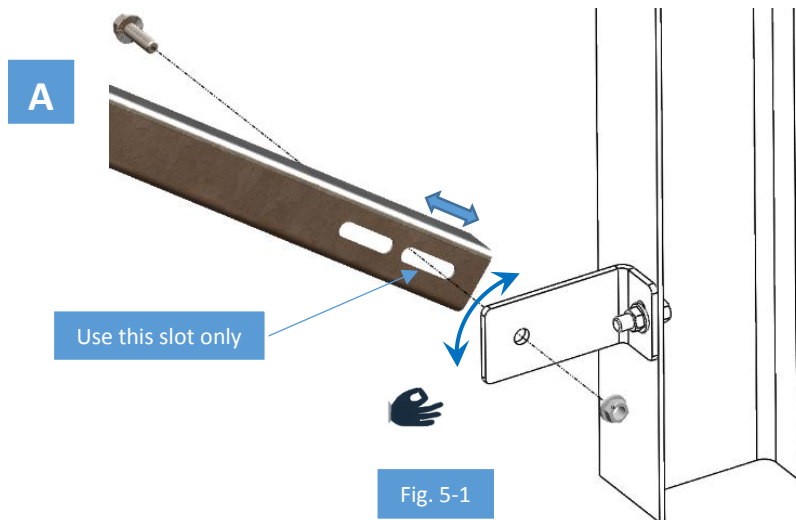
Step Three Install Bottom Brackets on W Posts as shown. Torque fasteners as per specification shown in Section (2.)



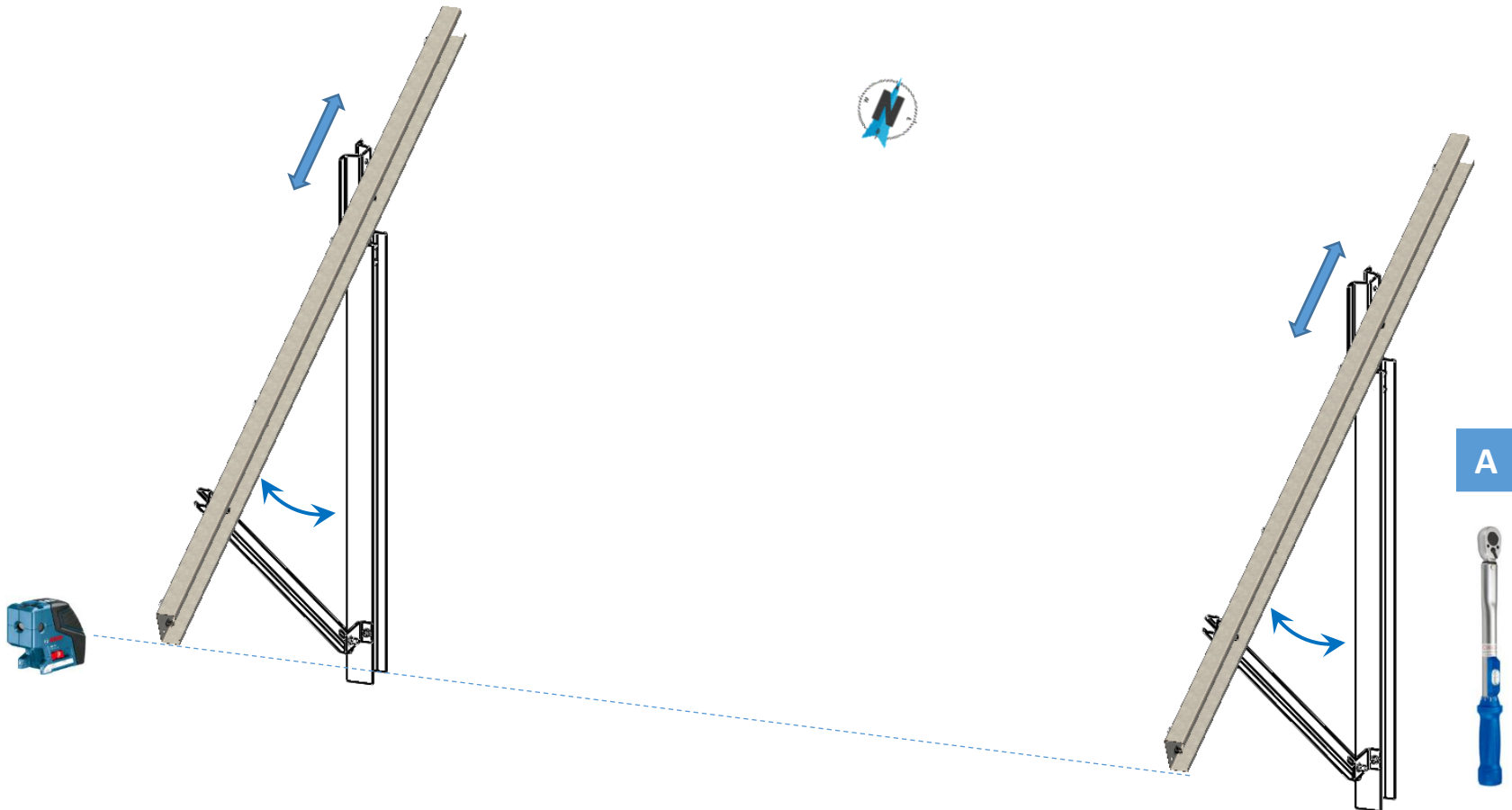
Step Four Install North-South Beam on Top Brackets at desired tilt angle.



Step Five Install Brace to Bottom Bracket using end slot (Fig. 5-1). Continue installing Brace to North-South Beam (Fig. 5-2).

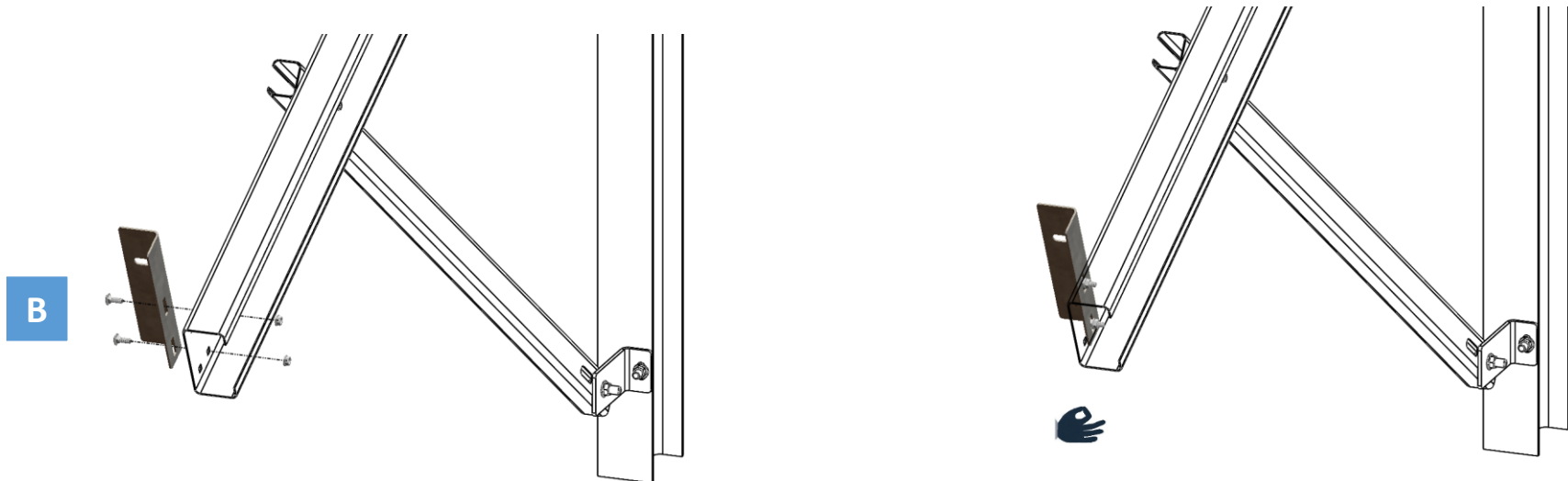


Step Six Align the leading edge of the North-South Beams and also to the required tilt angle. Torque fasteners as per specification shown in section (2.)

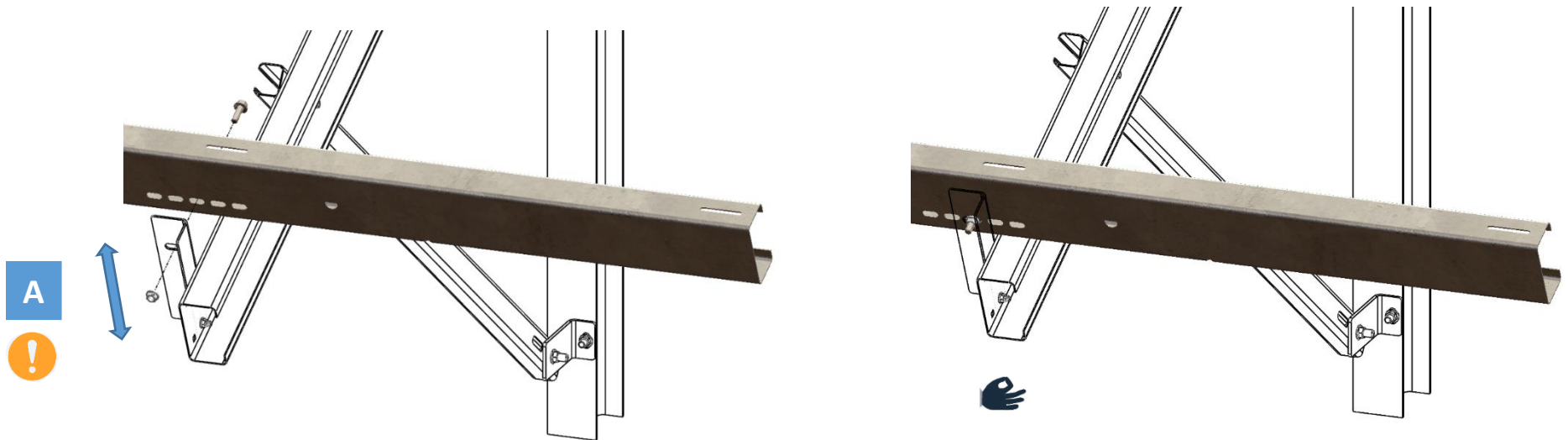


b. Typical Table Construction

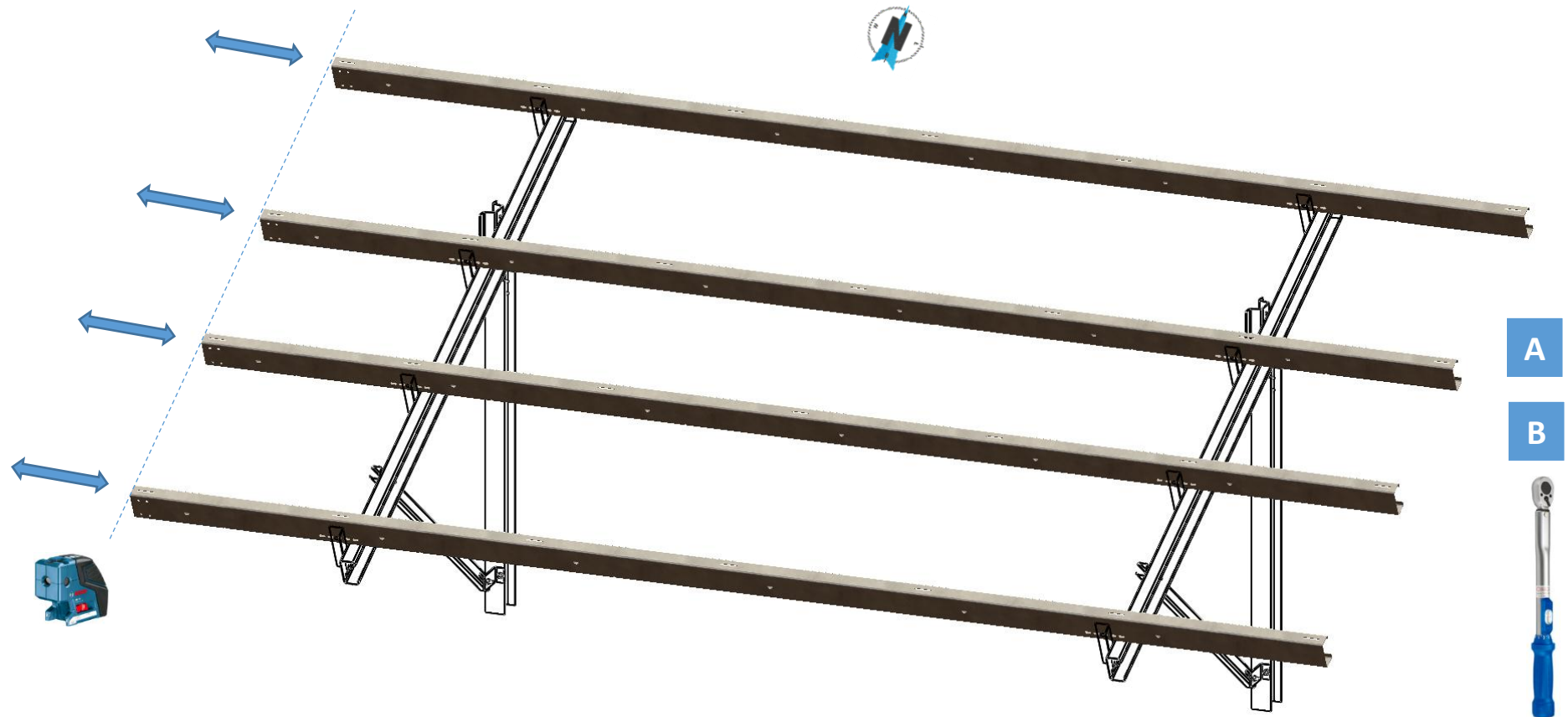
Step One Install East-West Bracket to North-South Beam by hand tightening fasteners.



Step Two Install East-West Beam to East-West Bracket by hand tightening fasteners. Ensure East-West Beam is seating on North-South Beam. Adjust East-West Bracket height as necessary.

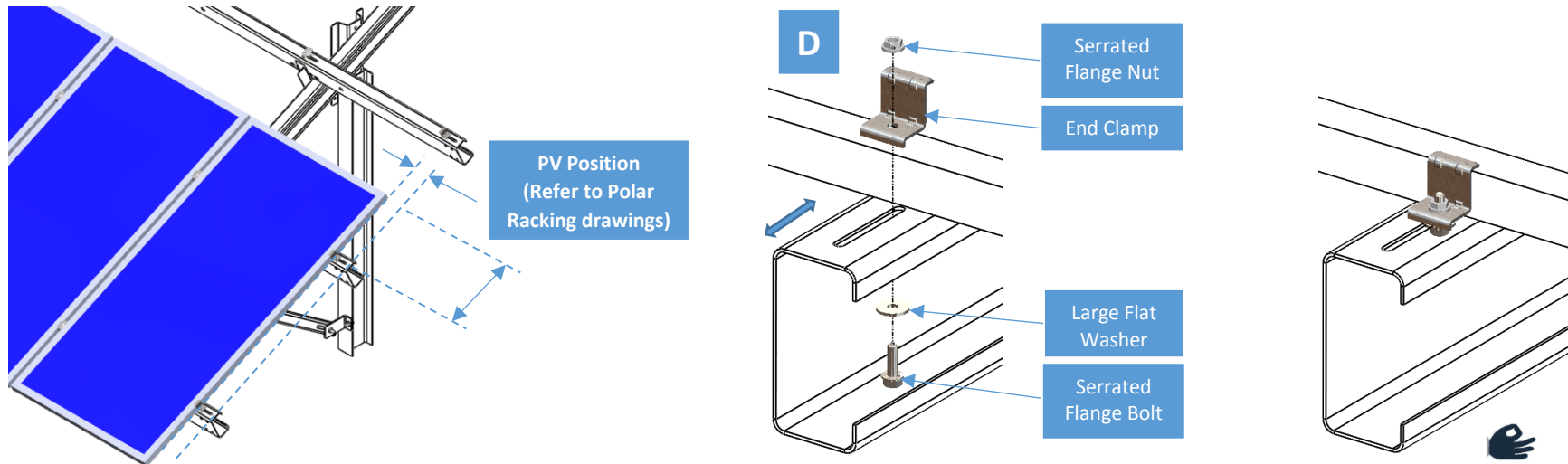


Step Three Align cantilever ends in north-south direction through rack adjustment. Torque fasteners as per specification shown in Section (2.)

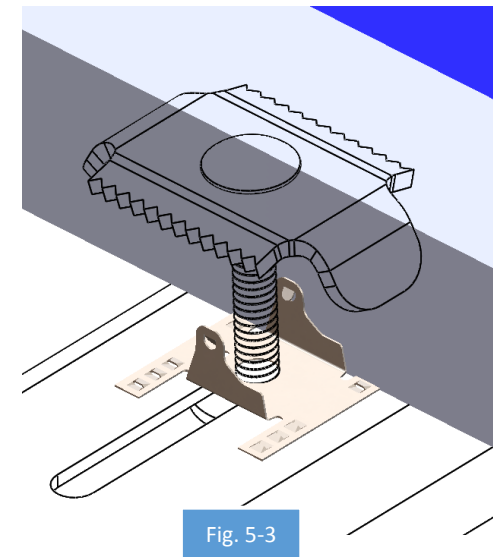
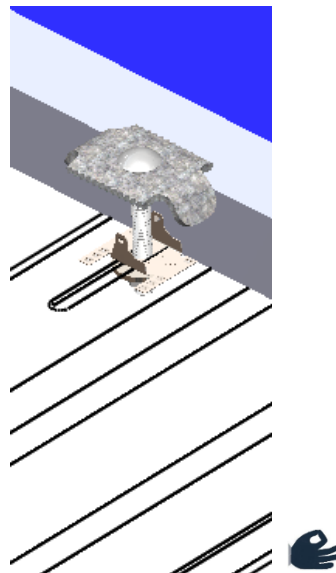
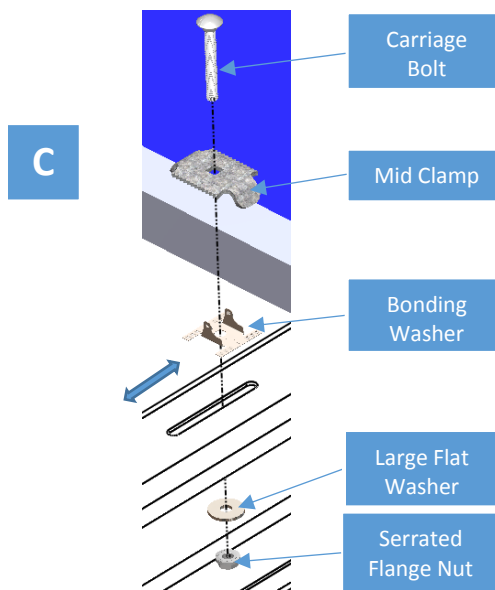


c. PV Installation

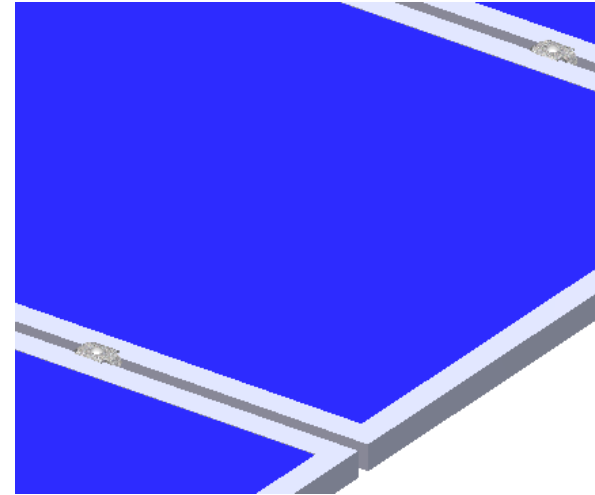
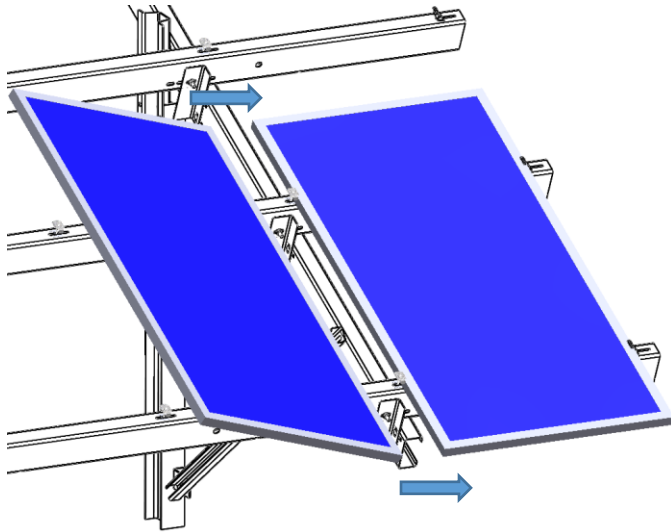
Step One Start with the South row and east-most panel. Position the panel on purlins per construction drawing. Affix with two end-clamps as shown. Make sure the vertical wall of end-clamp and solar module frame has no gap.



Step Two Continue with two hand tightened mid-clamps and ensure that the bonding washer is under the module frame and oriented with tabs flush with module frame (Fig 5-3).

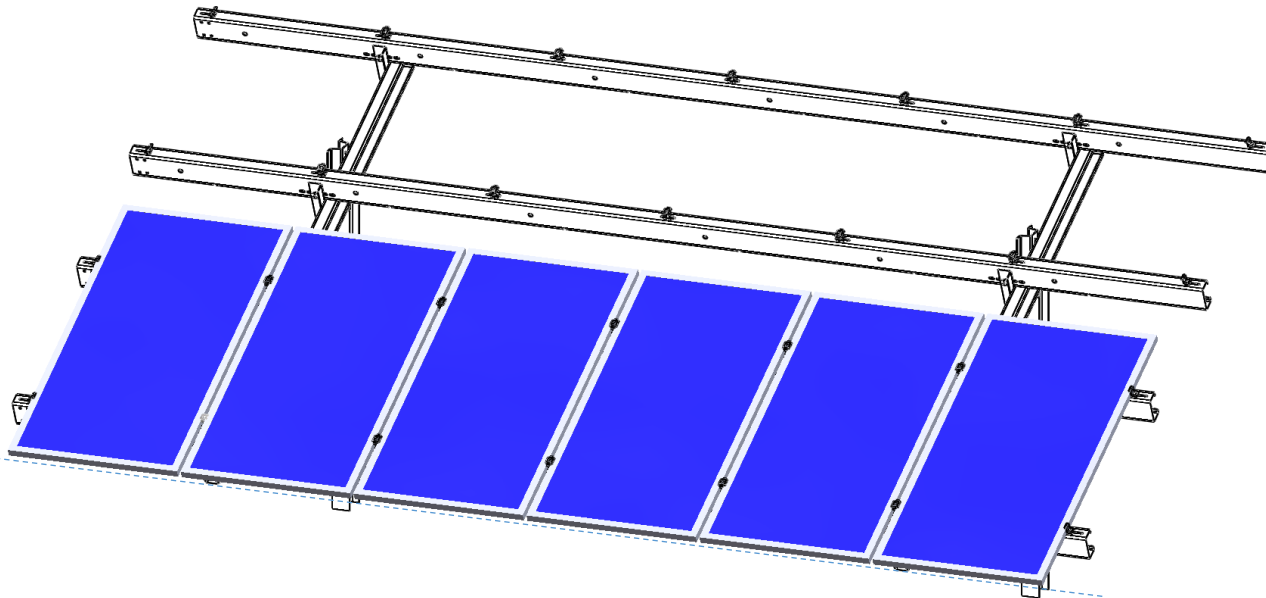


Step Three Continue with the adjacent panel.



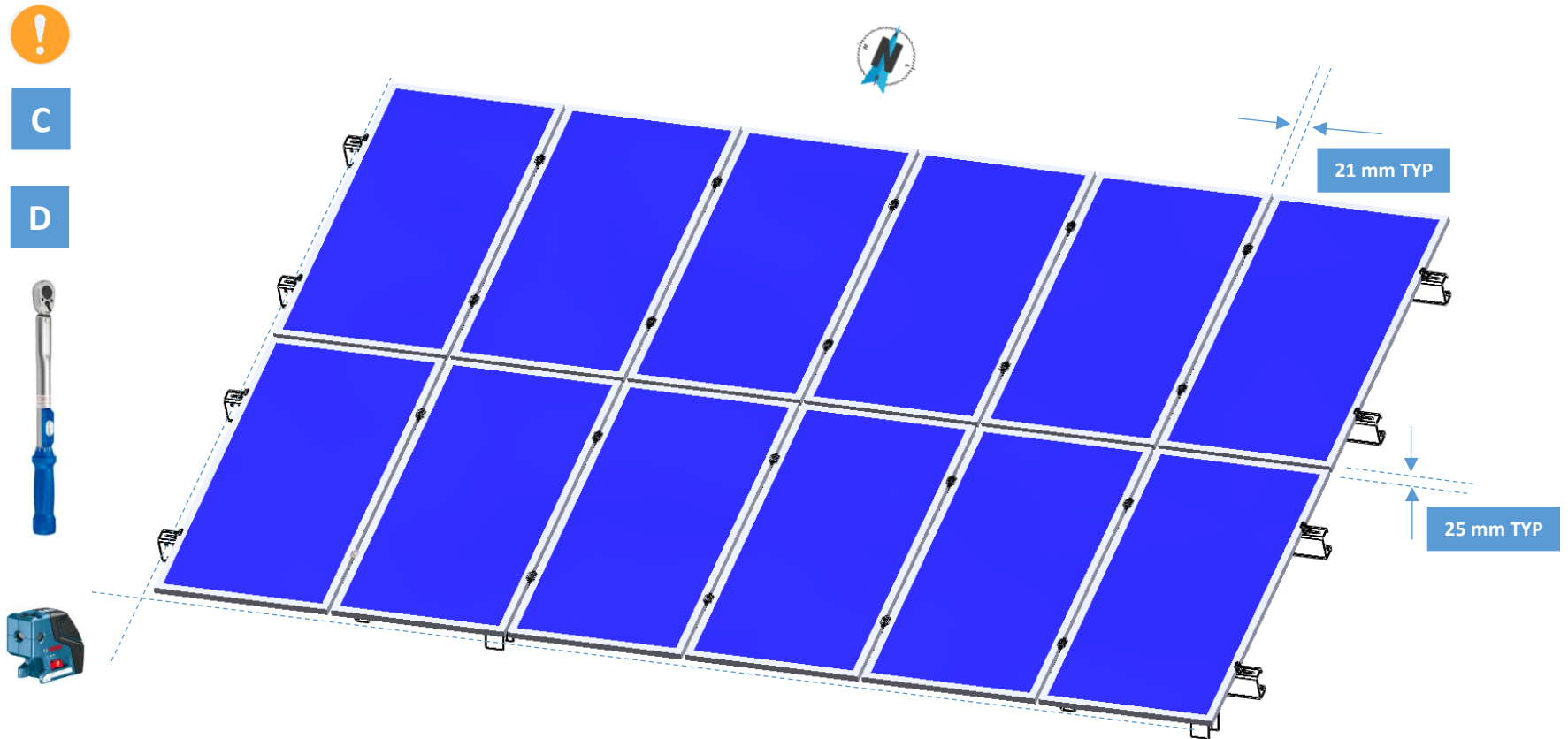
Step Four After completing the South row, continue on to the North row by aligning the first lowest row of panels straight in east-west direction with the reference panel. Refer to construction drawings for the appropriate size of gap to be left between two rows.

C



Step Five

After a full table of panels are populated and the table is square, torque fasteners as per specification shown in Section (2.)



d. Modular Table Construction

Note: The Polar PRU-D rack system is a modular racking system in which combinations from 2x6 to 2x20 can be configured with 4 standard rack kits: 2X3, 2X4, 2X6 and 2X8.



Kit 2x3



Kit 2x4



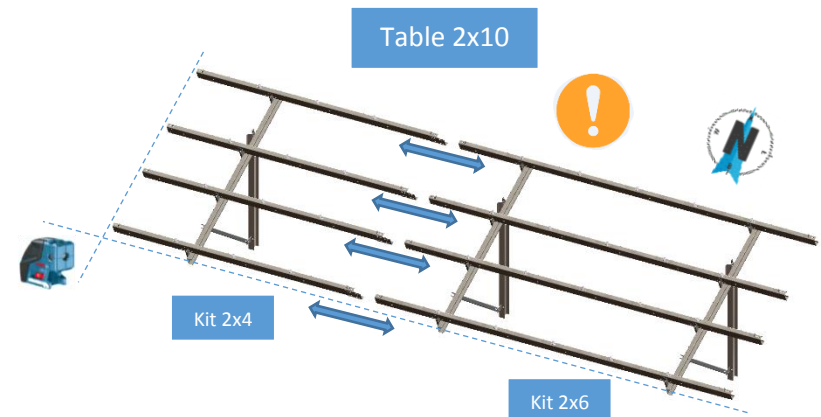
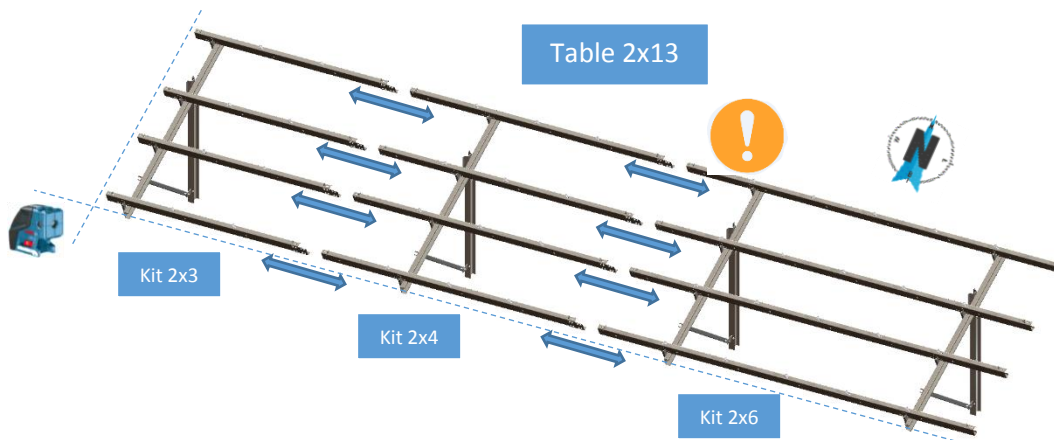
Kit 2x6



Kit 2x8

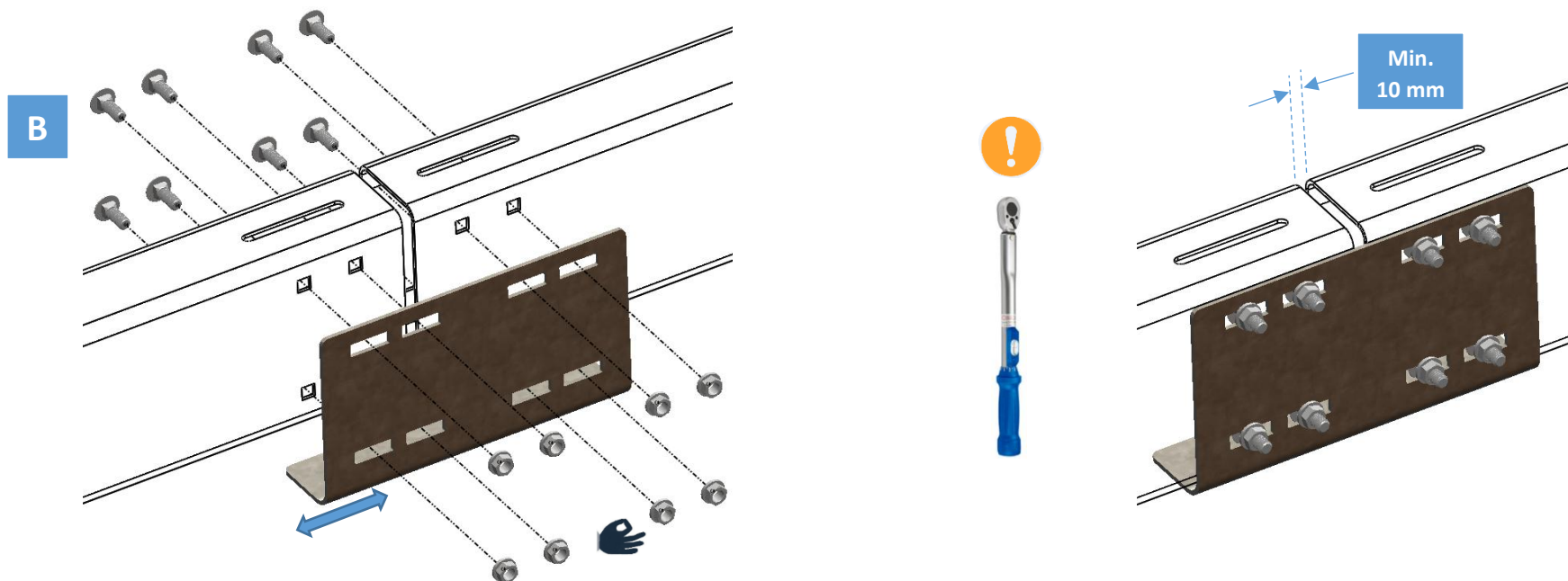
Step One

Table installation should start from the east side of the site, and always with a 2x6 or 2x8 table. Additional tables are added westwards with add on modules of 2x4 and 2x3 kits. Table installation should follow A-frame and Typical Table construction procedures. Make sure to connect 2x4 and/or 2x3 kit with a 2x6 or 2x8 table.



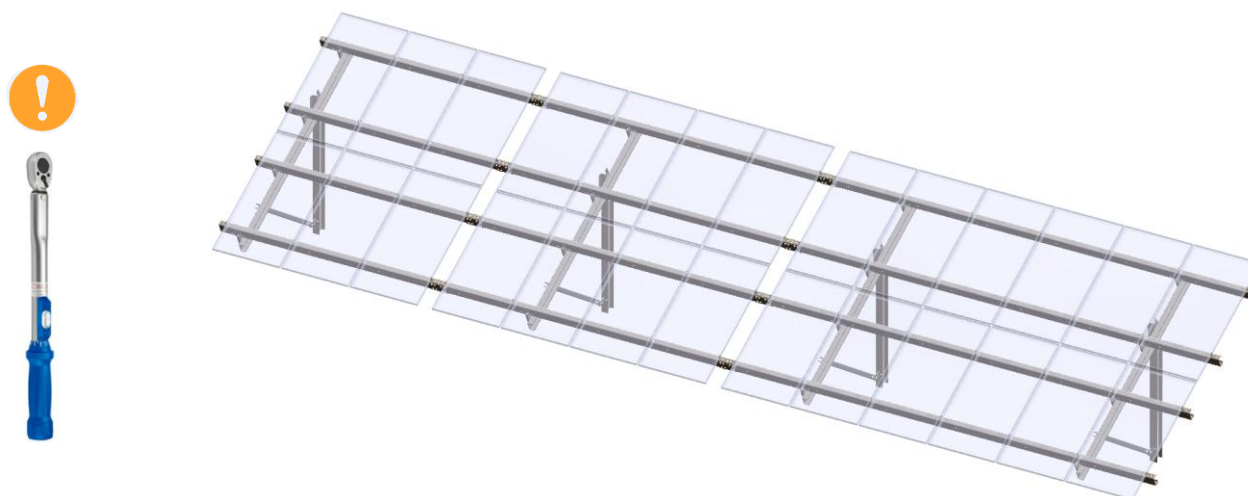
Step Two

Mate kit's east-west beams with splice plates, leaving minimum 10 mm gaps. After all beams and splices are populated and adjusted. Torque fasteners as per specification shown in Section (2.). Some tables does not require splice plate connections (Refer to construction drawings).



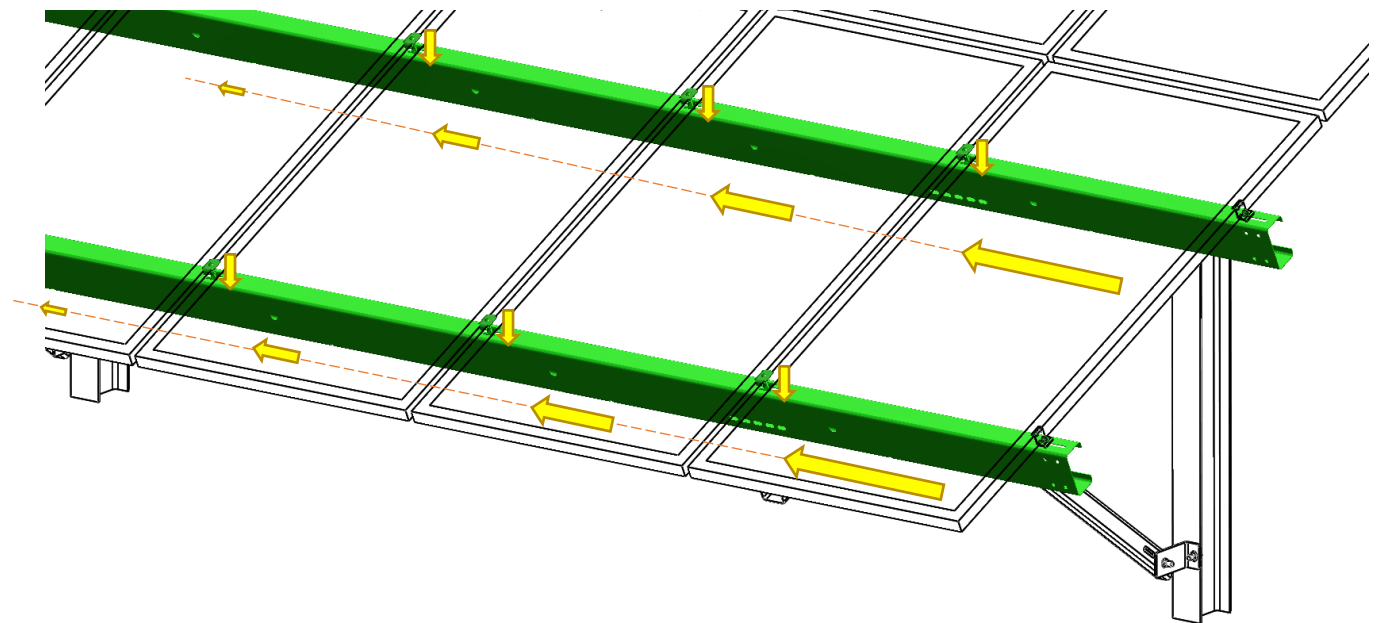
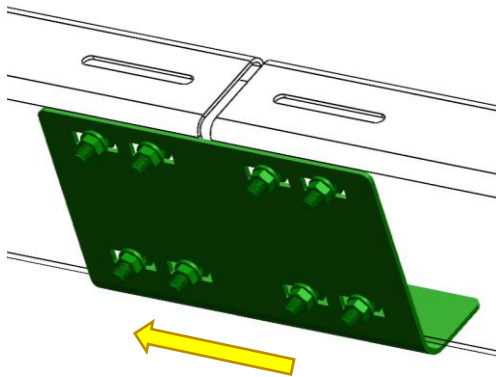
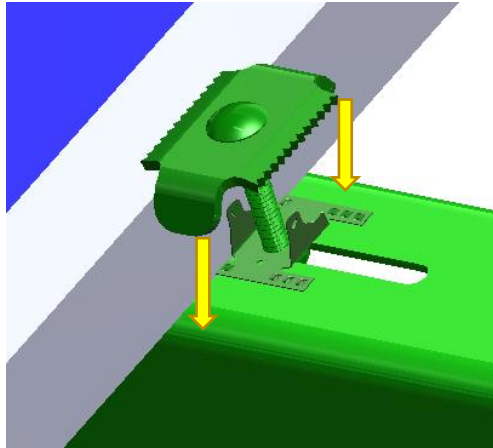
Step Three

Install PV panels by following PV installation procedures in Section (5c.)

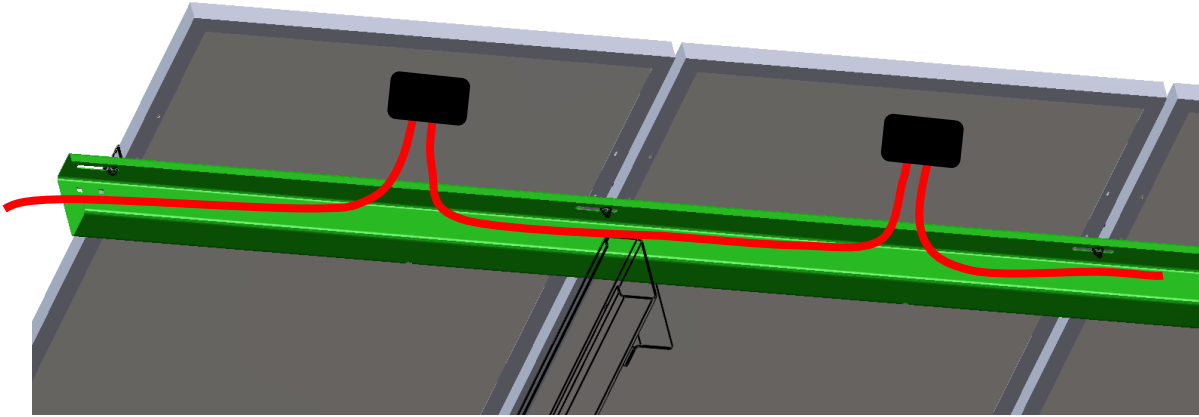


e. Bonding and Grounding

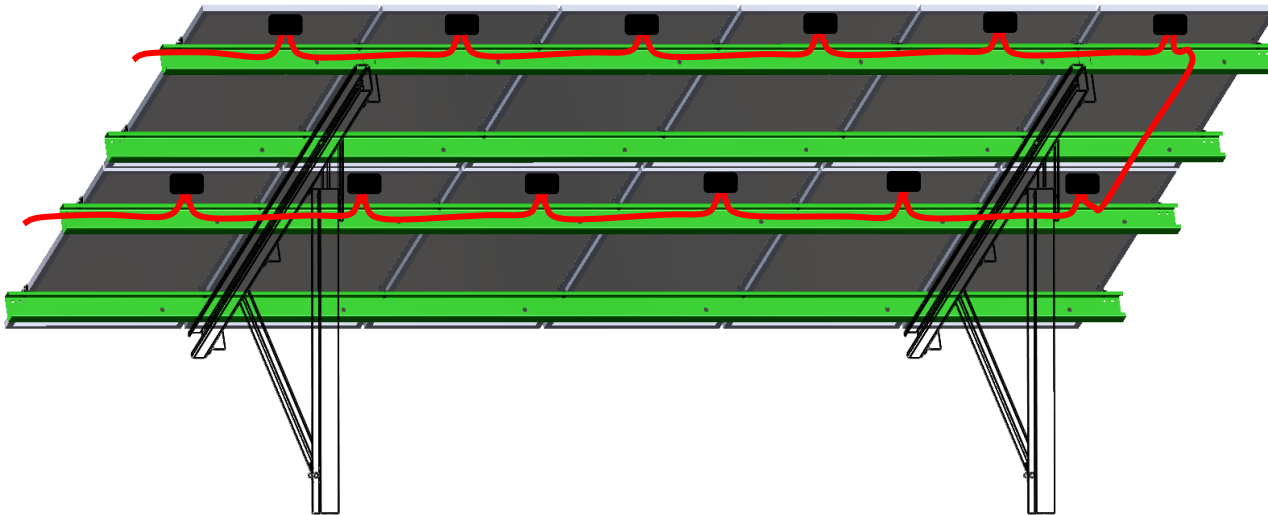
1. Two Mid-Clamps with polar bonding washers per PV Module are installed.
2. Polar bonding washers bond PV modules to galvanized E-W Purlins by scratching through the anodization on the panel frames.
3. Full row of modules are bonded together via purlins and splice plates.
4. Per separate row of modules within a table or a row of tables should be grounded.
5. If necessary tables can be grounded together using typical grounding lugs and ground wire as specified by a local Authority having Jurisdiction
6. It is the installer responsibility to check local codes and with the Authority having Jurisdiction, and to verify electrical requirements.



f. Wire Management



Route PV Module cables through the closest purlin to string with the next module box cable. Follow the stringing plan from the electrical engineering drawing. Holes are present every 1m for tie clips or cable routing. Drainage holes also ensure no water build-up.



Route all cables through the closest purlin for the full table of panels and follow the instruction from the owner's electrical engineering specifications to reach the combiner boxes.

6. Warranty and Product Maintenance

IMPORTANT WARNING	
It is critical that the Polar Racking be properly and securely attached together and installed on a roof. Improper installation could result in injury or damage to people and property including, but not limited to, the installer(s), building, roof, solar modules and other people and equipment. You are responsible for installing and securing the Polar Racking system properly and checking the attachments prior to module installation.	Read and understand all of the instructions and cautions supplied with your Polar Racking Product prior to installation or use. If you do not understand all of the instructions and cautions, or if you do not have sufficient mechanical and electrical experience and are not thoroughly familiar with the installation procedures, you should have the Product installed by a professional installer.

Polar Racking Inc. ("Polar") , warrants to the original purchaser ("Purchaser") of its racking Product(s) ("Product") that the Product shall be free from defects in material and workmanship for a period of ten (10) years from the date of original purchase ("Racking Warranty"), save and except for the finish of said Product.

• What Does The Warranty Cover?

The Racking Warranty covers any defects in material and workmanship, but does not include on-site labour.

• How Long Does The Coverage Last?

The Racking Warranty lasts for a period of ten (10) years from the date of original purchase. The warranty, during its term, is transferable from the Purchaser to a new owner of the Product upon written notice of said change of ownership being given from original purchase to Polar within 60 days of said change of ownership.

• What Will Polar Do?

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Polar shall at its option, and subject to the limitations described herein, Polar will: (i) repair or replace any defective Product at no charge; (ii) refund the full purchase price of the Product; or (iii) issue credit in the amount of the purchase price to be used toward the purchase of new Product or accessories from Polar. Such repair or replacement shall completely satisfy and discharge all of Polar's liability with respect to this limited Warranty.

• What Does This Warranty Not Cover?

The following are not covered by these warranties: on-site labour in any form and any problem or damage that is caused by abuse; negligence; failure to follow professional engineer stamped drawings for the specific installation; normal wear and tear; defective roofing; modifications or repairs not

performed or authorized by Polar; overloading; misuse, including but not limited to failure to assemble, mount, or use the Product in accordance with its written instructions or guidelines included with the Product or made available to the Purchaser; or an act of God (such as wind storms or similar events). Polar is not liable for or warranty material used on or fixed to the bottom of Product, which in all installations are chosen by the original purchaser/ installer/ user of the Product. All installations in corrosive atmospheric conditions are excluded and void said Racking Warranty. This Racking Warranty shall be Void if installation of the Product is not performed in accordance with any Professional Engineer stamped drawings created for the specific installation, or Polar's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized in writing by Polar, or if the Product is installed in an environment of fashion for which it was not designed.

The Racking Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

No warranty is given for Products purchased or used outside the United States, Canada, or Mexico. To the furthest extent permitted by law, (i) this warranty does not cover damage to property other than the Product itself; and (ii) the remedies provided for herein shall be exclusive.

POLAR LIMITS THE DURATION OF ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE TO THE SHORTEST PERIOD PERMITTED BY LAW, WHICH IN ANY EVENT SHALL NOT EXCEED THE DURATION OF THIS WARRANTY. Some provinces/states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. ALSO, CONSEQUENTIAL AND INCIDENTAL DAMAGES ARE NOT RECOVERABLE UNDER THIS WARRANTY. Under no circumstances shall Polar be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product. Manufacturers of related items. Some provinces/ states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Polar will not be held responsible for any modification or alterations made to any approved design layout and/ or specification provided by Polar. Any and all proposed changes must first be reviewed, and approved in writing by Polar's Engineering team. No warranty is provided or implied by Polar with regards to longevity or leak-resistance of the roof, validity of any roof warranty, ballasting or anchoring of the Product, suitability of the roof to support the installation of such Product, or otherwise. By acceptance of this document, the Purchaser acknowledges that they understand and agree to/ with the above statement and any and all limitations detailed in this warranty.

• How Do You Get Service?

In order to be eligible for service under this warranty you must immediately notify Polar, in writing, upon learning of any defect of its Products by either calling the phone number listed above or writing to the address listed above and explaining the nature of defect. If appropriate, arrangement for service under this warranty will be made. You may be required to provide proof of purchase prior to obtaining service under this warranty. In addition, Polar may require you to return the Product to Polar, in its sole discretion, as to whether the Product is defective.