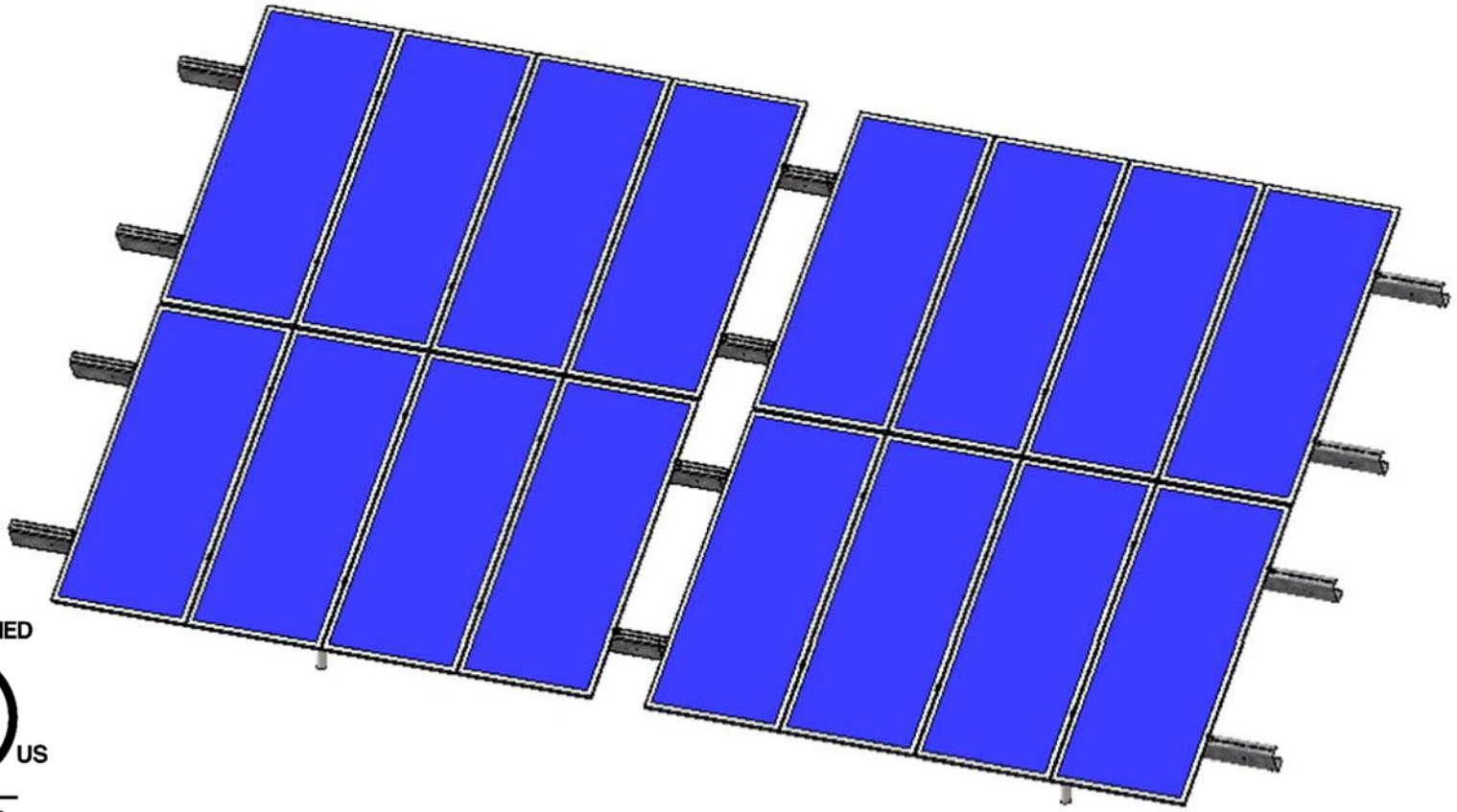
2x8 DUAL-LEG/SINGLE POST PORTRAIT SYSTEM



ETL CLASSIFIED

UL2703 Classified for Bonding and Grounding

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REVISION 43

1. Safety

a- 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.

b- Warnings and Symbols

Throughout this manual you will notice several warning notes which consist of:

- Warning Symbols
- Indicator Word to show the danger Level
- Information regarding the source and type of the danger
- Measures to avoid the hazard prevent injuries or property damages

	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 is required

c- Responsibilities of the Installer

Every person installing this system must read and fully understand every section of this manual prior to working on the system. This installation manual should be read in conjunction with the provided Issued for Construction (IFC) drawings for your specific project. Proper Personal Protective Equipment (PPE) must be worn at all times, while performing installation or maintenance.

It is the responsibility of the installer to ensure all applicable safety measures are adhered to while installing this PV Racking system. Any modifications to the system or parts are to be performed only by authorized personnel and must be approved by Polar Racking Inc. (Polar Racking) prior to implementation. The installer must have adequate experience with all materials and tools used to install this system. Furthermore, the installer must be able to recognize any possible danger, whether it is stated in this manual or not. It is recommended that a site-specific hazard assessment is completed in advance of any construction work. Installer must inform Polar Racking with any installation issues immediately. Any consequences due to incorrect installation is the responsibility of the installer.

Due to the inherent properties of mating steel components, please ensure the limiting speed of cordless drivers (RPM) is set to the lowest torque setting (vs. drill setting), for all 5/16" fasteners to prevent over torquing. 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.

d- 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. A replacement manual may be obtained by contacting Polar Racking using the contact information provided at the back of this manual.

2. Tools and Hardware

a- Tools

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)

Power Drill

OR

Laser Level or String line

Torque Wrench

Tape Measure

Compass

Level

Square

Figure 1: Tools required for installation.

b- Hardware

Connection A

- 1/2"–13 Serrated Flange Bolt, 1” & 1-1/2” **(Based on connection)** Length, Grade 5, Magni 565 Coated or HDG
- 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated or HDG

Connection B

- 3/8”–16 Carriage Bolt, 1” Length, Grade 5, Magni 565 Coated or HDG
- 3/8”–16 Serrated Flange Nut, Grade 5, Magni 565 Coated or HDG

Connection C

- 5/16"-18 x 2-1/2", Bolt, Carriage, 18-8 SS, ASTM F593C (PV Height: 26-40mm)
- 5/16"-18 x 3", Bolt, Carriage, 18-8 SS, ASTM F593C (PV Height: 41-50mm)
- 5/16–18 Serrated Flange Nut (or Hex Nut), 18-8 SS, ASTM F594C
- 5/16” Washer, Flat, 1''OD, 18-8 SS
- 5/16” Washer, Lock, 0.680'' OD, 18-8 SS

OR:

- 3/8” Washer, Flat, 1''OD, 18-8 SS, USS
- 3/8” Washer, Lock, 0.680'' OD, 18-8 SS

Connection D

- 5/16”–18 Serrated Flange Bolt (or Hex Head Bolt), 1.0” Length, 18-8 SS, ASTM F593C
- 5/16"-18 Serrated Flange Nut (or Hex Nut), 18-8 SS, ASTM F594C
- 5/16” Washer, Flat, 1''OD, 18-8 SS
- 5/16” Washer, Lock, 0.680'' OD, 18-8 SS

OR:

- 3/8” Washer, Flat, 1''OD, 18-8 SS, USS
- 3/8” Washer, Lock, 0.680'' OD, 18-8 SS

Connection E

- 1/2" -13 Cap Screw Hex Head Bolt, 2” Length, Grade 8, Magni 565 Coated or HDG
- 1/2” -13 Hex Head Nut, A194 Grade – 2H, Magni 565 Coated or HDG
- 1/2” Washer, Flat, 1.375'' OD, HDG Coated or Magni 565
- 1/2” Washer, Lock, HDG Coated or Magni 565

Connection F

- U-Bolt, 1/2"-13 x 5-5/8" x 7-13/16", 3" Thread Length, Gr. 5, Magni 565
- 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated or HDG
- 1/2” Washer, Flat, 1.375'' OD, HDG Coated or Magni 565

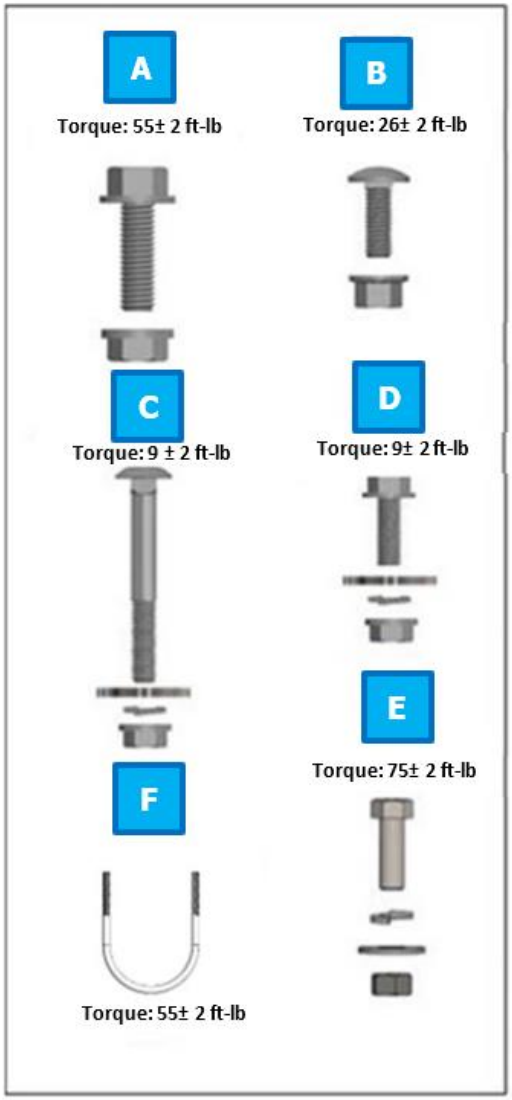


Figure 2: Hardware required for installation.

Important: All fasteners should be torqued marked, using a sharpie, once torqued to specifications, to indicate that the step is completed. Torque mark should propagate from component to washer to fastener (Nut/bolt).

3. Storage and Handling

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 and protected from environmental elements such as mud, snow, ice, dirt and accumulation of water during storage.
- Do not stack anything on racks or pallets of components.
- Stage delivered racks components on level ground and must not be immersed in water or mud.
- Lift shipped bundles from the center of mass (i.e. Channels to be stored, lifted and handled on the flange not the web, see figure 3).
- 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.
- If any product stored in its original packaging becomes immersed in water, mud or similar contaminant the product must be cleaned and dried.
- Once removed from its original packaging, the product must be kept free from mud, water immersion and other contaminants. Should this occur, the product must be cleaned and dried.

Acceptable materials for the storage of roll formed components:

- Aluminum.
- Galvanized steel.
- Stainless steel.
- Wood: pine, spruce and poplar only.

Materials not to be used for the storage of roll formed components:

- Copper.
- Cardboard.
- Non-galvanized steel.
- Wood: larch, oak, chestnut, red cedar, Douglas fir, white cedar, pressure treated lumber and all woods with a pH < 5.
- Bituminous membranes.
- Products containing fire retardant or preservation treatments.

Product Modification:

- Products must not be modified from their original manufactured condition without expressed written permission of Polar Racking.

Material Inspection:

- All material must be inspected as delivered to the site. Any issues or discrepancies must be reported in a timely manner.

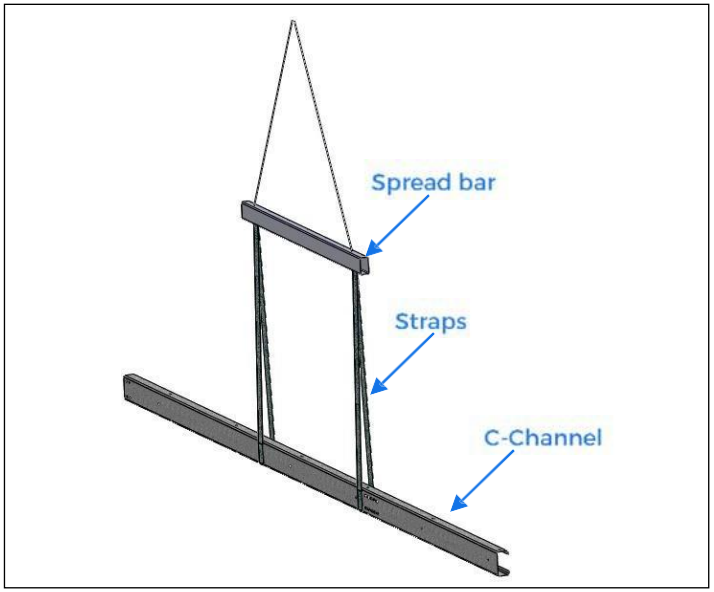


Figure 3: Proper way for lifting beams

4. Racking Overview

a. Dual Leg

1 – Legs

2 - North-South Beam

3 - Brace

4 - East-West Bracket

5 - East-West Beam

6 - End-Clamps

7 - Mid-Clamps

8 - Solar Modules

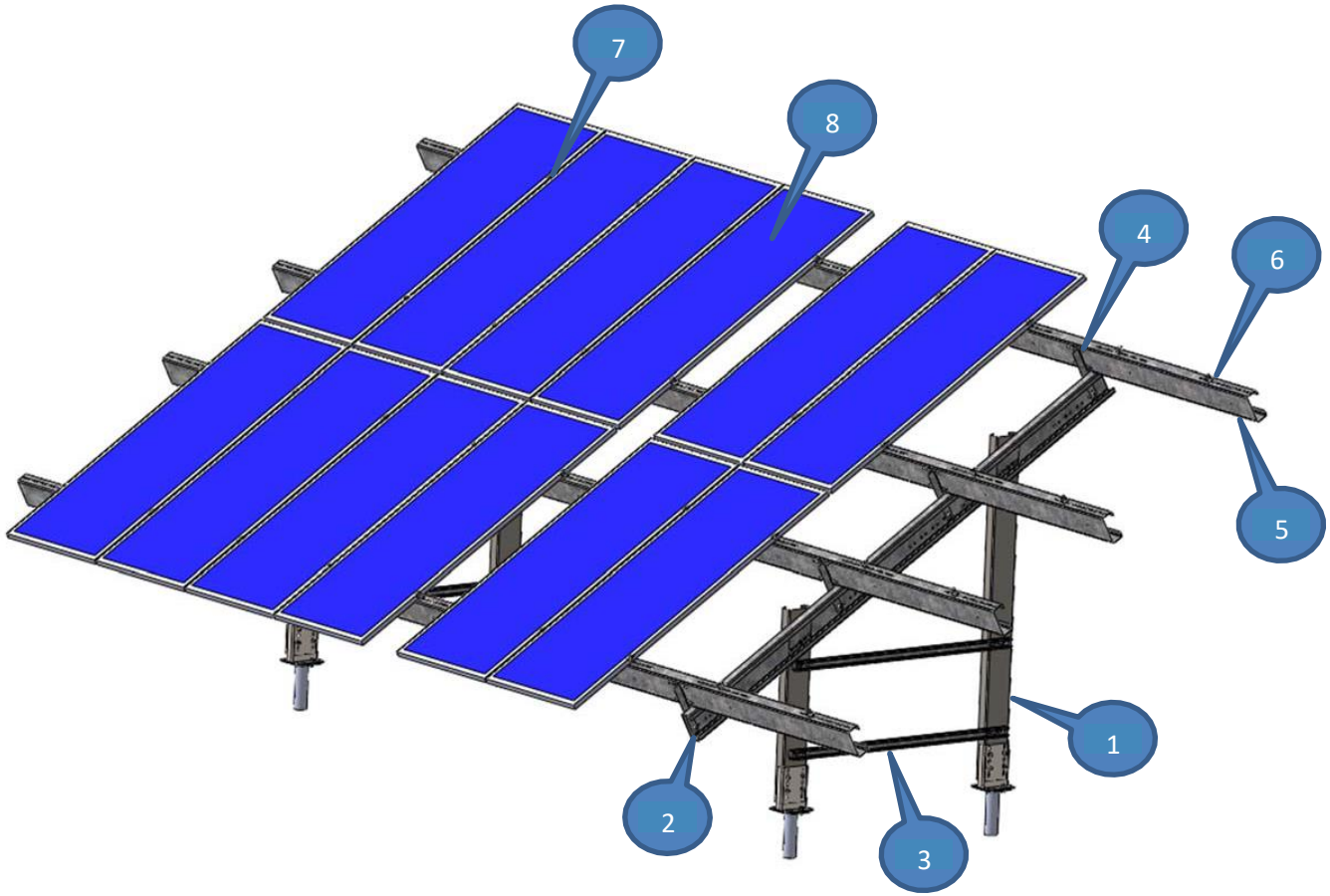


Figure 4.1: Dual Legs Racking Overview

b. Single post

1. Post
2. North-South Beam
3. Brace
4. East-West Bracket
5. East-West Beam
6. End Clamps
7. Mid Clamps
8. Solar Modules

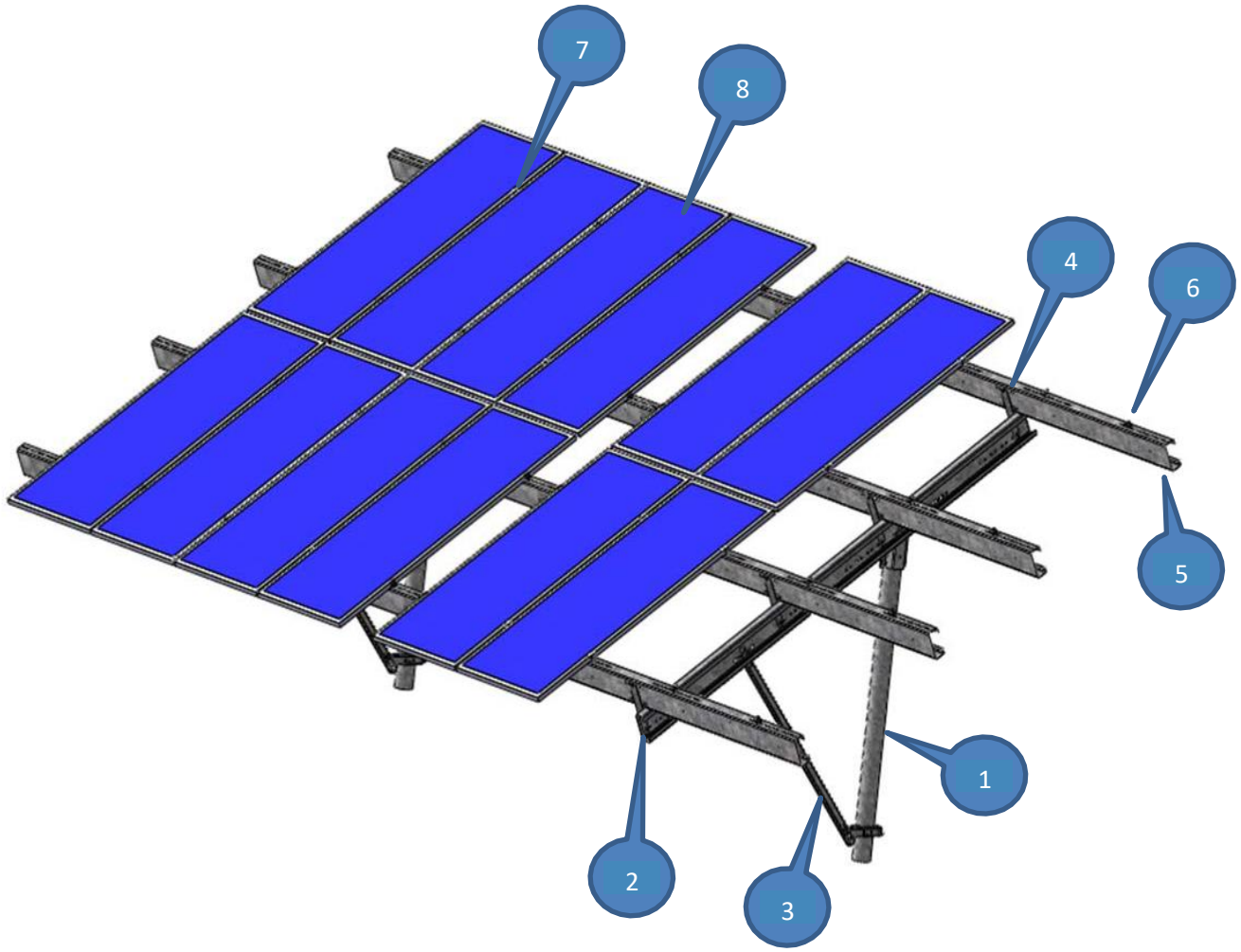


Figure 4.2: Single post Racking Overview

c. Foundation Options

Foundation options

a. Driven Round Post
b. Cast-In-Place Concrete Pier
c. Helical Pile
d. Ground Screw
e. Ballasted System (Dual Leg Only)

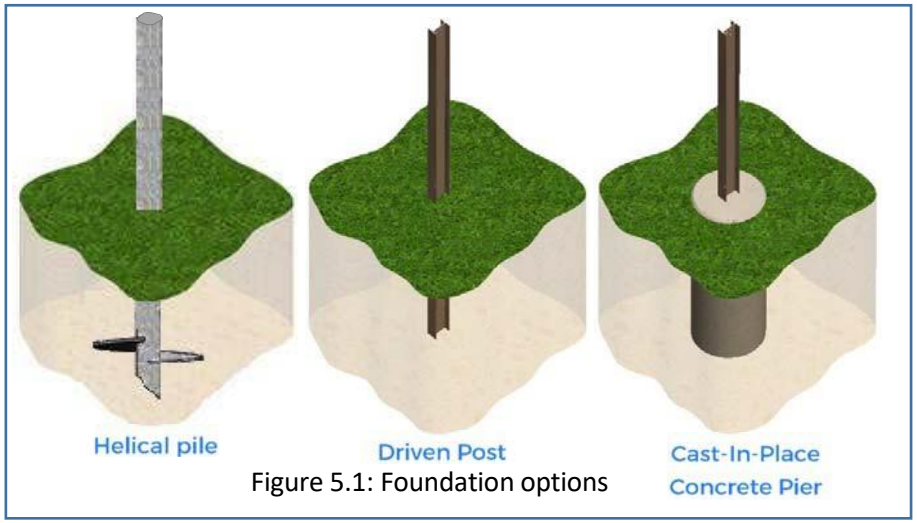


Figure 5.1: Foundation options

For Ballasted systems, **tubs for pour-in concrete or gabion baskets** foundations are available. Depending on the option selected, always follow the assembly and set-up instructions as outlined in the manufacturer's installation instructions. Also, consider the recommendation outlined in the geotechnical report regarding soil preparation requirements.

When using pour-in-place ballasted foundations, it is recommended for gravel bedding to be laid underneath the tub prior to pouring the concrete. This will limit direct contact between the concrete and the soil and provide firm support to the ballast block. Inadequate gravel beds may lead to concrete cracking. Note that it is important for ballasts, regardless of whether it is pour-in-place or gabion stone, to be level in the E-W and N-S directions relative to the surrounding grade.

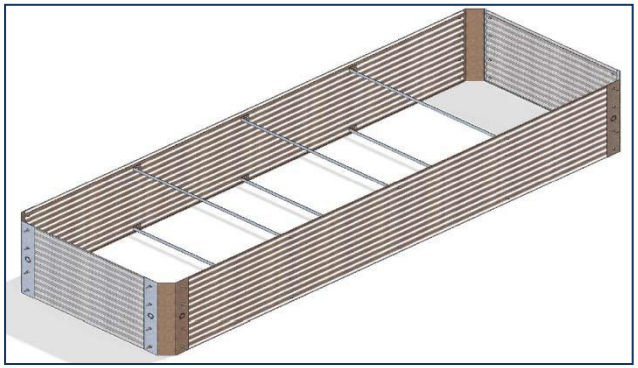


Figure 5.2: Tub Set-up (other options available)

Pouring of the concrete into the tub should be done after all legs/ A-Frames are placed in position within the tubs. Always follow specifications and dimensions outlined on the site-specific **Engineering Drawings.**

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

Foundation Guidelines:

I. Piles shall be installed at the rate of one revolution per pitch.
II. Pile to be vertical ±1.0° in the east-west and north-south direction.

d. 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 inch (25 mm)
- East – West Spacing: ±2 inches (51 mm)
- Height: ±2 inches (51 mm)
- Plumbness: ±1°
- Rotation: ±2°

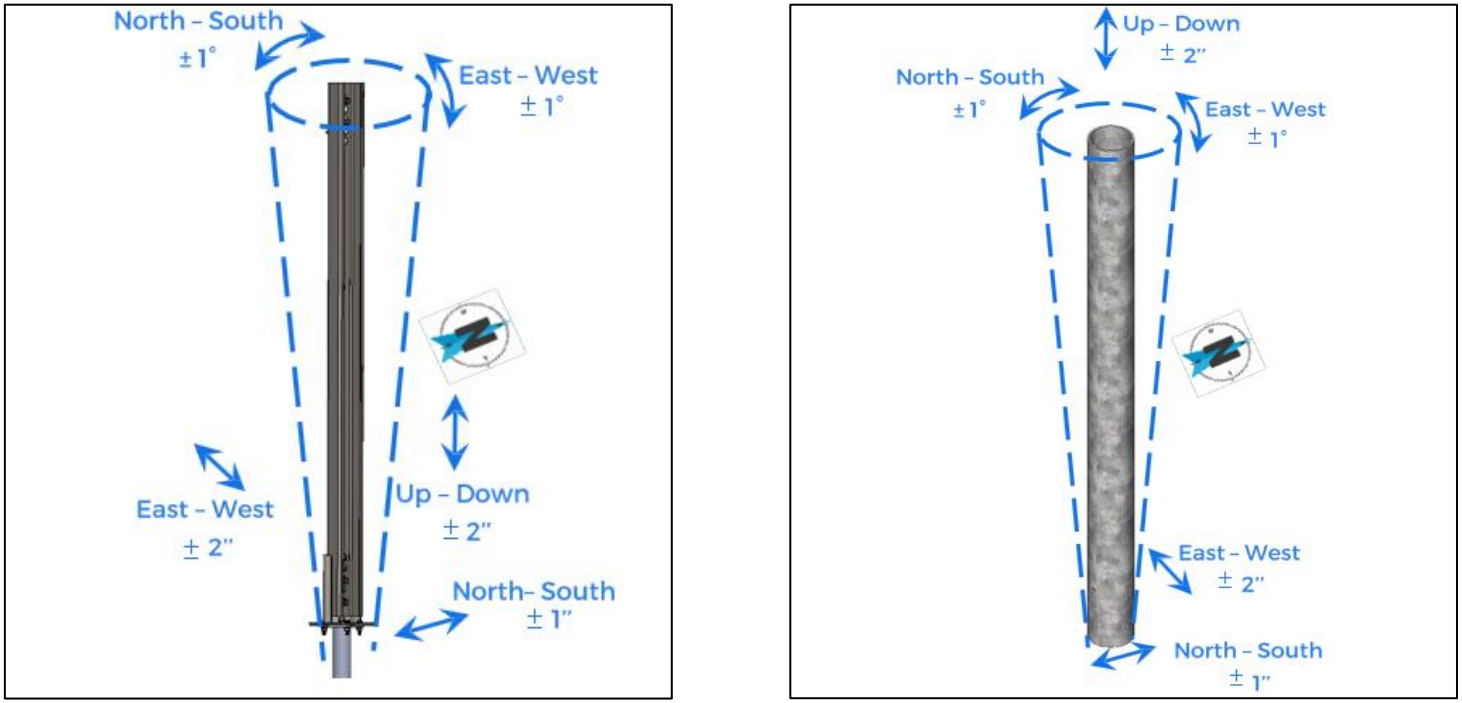


Figure 6: Leg / post installation tolerance

e. Racking Tolerances and Adjustability for Dual Legs

- Foot Bracket Up – Down: ±2 inches (51 mm) (Fig.7-1)
- North – South Beam: ±3.5 inches (89 mm) (Fig. 7-2)
- East – West Beam: ±2 inches (50 mm) (Fig. 7-3)
- East – West Bracket: ±0.75 inches (19 mm) (Fig. 7-4)

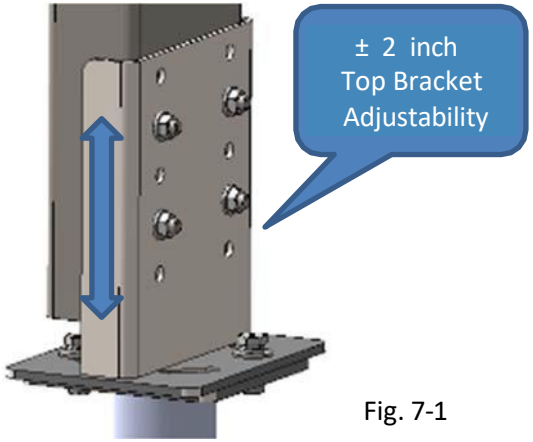


Fig. 7-1

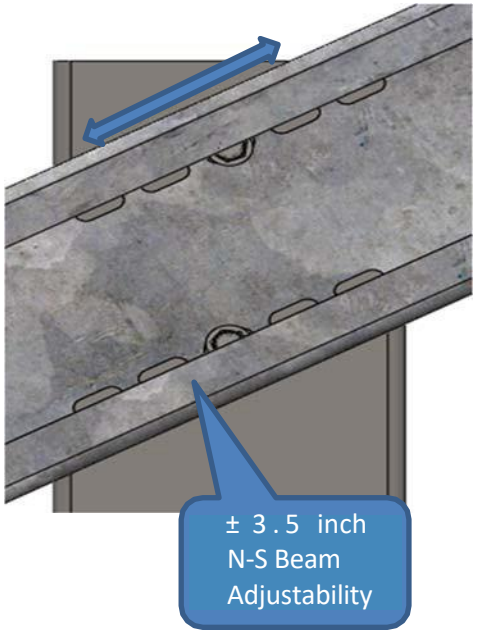


Fig. 7-2

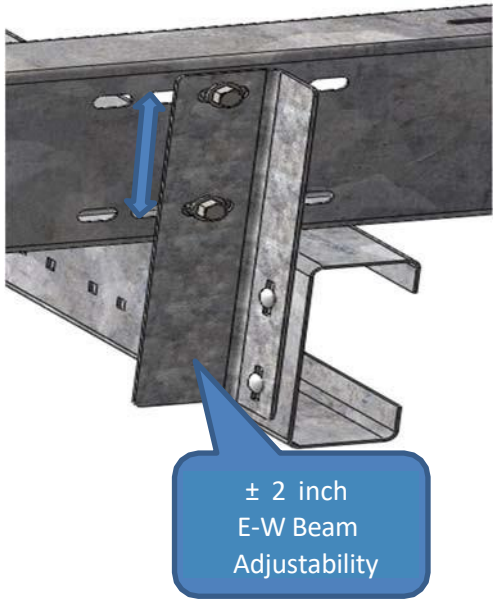


Fig. 7-3

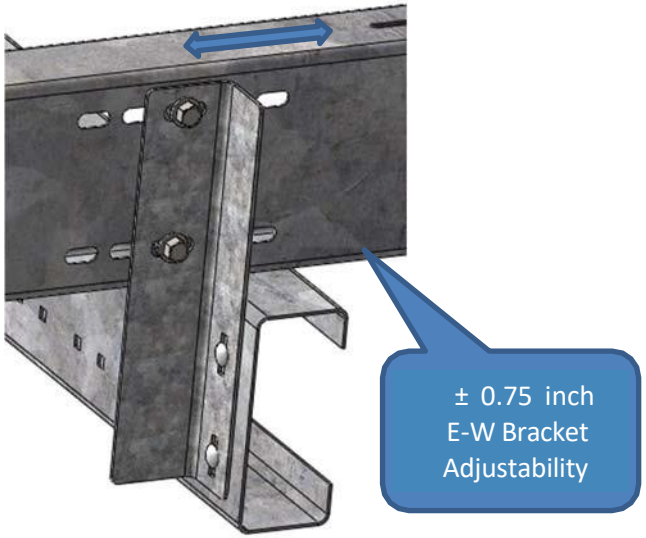


Fig. 7-4

Figure 7: Rack Tolerances and Adjustability for Dual Leg

f. Racking Tolerances and Adjustability for Single Post

- Top Bracket Up – Down: ±2.0 inches (±50 mm) (Fig. 8-1)
- North – South Beam: ±3.5 inches (89 mm) (Fig. 8-2)
- East – West Beam: ±2 inches (50 mm) (Fig. 8-3)
- East – West Bracket: ±0.75 inches (19 mm) (Fig. 8-4)

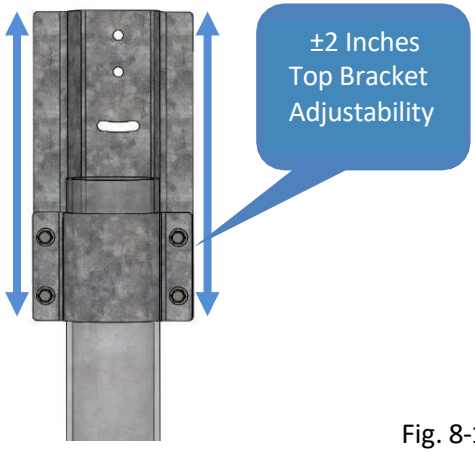


Fig. 8-1

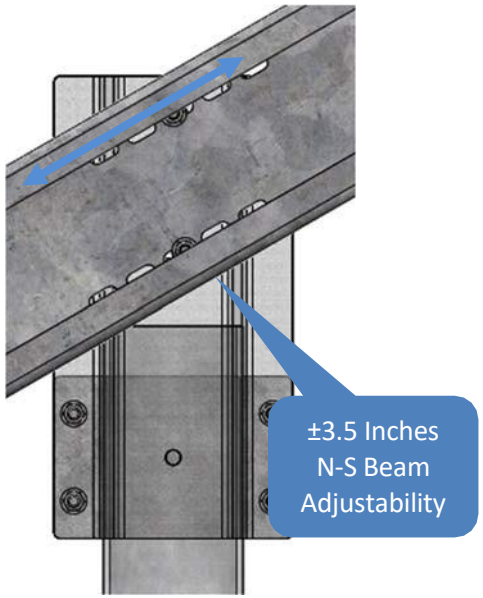


Fig. 8-2

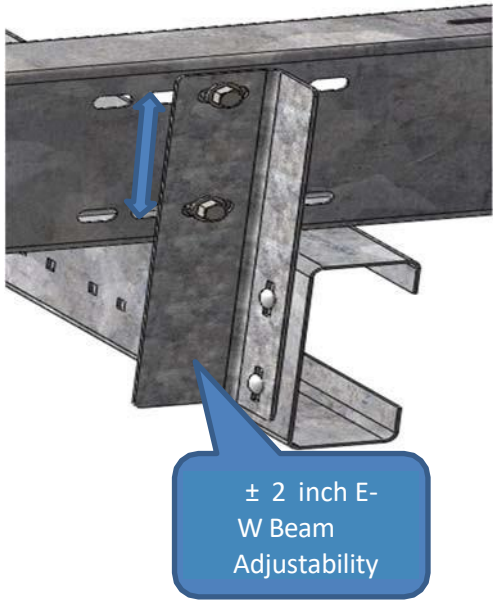


Fig. 8-3

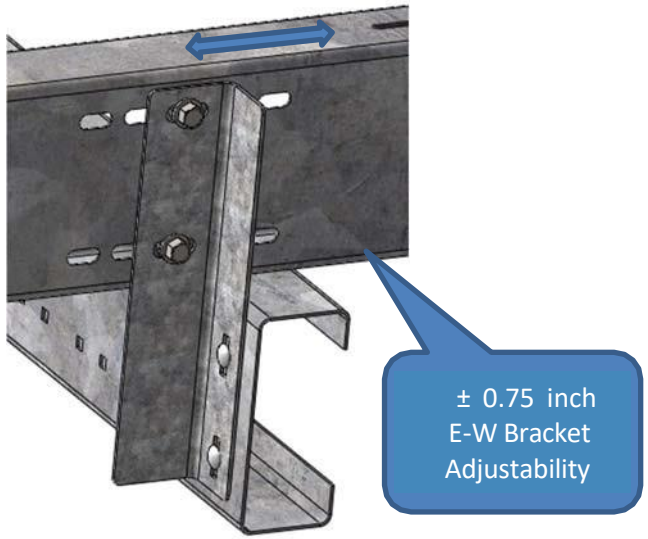


Fig. 8-4

Figure 8: Rack Tolerances and Adjustability for Single Post

5. Installation Instructions

Note: See Appendix 1 for Rack Component pages 37-40

a. A-Frame Construction

I. For Dual leg

Note: Refer to Polar Racking drawings for Post size, optimal height, minimum embedment, and spacing. Make sure Post Spacing is measured from center to center of the posts measured at the top of the posts. Install the first Post to the optimal height. Make sure the next Posts are installed to specified tolerances.

Step One Install Foot Brackets on ground screws or helical piles (if applicable). Make sure they are all at the same level within a table. Align all due south. Grab one (1) e.a - 1/2" -13 Cap Screw Hex Head Bolt, (2") Length, Grade 8, Magni 565 Coated or HDG , two (2) e.a 1/2" x 1.375" O.D Flat Washer , Magni 565 Coated (or HDG), and one (1) e.a 1/2" -13 Hex Head Nut, A194 Grade – 2H, Magni 565 Coated or HDG and one (1) 1/2" Washer, Lock, HDG Coated or Magni 565 for each slot. Refer to IFC drawings for number of fasteners required. Hand tighten these fasteners through the provided base slots. Repeat for all fasteners as in the figure below.

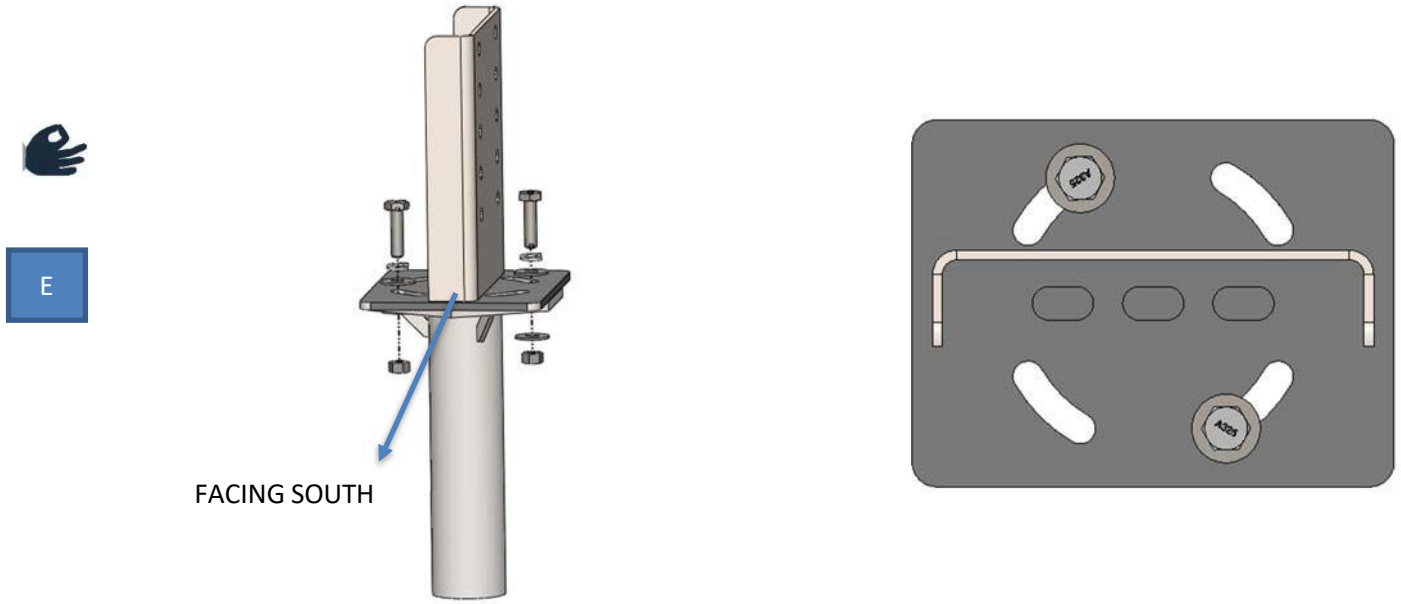


Figure 9: Foot Bracket Installation

Step Two: Grab the post, position it in the foot bracket, and then adjust to the foot bracket slots until the optimal height is achieved. Grab four (4) 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and four (4) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG). Hand tighten these fasteners connecting the foot bracket and the post. Make sure the next posts are installed to the specified tolerances in section 4-d. Repeat this step for the front and rear legs.

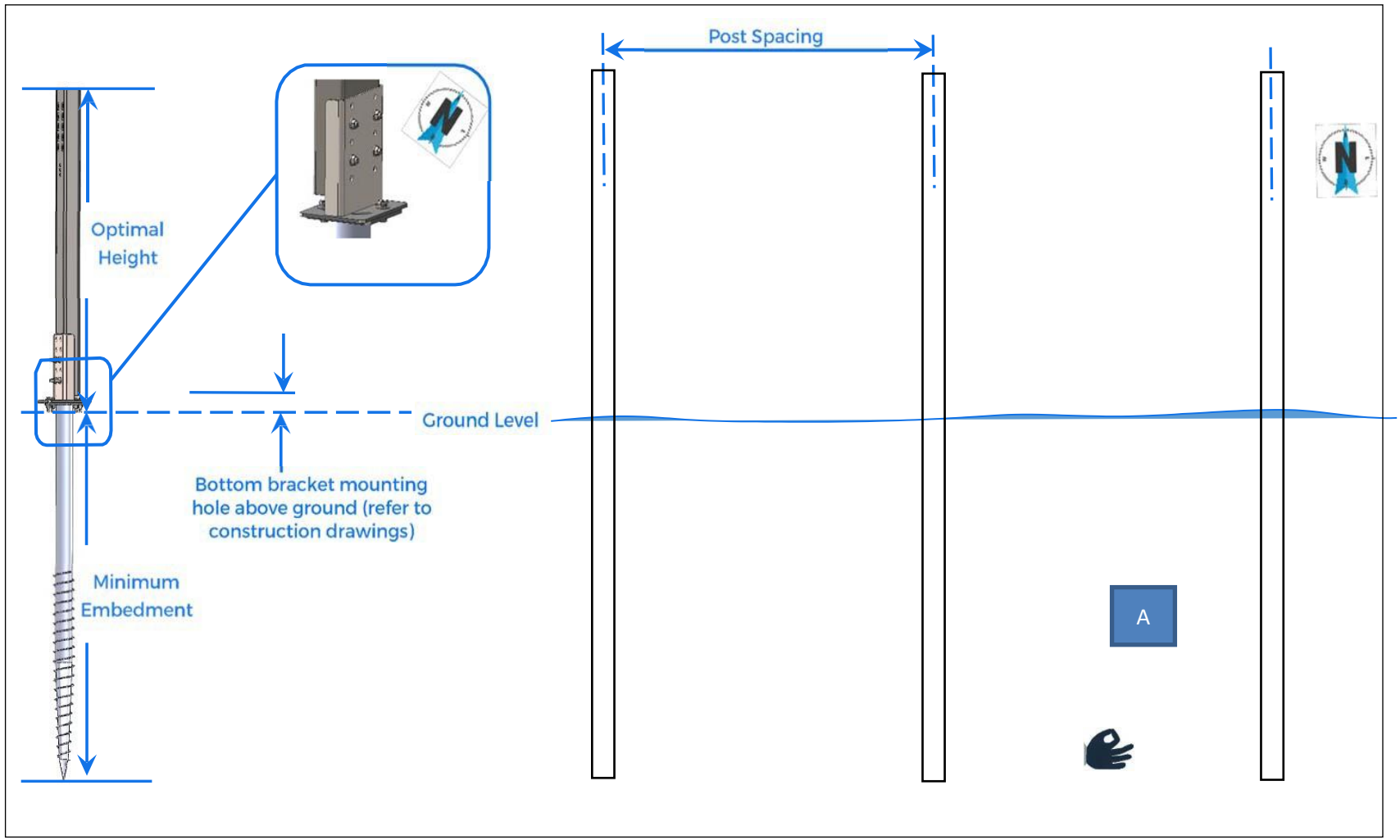


Figure 10: Post installation

Step Three

Grab the North-south beam, position **(farthest slot set in North – South beam as in the figure below**), and install it on the back leg as in the below figure with two (2) 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and two (2) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG), and hand tighten it. As per the desired tilt angle, position the North-South beam to the respective front leg and install with another set of two (2) 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and two (2) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG), and hand tighten it.

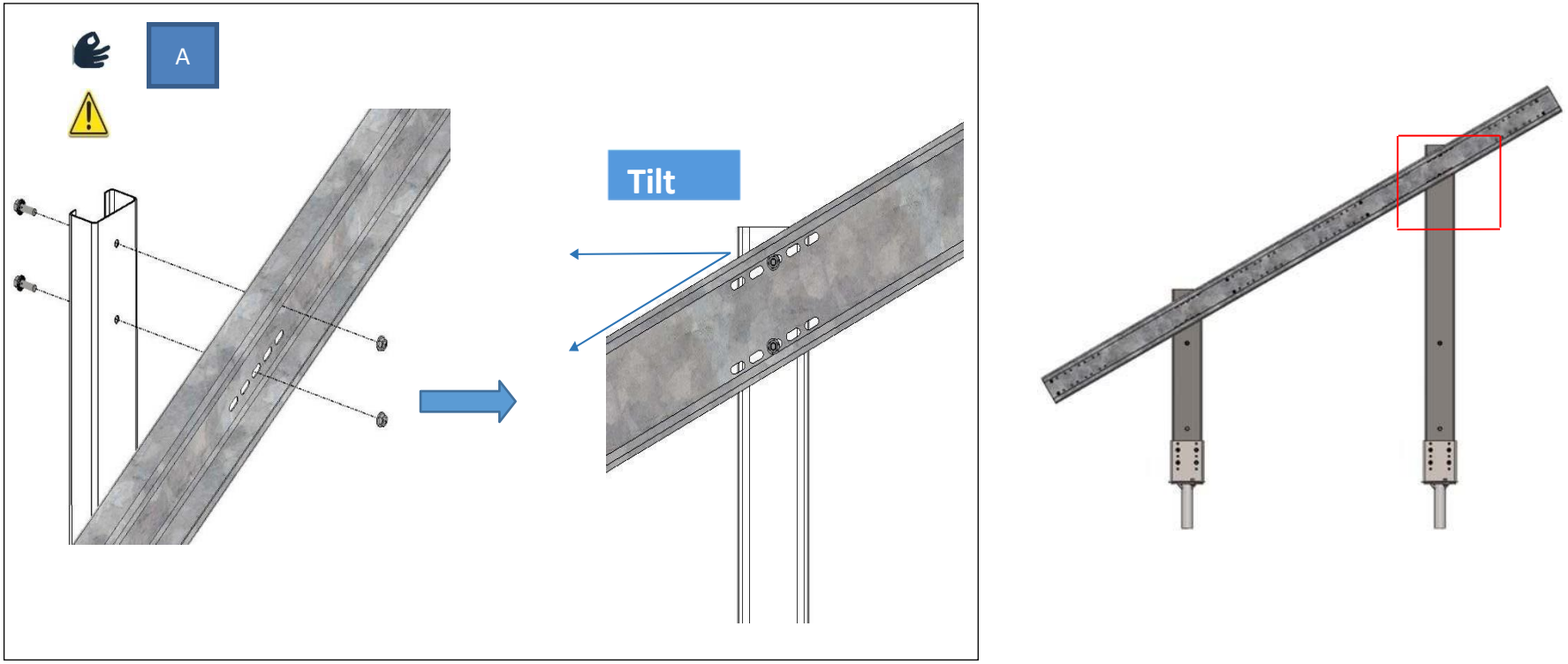


Figure 11: North South beam Installation

Step Four Grab the brace and install it in between the legs at the outermost slots as in the below figure with 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG). **(Number of braces depends on the design loads. Check the engineering drawings provided, the illustration below as reference).**

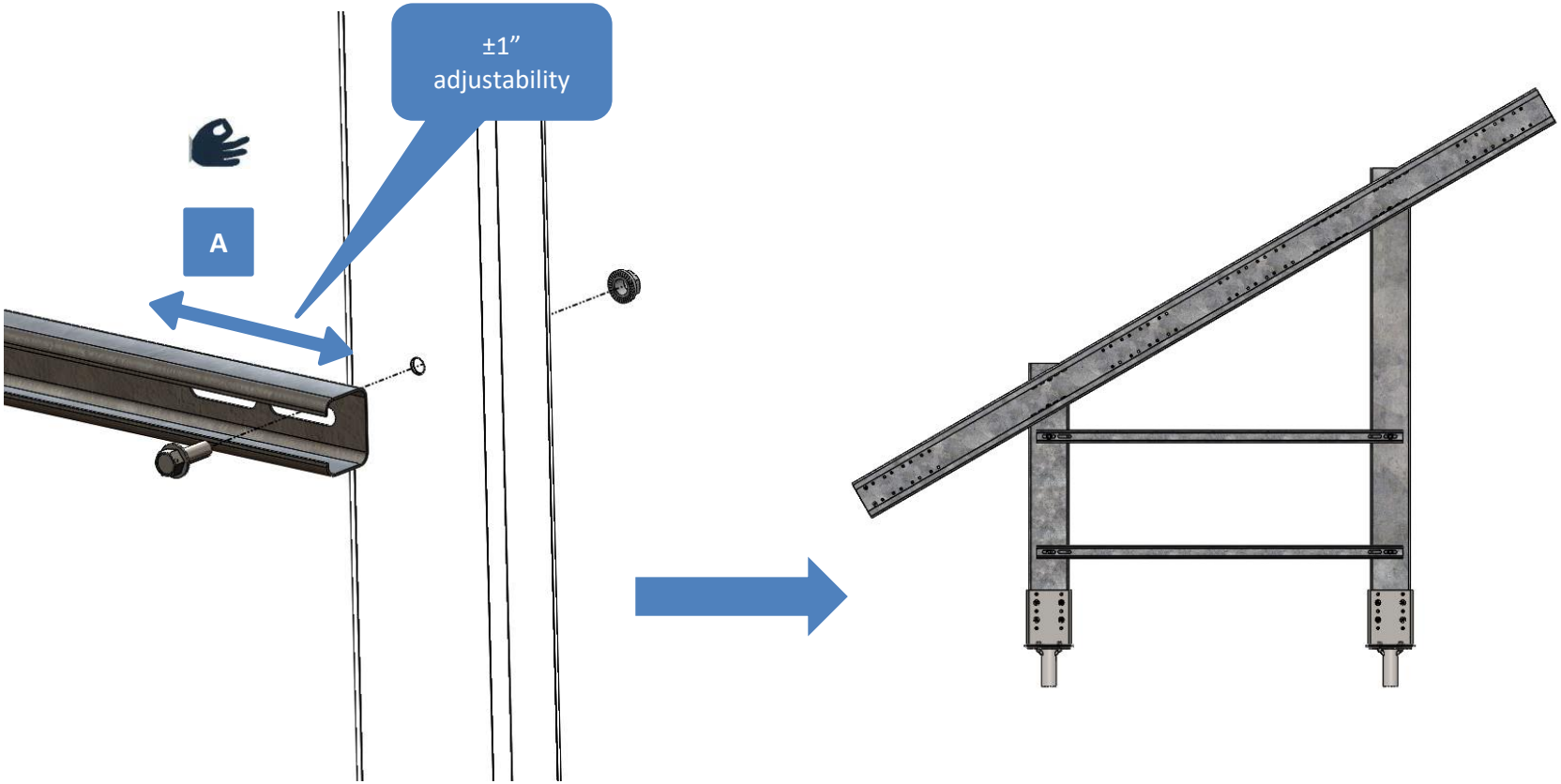


Figure 12: Brace installation

Step Five Align the leading edge of the North-South Beams at the required tilt angle and torque all fasteners (in steps 1, 2, 3, and 4) as per specifications shown in section 2-b of this document.

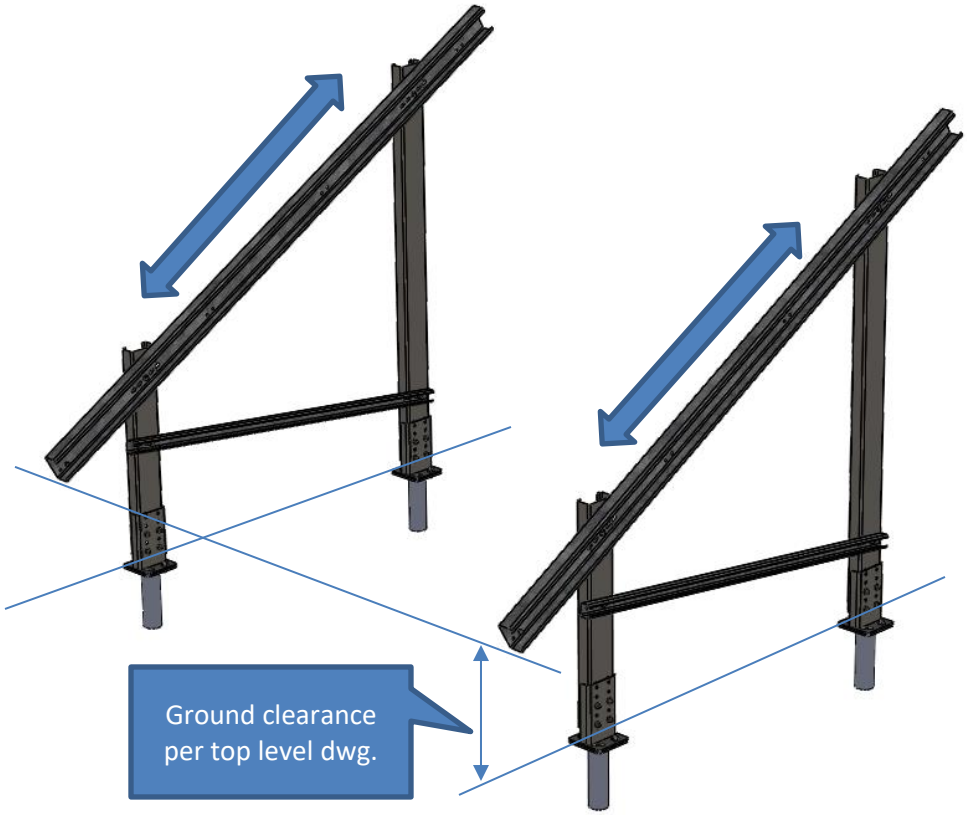


Figure 13: A-Frame Alignment

II. For Single Post

Note: Refer to Polar Racking drawings for Post size, optimal height, minimum embedment, and spacing. Make sure Post Spacing is measured from center to center of the posts, measured at the top of the posts. Install the first Post to the optimal height. Make sure the next Posts are installed to the specified tolerances.

Step One Install the bottom Brackets on the ground screws or helical piles at 8in from ground level. Align all due south as in the figure below. Hand tighten it with 1/2”-13 U-Bolt and serrated Nut of Gr. 5, Magni 565. Make sure they are all at the same level within a table. Repeat the same at the opposite corner slots as in the figure below.

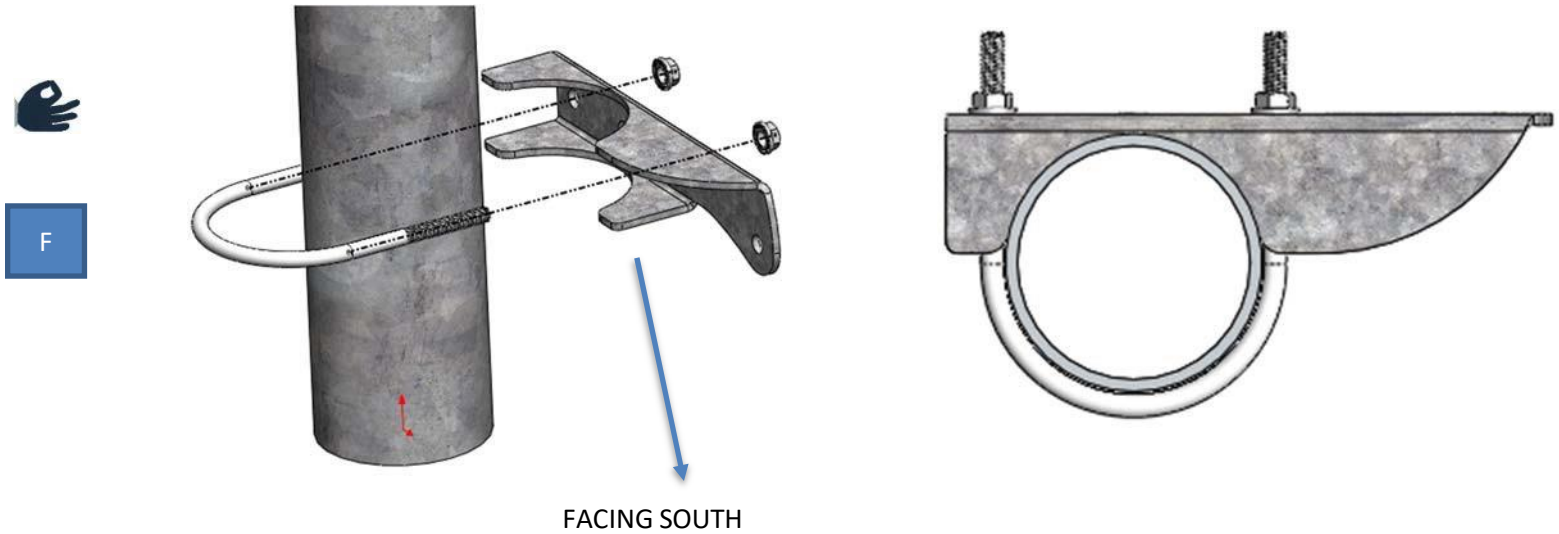


Figure 14: Bottom bracket Installation

Step two Grab the bracket top front and back and mate the components as in the figure below. Grab 1/2"–13 Serrated Flange Bolt, 1-1/2” Length, Grade 5, Magni 565 Coated (or HDG) and 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG). Then install it on post 2” from the top surface. Align all due south as shown below and hand tighten. Refer to the figure for correct orientation.

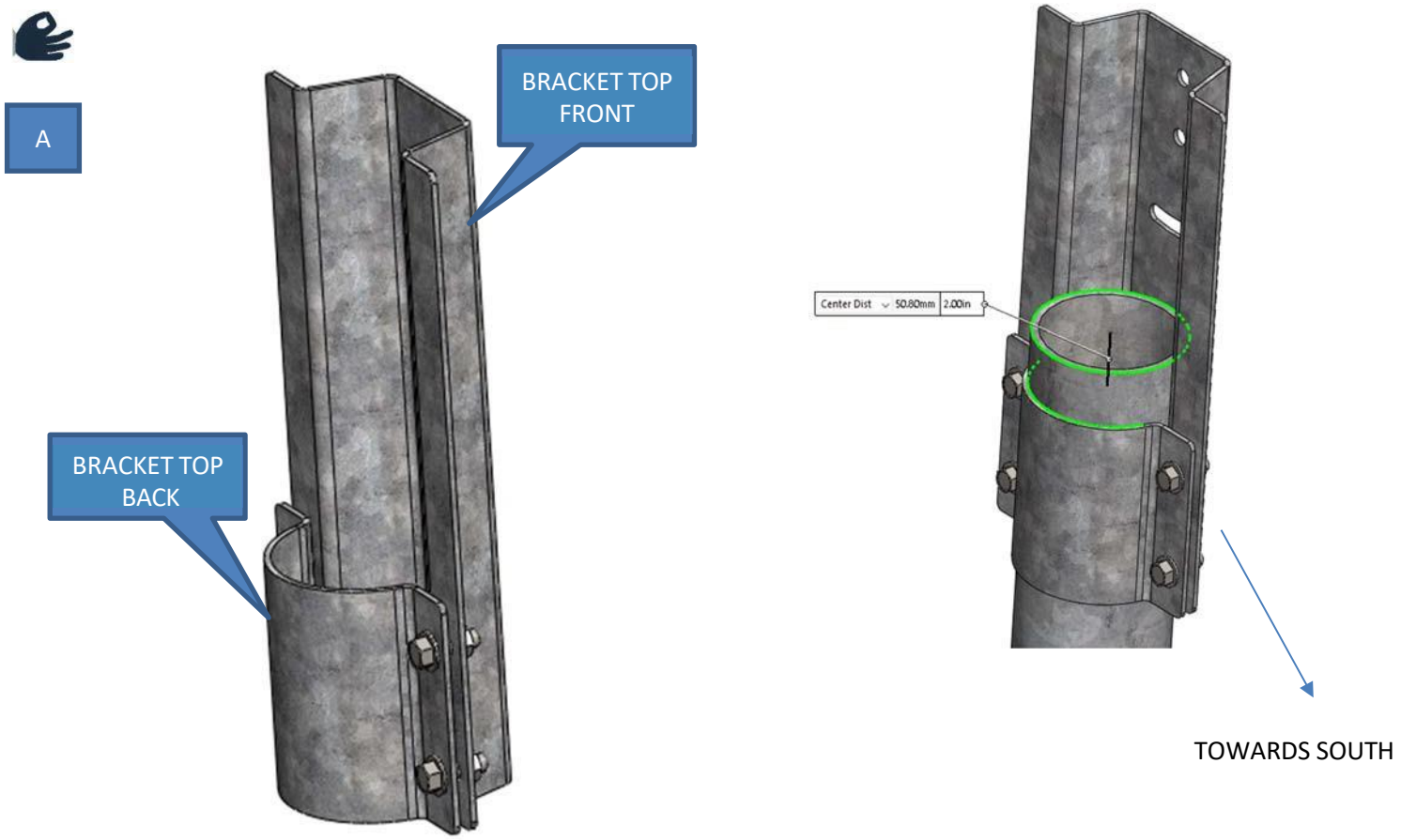
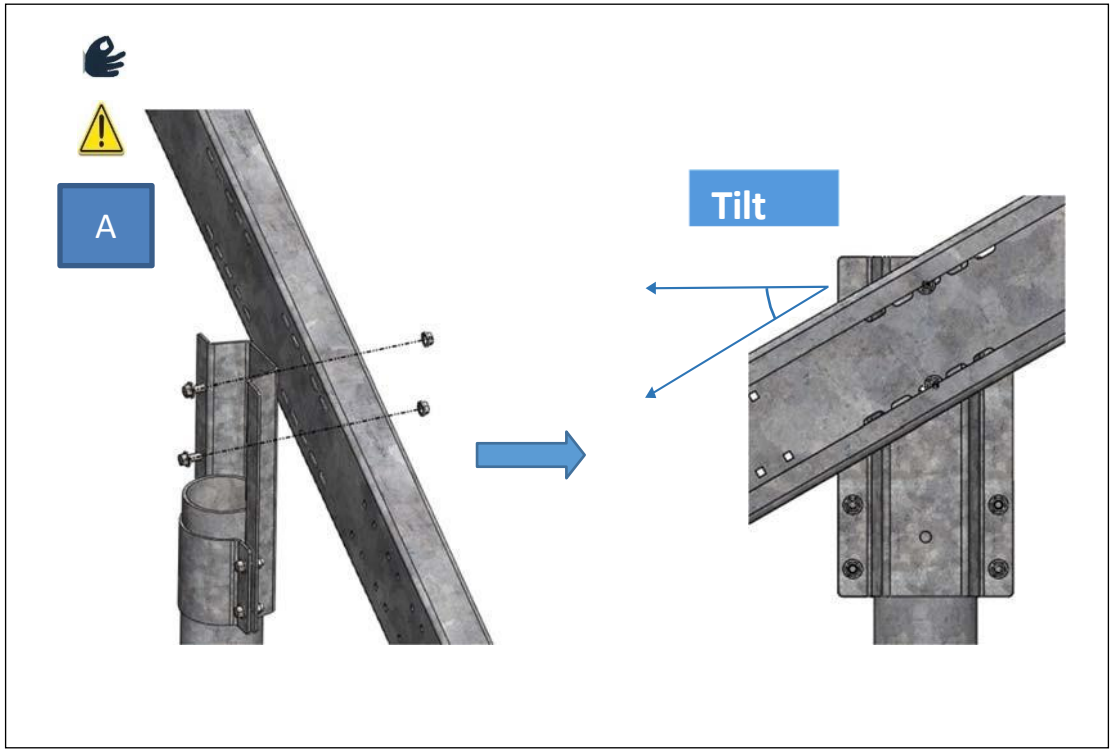


Figure 15: Bracket top front and back Installation

Step Three Grab the North-south beam, position **(second slot set in North – South beam** & as per the desired tilt angle as in the figure below), and install it on the bracket top front with two (2) 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and two (2) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG), and hand tighten it.



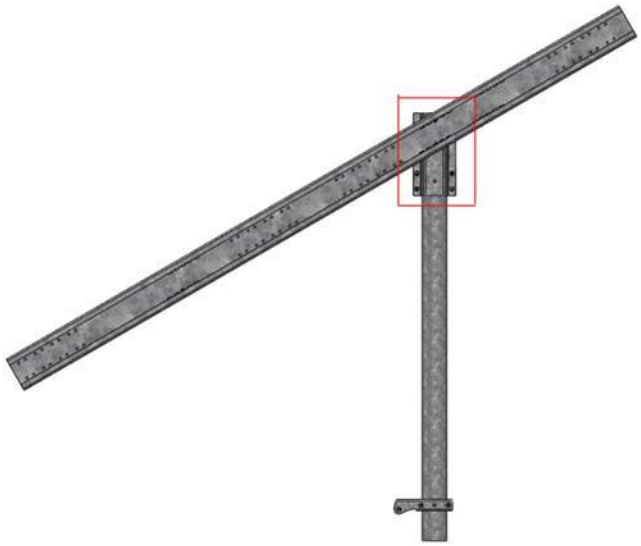


Figure 16: North-South beam Installation

Step Four Grab the brace and install it in between the post's bottom bracket and North – South beam at the outermost slots on the brace as in the figure below with two (2) 1/2"– 13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and two (2) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG). Hand tighten the fasteners.

Figure 17: Brace installation

Step Five Align the leading edge of the North-South Beams at the required tilt angle and torque all fasteners (in steps 1, 2, 3, and 4) as per specifications shown in section 2-b of this document.

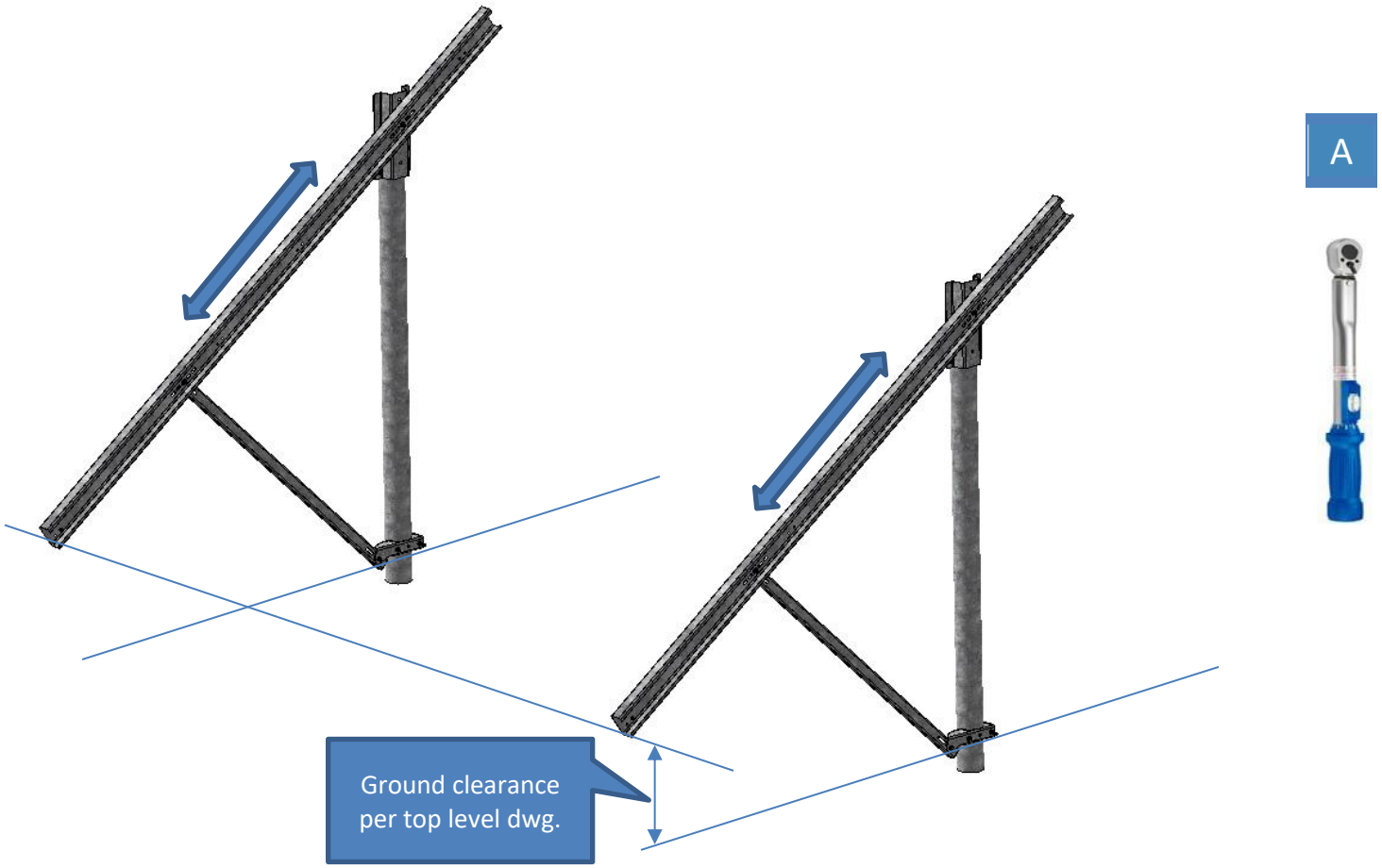


Figure 18: A-Frame alignment

b. Typical Table Construction

Table construction involves installing the East-West beams to the A-frame and PV modules which is similar for both the Dual leg & single post assemblies. For illustration purposes, the following installation procedure has been shown for the Dual leg assembly.

Step One Install 4 (four) East-West Brackets to each North-South Beam by hand tightening fasteners using two (2) 3/8"–16 Carriage Bolt, 1" Length, Grade 5, Magni 565 Coated or HDG and two (2) 3/8"–16 Serrated Flange Nut, Grade 5, Magni 565 Coated or HDG per bracket as shown in the figure below.

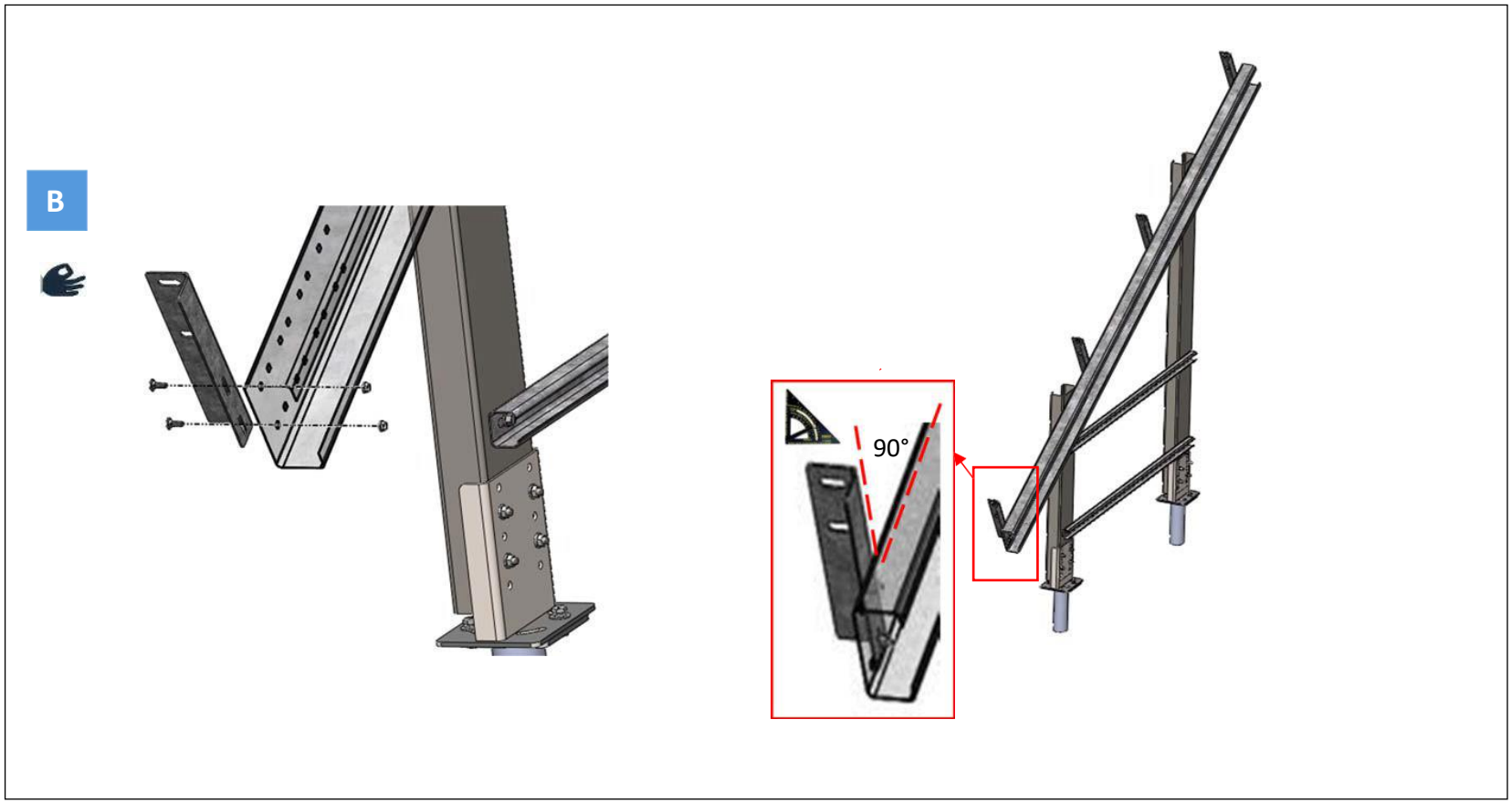


Figure 19: East-West Bracket Installation

Step Two

Mate the east-west beams with a splice as shown in the figure below, leaving minimum 10 mm gap. The splice consists of two (2) Splice Plates that are flush to the inside web of the C-channel. Each Splice Plate flange should be flush with the C-channel flange and placed in opposite orientations from each other. After all beams and splices are populated and adjusted, use twelve (12) 1/2"–13 Serrated Flange Bolt, 1" Length, Grade 5, Magni 565 Coated (or HDG) and twelve (12) 1/2"–13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG) on the flange of the east-west beam. Then use eight (8) 3/8"–16 Carriage Bolt, 1" Length, Grade 5, Magni 565 Coated or HDG and eight (8) 3/8"–16 Serrated Flange Nut, Grade 5, Magni 565 Coated or HDG and torque fasteners as per IFC drawings and section 2-b above.

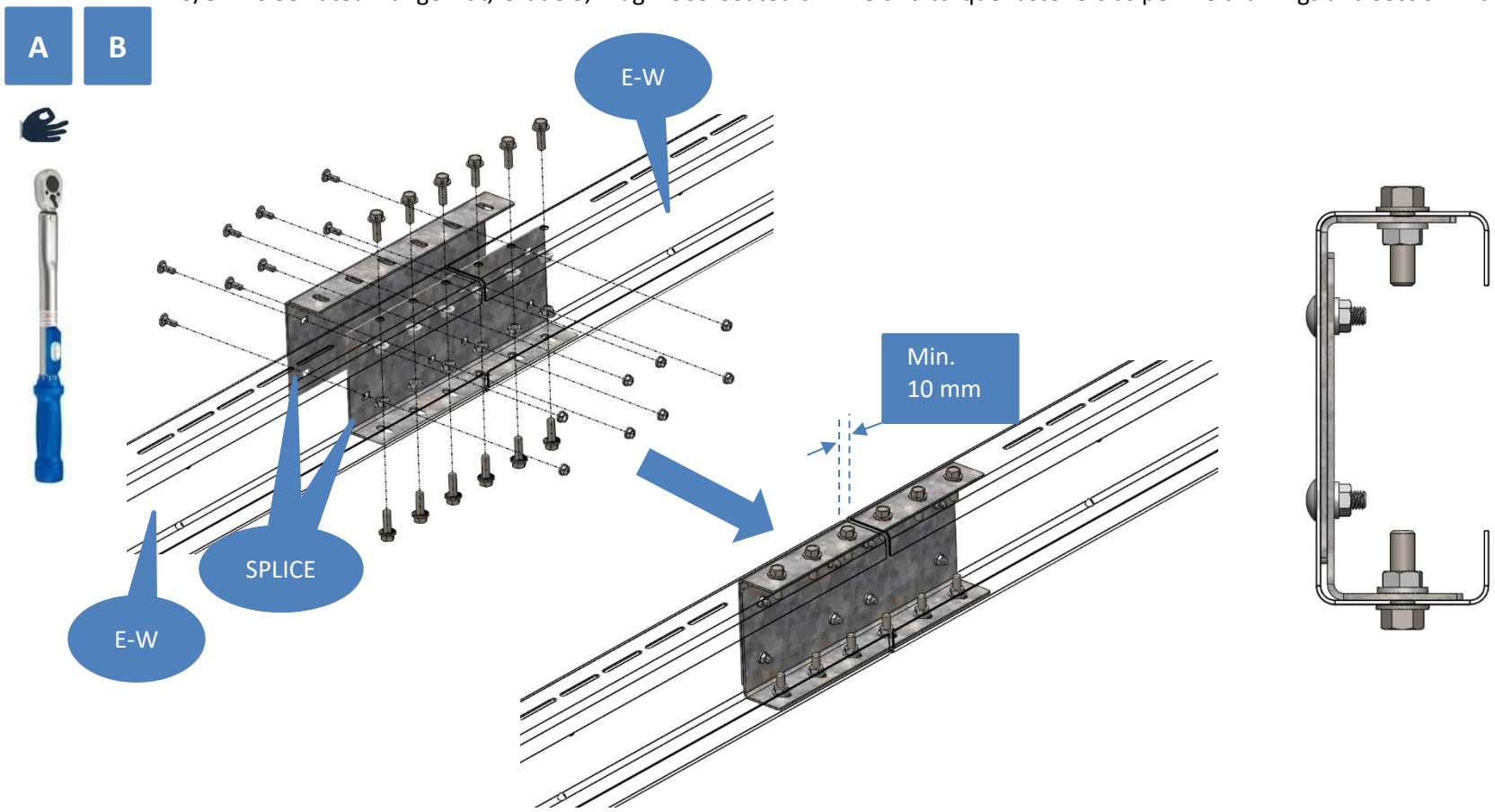


Figure 20: Splice beam installation

Step Three

Grab the East-West beam assembly and make it flush with the East-West to North-South bracket. Ensure the East-West Beam is sitting on the North-South Beam (with the drain holes down). Adjust the East-West Bracket height, as necessary. Match one of the slots on the East-West beam and avoid forcing the beam/bracket into a slot. Grab two (2) 1/2"–13 Serrated Flange Bolt, 1-1/2" Length, Grade 5, Magni 565 Coated (or HDG) and two (2) 1/2"– 13 Serrated Flange Nut, Grade 5, Magni 565 Coated (or HDG). Hand tighten these fasteners to the E-W to N-S bracket. See section 4-e and 4-f of this document for tolerances and adjustability. Once all brackets have been squared off, all the holes line up with fasteners, and the E-W beam is in place, torque the fasteners connecting the N-S beam to the E-W beam using specified values from section 2-b.

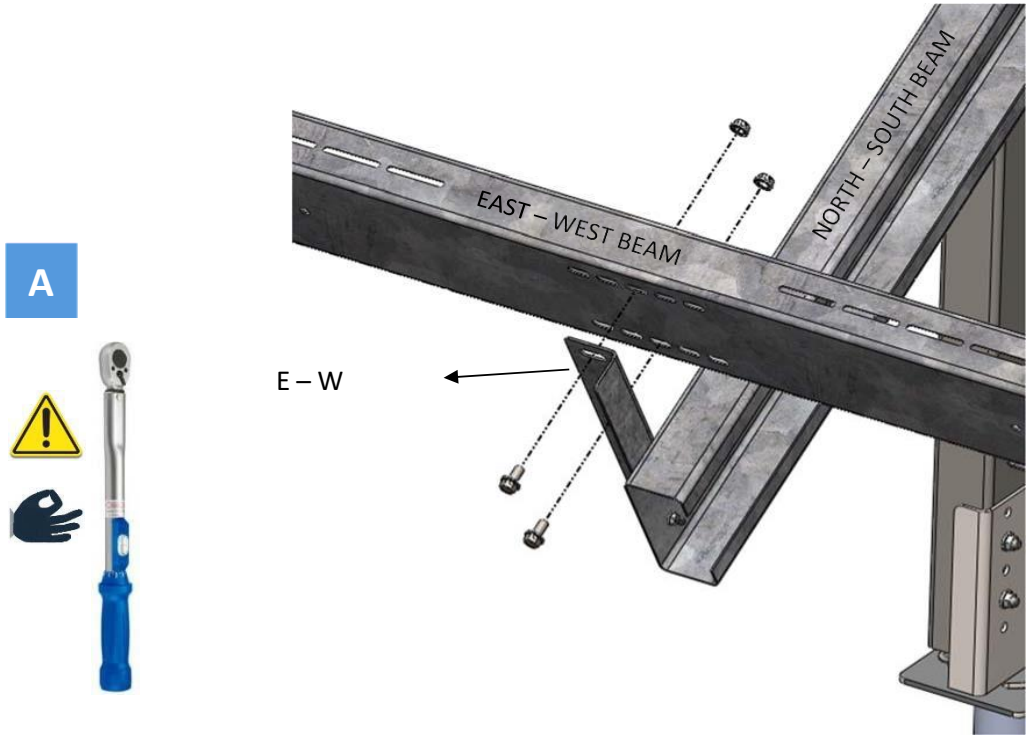


Figure 21: East-West Beam installation

2x8 is a standalone table but it can be connected to create combined tables after some analysis and engineering. **Please consult POLAR RACKING INC for the proper engineering and analysis.**

c. PV Module Installation (Top Clamps)

Step One

Start with the South row and the most easterly module. Position the module on purlins as per the construction drawing (verify the clamping zone distance "B" shown in the figure below and as per the IFC drawings and distance A as per the installation manual of the selected PV module. Fix the first end module with two end-clamps as shown in the figure below using one (1) 5/16"-18 Serrated flanged Bolt (or Hex Head Bolt), 1.0" Length, Grade 5, Magni 565 Coated or HDG, one (1) flat washer, one (1) lock washer and one (1) 5/16"-18 Serrated flanged nut (or Hex Head), Grade 5, Magni 565 Coated or HDG per clamp. Make sure the vertical wall of the end clamp and the solar module frame are flush and no gap is present. Do not over-torque the 5/16" bolts, hand-tight the bolts first and then torque to the specified rate, (See section 2-b of this document for hardware and torque rates). **DO NOT USE IMPACT GUN WITH ANY 5/16" BOLT.**

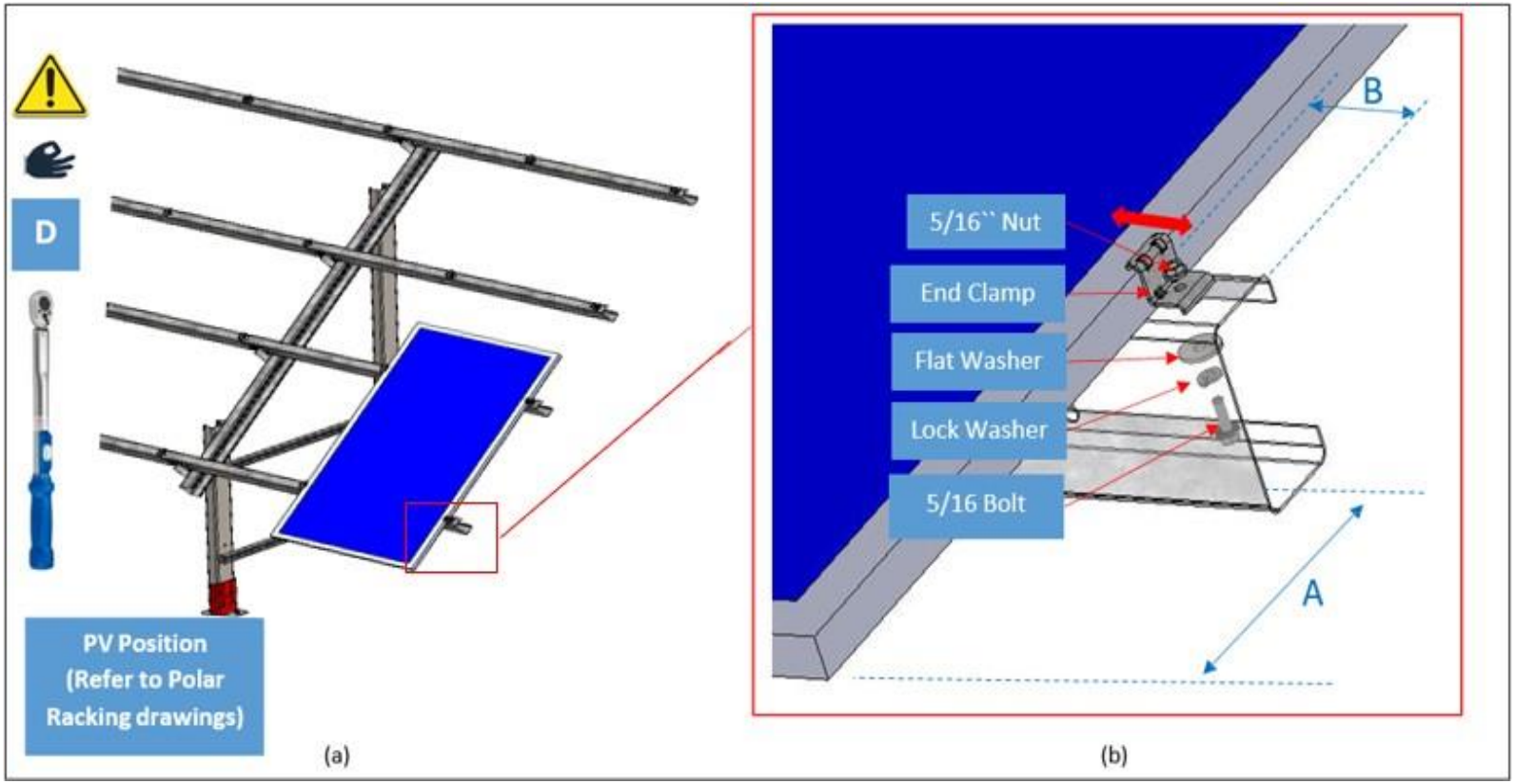


Figure 22: Module to End clamp connection

Step Two Hand tighten the two Intermodule-clamps as shown in the figure below and the IFC drawings provided. Use one (1) 5/16”-18 Serrated flanged Bolt (or Hex Head Bolt), 2.5” or 3” Length **(based on the module thickness)**, Grade 5, Magni 565 Coated or HDG, one (1) flat washer, one (1) lock washer and one (1) 5/16”-18 Serrated flanged nut (or Hex Head), Grade 5, Magni 565 Coated or HDG per clamp. Do not over-torque the 5/16” bolts. Hand-tighten the bolts first and then torque to the specified rate, (See section 2-b of this document for hardware and torque rates). **DO NOT USE IMPACT GUN WITH ANY 5/16” BOLT.**

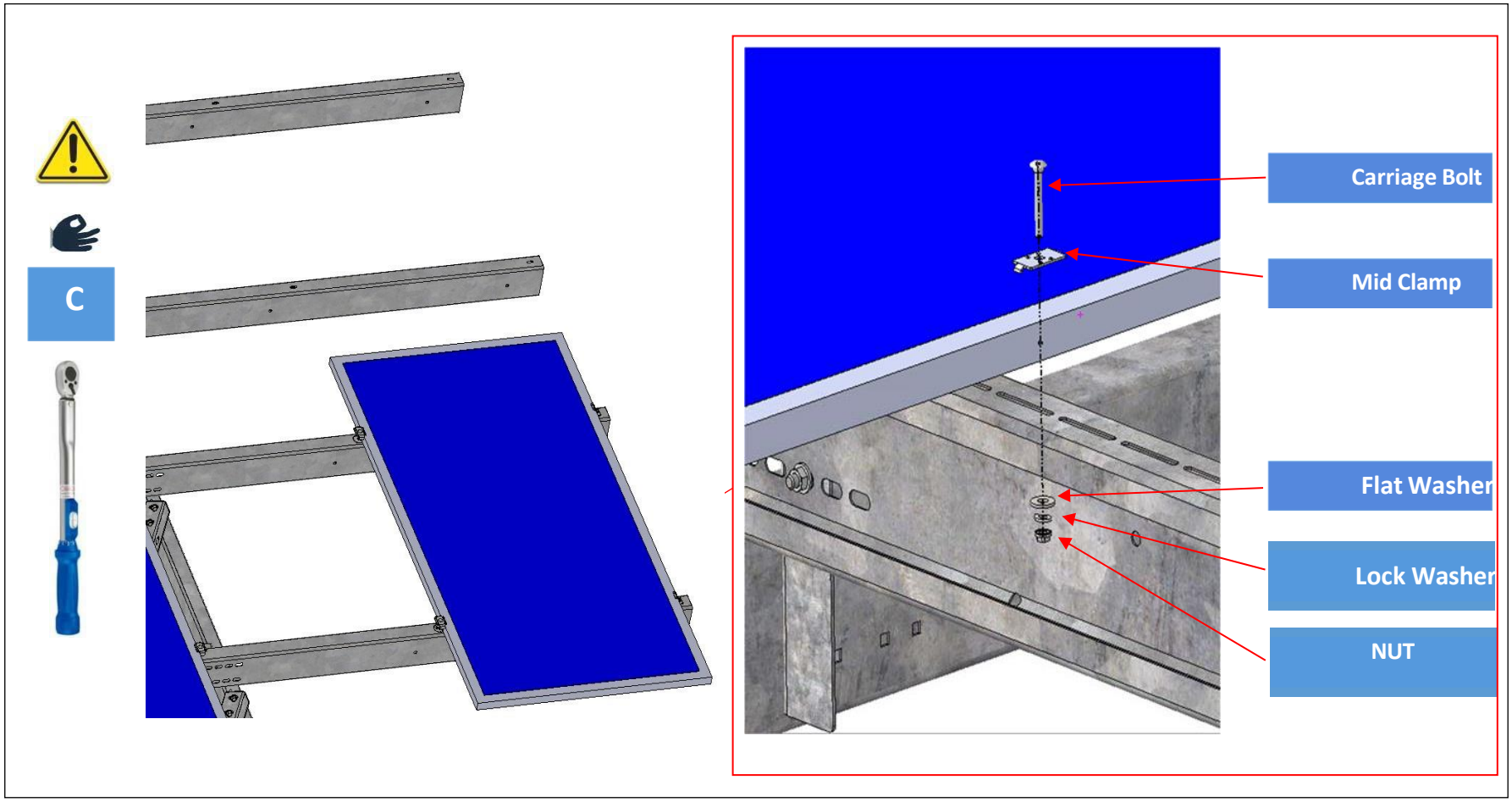


Figure 23: Intermodular connection

Step Three Continue with installing the adjacent module, and clamp as per the direction specified in steps one and two above and as shown in the figure below. End clamps are used after the fourth module in the row. Do not over-torque the 5/16" bolts. Hand-tighten the bolts first and then torque to the specified rate, (See section 2-b of this document for hardware and torque rates). **DO NOT USE AN IMPACT GUN WITH ANY 5/16" BOLT.**

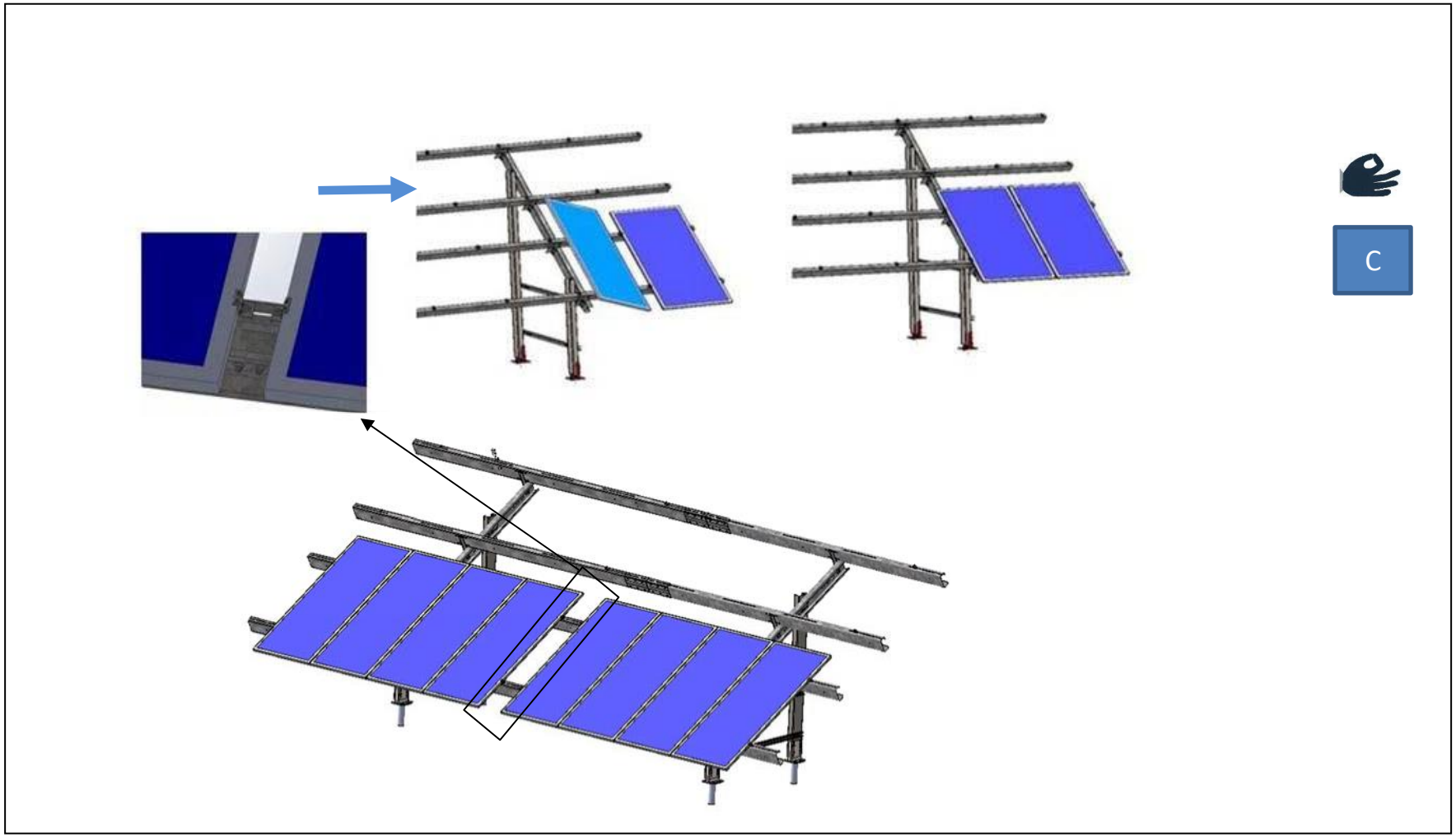


Figure 24: Modules Installation (first row)

Step Four Install the next row as shown in the figure below (refer to IFC drawings for the appropriate size of gap to be left between the two rows). After a full table of modules has been fastened into place and the table is square, torque all fasteners as per specifications shown in section 2-b of this document. Do not over-torque the 5/16" bolts. **DO NOT USE IMPACT GUN WITH ANY 5/16" BOLT.** Note: All table configurations are installed in the same manner as the 2x8 table. (refer to engineering drawings for more details)

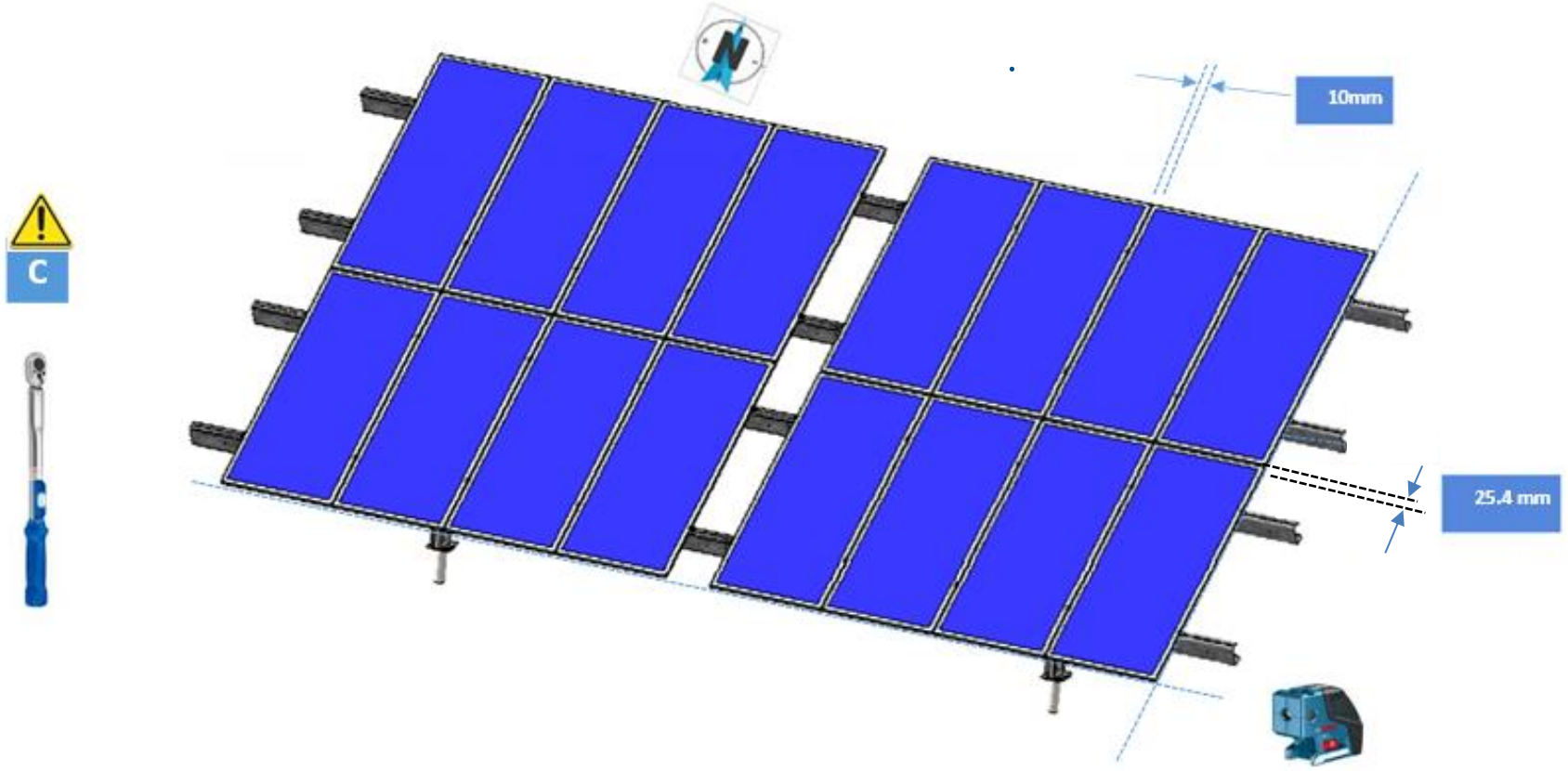


Figure 25: Full Table Installation

d. Wire Management

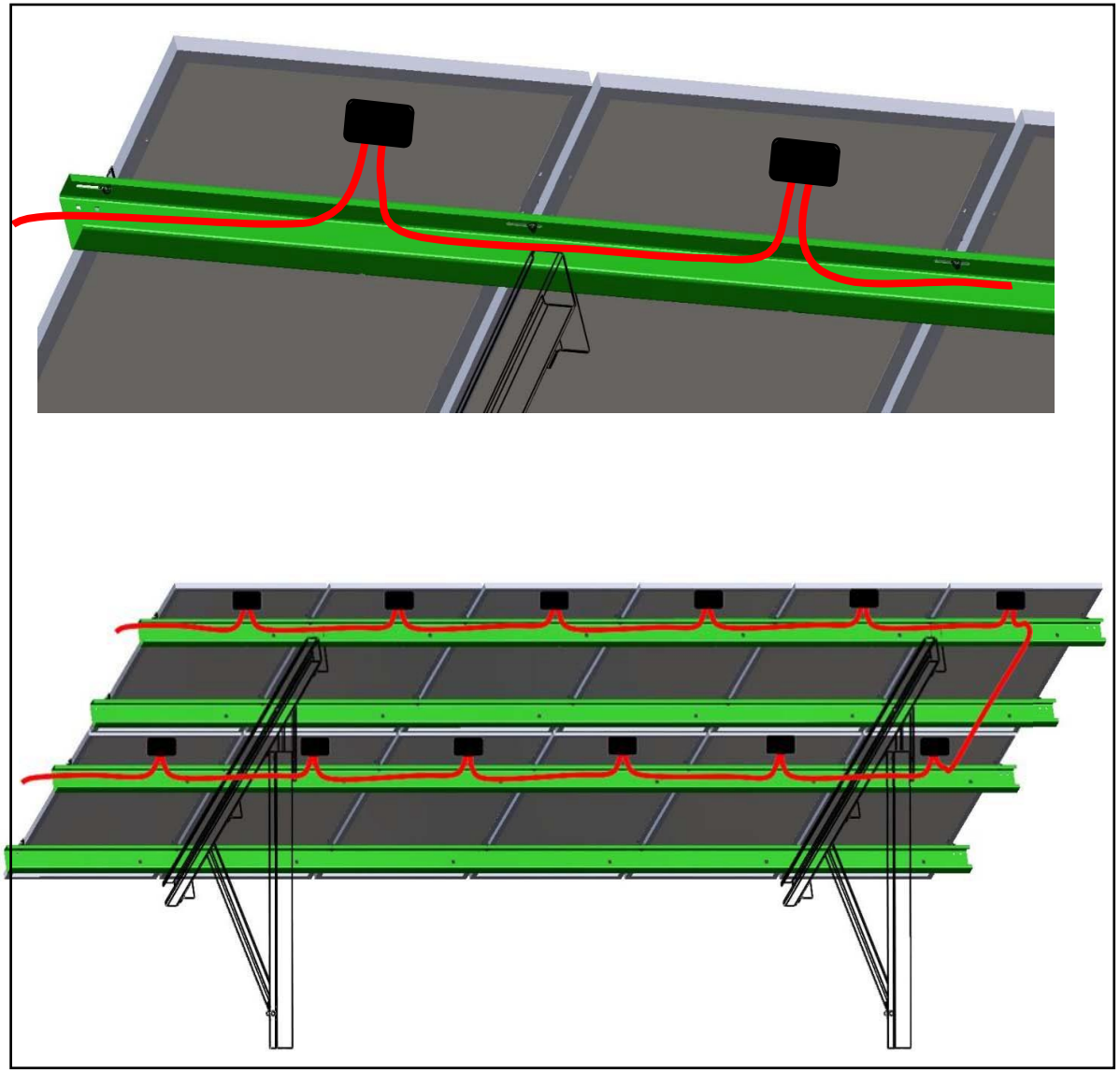


Figure 26: Wire Management

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. Wire management holes are spaced out equally on the E-W beam for connection of tie clips or cable routing (see figure 25)

Route all cables through the closest purlin for the full table of modules and follow the instruction from the owner's electrical engineering specifications to reach the combiner boxes. Make sure that the maximum series Fuse Rating is 30 Amps.

Installer is responsible for and shall 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, NEC 690: Solar Photovoltaic Systems, and CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.

Note:

Drainage holes at the bottom of the east-west beam to ensure no water build-up in the beam.

6- List of Approved PV Modules for Bonding and Grounding

Table 1: Approved PV modules

MANUFACTURER	MODEL(S), WHERE "XXX" IS THE MODULE POWER RATING
Adani	ASa-b-c(xxx)-d Where "a" can be M, P; "b" can be 7, 14; "c" can be PERC, or blank; "d" can be 72, 144;
Astronergy Solar	aaSMbbyyC/zz-xxx Where "aa" can be CH or A; "bb" can be 60, 66, or 72; "yy" can be blank, 10 or 12; "C" can M, P, M(BL), M-HC, M(BL)-HC, P-HC, M(DG), or M(DGT); and "zz" can be blank, HV, F-B, or F-BH
Boviet Solar	BVM66aMb (xxx) c-d where "a" can be 12, or 13; "b" can be M(L), M9(L), or M; "c" can be S, S-H, or S-H-HC; "d" can be BF or BF-DG.
Canadian Solar	CSbY-xxxZ Where "b" can be 1, 3 or 6; "Y" can be H, K, L, N, P, U, V, W, X or Y; and "Z" can be M, P, MS, PX, M-SD, P-AG, P-SD, MB-AG, PB-AG, MS-AG, or MS-SD
CSUN	CSUN xxx a-b Where "a" can be 60 or 72; "b" can be P or M.
ET Solar	ET-YZZZxxxAA Where "Y" can be P, L, or M; "ZZZ" can be 660, 660BH, 672, 672BH, 754BH, 766BH, 772BH; and "AA" can be GL, TB, TW, WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
GCL	GCL-a-(xxx)-b Where "a" can be M3, M6, P3, or P6; "b" can be 72, or 72H.
Hansol	ND-AN3 (300, 305, 310, 315, 320, 325, 330) HS (290, 295, 300, 305, 310, 315, 320, 325, 330) ME-V001
Hanwha Solar (Q Cells)	B.LINE PLUS L G4.1 (317 - 347) B.LINE PLUS L G4.2 (317 - 347) Q.p L-Ga(xxx)b Where "p" can be Peak, Peak DUO, Plus, Plus DUO, or Pro; "a" can be 4, 4.1, 4.2, 5, 5.2, 5.3, 6, 6.1, 6.2, 6.3, 7, 7.1, 7.2, 7.3, 7.4, 7.7, 8, 8.1, 8.2, 8.3, 9, 9.1, 9.2, or 9.3; "b" can be blank or /BF.
Heliene	72-a (xxx) Where "a" can be M, P, BLK.
JA Solar	JAMabc(xxx)d Where "a" can be 60, or 72; "b" can be D, or S; "c" can be 00, 30 or 09; "d" can be BP, MB, PR.

MANUFACTURER	MODEL(S), WHERE "XXX" IS THE MODULE POWER RATING
Jinko Solar	JKM (xxx) a-b Where "a" can be P, PP, or M; "b" can be 72, 72-J4, 72-V, 72H-V, 7RL3-TV, or 7RL3-TV-A3-US.
LG	LG(xxx)a-b Where "a" can be N2W, N2T, or S2W; and "b" is A5.
Longi	LRn-bc(xxx)d Where "n" can be 4, 5, or 6; "b" can be 60 or 72; "c" can be HBD, HPB, HPH, HPM, HPB/HIB, HPH/HIH, or BP; "d" can be M or Blank.
Panasonic	SC(xxx) B2
Seraphim	SRP-(xxx)BMA-BG
SEG	SEG-(xxx)BMA-BG
S-Energy	SD20/25-72BDE (xxx)
Silfab	SYY-Z-xxxAb Where "YY" can be IL, SA, LA, SG or LG; "Z" can be blank, M, P, or X; "A" can be blank, B, H, M, N; and "b" can be A, C, G, K, L, N, T, U or X
Suniva	OPTxxx-AA-B-YYY-Z Where "AA" is either 60 or 72; "B" is either 4 or 5; "YYY" is either 100,101,700,1B0, or 1B1; and "Z" is blank or B
Sunpower	E20-(320-327)-COM
Talesun	TP572 - (320-330) TPH6H72M-360, 365, 370, 375, 380
Trina Solar	TSM-PD14(xxx) TSM-PE14A(xxx) TSM-PE15H TSM-ab(II)(xxx) TSM-DEGab.20(II)(xxx)
Vsun	VSUN(xxx)-ab-c Where "a" can be 60, 72, or 144; "b" can be M, or BMH; "c" can be BB, DG, or blank.
Vikram Solar	VSMa.72(xxx).05 Where "a" can be DT, or DHT.
Znshine	ZXMa-bc(xxx) Where "a" can be 6, or 7;_ "b" can be LDD, NH, NHLDD, NHDB, SH, SHLDD, or SHDB: "c" can be 72, 120, or 144.

7- Product Maintenance

a) General Inspection Notes:

For the purpose of annual maintenance inspections, we suggest using the following strategy for site planning purposes. Annual inspections will be performed on ten percent (10%) of the total number of tables within the site. These samples are to be randomly chosen from all tables within the site. Once a table is inspected or repaired, the table location must be recorded on the inspection and maintenance log located in the Appendix 3 of this manual. The inspection history of the site must be provided to the maintenance Contractor prior to each annual inspection to ensure that new tables are selected for inspection each year.

b) Racking Structure:

Inspect all bolted joints for any indications of connection slippage as well as loose or missing fasteners. Should you find a loose or missing fastener, replace the fastener then re-tighten the entire table to the specifications listed in the fastener tightening table provided on this manual. If no indications are noted proceed to the next table in the zone. Once a rack has been inspected during a random check, it shall not require subsequent checks in following years. Inspect the rack for general damage as well. General damage can be anything causing permanent deformation that will affect the performance or structural integrity of the component(s). Record your findings on the inspection and maintenance log located in the Appendix of this manual.

Condition	Action
Missing fasteners	Replace fasteners, tighten to published specification Re-tighten the entire table
Visual connection slippage / gaps	Re-tighten the entire table
Bent or twisted support beams	Replace components
Deeply scratched or gouged surfaces	Refer to the corrosion repair process in the corrosion inspection section

c) Fastener Replacement:

Refer to the fastener specification list of this manual for the correct fastener dimensions, class and grade. It is important to utilize a zinc coated fastener to avoid corrosion issues. Replacement fasteners must be coated after installation, on all sides with a layer of zinc rich paint that meets or exceeds ASTM A780 to guard against corrosion.

d) PV Module Clamps:

Inspect the PV module mounting brackets to ensure they have not loosened. By hand only, attempt to rotate the module clamping brackets that secure the module to the racking structure for no less than 8 panels. Record your findings on the inspection and maintenance log located in the Appendix of this manual.

Condition	Action
Clamp moves with hand pressure	Replace the nut and grounding device and tighten to specification. Refer to the fastener tightening table of this manual.

e) Welded Component Inspection

Visually inspect the structure for any signs of degradation such as obvious cracks, component separation, etc. Record your findings on the inspection and maintenance log located in the Appendix of this manual.

Condition	Action
Cracks or separation of welded areas	Take photo documentation of the condition and contact Polar Racking for repair authorization
Red rust corrosion	Repair as per Section g (Corrosion Repairs) of this manual

f) Corrosion Inspection:

Repair any surface corrosion in excess of 3% red rust according to ASTM D610 for general or spotted rust as shown in Appendix 2. The representative images shown in are 1:1 scale. Therefore, repair is only required when the steel member exhibits a corrosion amount above 3% red rust over the entire surface. Edge rust is acceptable and does not require additional action.

g) Corrosion Repairs:

To repair, remove the red rust corrosion either by sand blasting or local sanding/ grinding. Clean the affected area thoroughly in accordance with the paint manufacturer specifications. Cover the affected area using zinc-rich paint to protect the bare steel. Use any spray-on or brush-applied paint that meets or exceeds ASTM A780. Document the repair location of the affected table and record the date of repair in the Inspection Log Sheet located in the Appendix 3. Consult with Polar Racking for replacement steel components that exhibit excessive corrosion such as through-hole perforation. Record any additional issues and actions taken during the corrosion inspection on the inspection and maintenance log located in the Appendix 3 of this manual.

8- Warranty and Product Maintenance

IMPORTANT WARNING	
It is critical that the Polar Racking is properly and securely attached together and installed on the piles. Improper installation could result in injury or damage to people and property including, but not limited to, the installer(s), building, 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 the installation manual that is 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 seek professional help from a competent installer to install the Product.

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/or defects due to poor workmanship for a period of ten (10) years from the date or 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/or defects due to poor 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, 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; modifications or repairs not performed or authorized by Polar; overloading; miss-use, 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.. 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.

APPENDIX 1- CORE FLEX RACK COMPONENTS TESTED AND APPROVED FOR GROUNDING AND BONDING

Table 2: CORE FLEX Portrait Rack Components

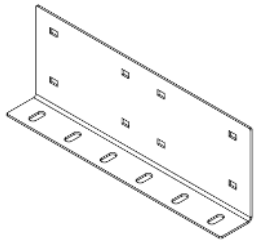
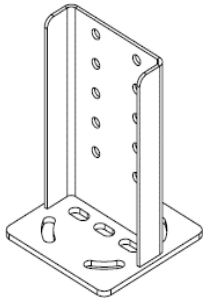
Item no.	Name	Manufacturer/ trademark[2]	Type / model	Technical data	Used in	Photo
1	8" East-West Bracket	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** Hot dipped galvanized as per ASTM A123, Grade 75, **Details:** Length 370mm for 8" beam. **Thickness**: Ga10.	Single and Dual Leg	
2	8" Splice	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** Hot dipped galvanized as per ASTM A123, Grade 75, **Details:** Length: 203.2mm for 8"beam respectively. **Thickness**: Ga10.	Single and Dual Leg	
3	Foot Bracket	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** Hot dipped galvanized as per ASTM A123, Grade 75, **Details:** Length x Width x Height: 250mmx190mmx288mm **Thickness**: Plate: 8mm; Leg: 5mm.	Dual Leg	

Table 2: CORE FLEX Portrait Rack Components (CONTINUED)

Item no.	Name	Manufacturer/ trademark[2]	Type / model	Technical data	Used in	Photo
4	North-South Beam	Polar Racking, Inc.	Various	**Material:** 50 ksi min.-prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 3.5"X8" Standard C shape, **Length**: Varies, **Thickness**: Ga16-Ga12.	Single and Dual Leg	
5	Brace	Polar Racking, Inc.	Various	**Material:** 50 ksi min.-prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 2"x2.5" Standard C shape, **Length**: Varies **Thickness**: Ga16-Ga12.	Single and Dual Leg	
6	East-West Beam	Polar Racking, Inc.	Various	**Material:** 50 ksi min.-prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 3"x6" or 3.5"x8" Standard C shape, **Length**: Varies **Thickness**: Ga16-Ga12.	Single and Dual Leg	

Table 2: CORE FLEX Portrait Rack Components (CONTINUED)

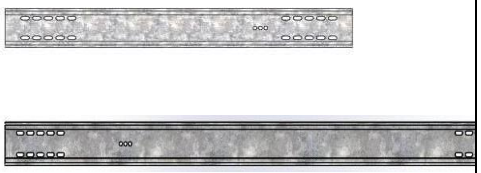
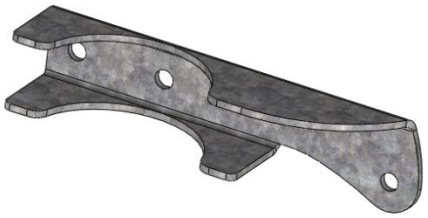
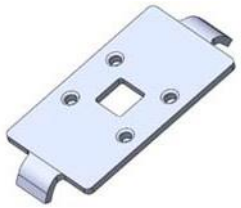
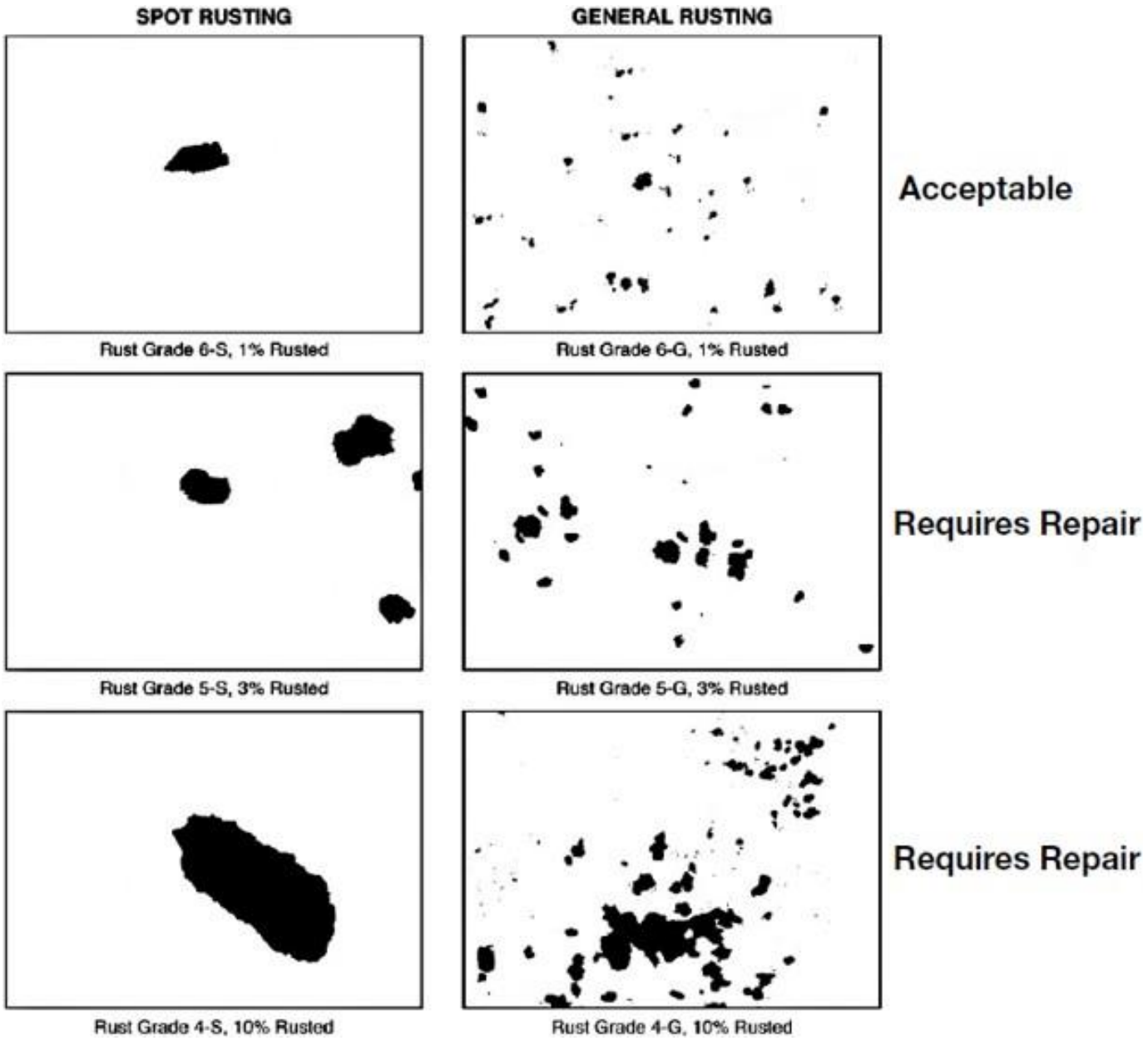
Item no.	Name	Manufacturer/ trademark[2]	Type / model	Technical data	Used in	Photo
7	Leg	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 3"x6" short and long legs, Standard C shape, **Length**: Varies **Thickness**: Ga16-Ga12.	Dual Leg	
8	Bracket bottom	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 5.5"&5.563"OD,, standard **Thickness**: Thk 6 mm	Single post	
9	Bracket top front	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 5.5" & 5.563" O.D., 15-35°, standard **Thickness**: 4.76 mm THK	Single post	

Table 2: CORE FLEX Portrait Rack Components (CONTINUED)

10	Bracket top back	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Details:** 5.5" & 5.563" O.D., standard **Thickness**: 4.76 mm THK	Single post	
11	End-Clamps *	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Pre-galvanized as per ASTM 653, **Height**: 30-50mm **Thickness**: Ga10.	Single and Dual Leg	
12	Intermodular -Clamps *	Polar Racking, Inc.	Various	**Material:** 50 ksi min.- prime steel; **Finish:** G90 Hot dipped galvanized per ASTM 653, **Details:** Length: 50mm. **Thickness**: Ga10.	Single and Dual Leg	
13	Grounding Lug	ILSCO- SGB-4	Various	UL 467 compliant with use of 4-14AWG solid copper conductors, assembly consist of: tin- plated, solid copper lay- in lug with SS set screw, torqued at 35 in-lbs.	Single and Dual Leg	

APPENDIX 2 – RED RUST GRADING ACORDING TO ASTM D610, Fig 29



APPENDIX 3 – INSPECTION AND MAINTENANCE LOG SHEET

Inspection Start Date	Inspector Name (print)	Inspector Signature	Customer Name (print)	Customer Signature

Inspection Zone	Table Location	Inspection Type F=Fastener, W=Weld, V=Visual	Details of Inspection/Maintenance Performed

APPENDIX 4 – TABLE LEG CONVERSION KITS

Quantity Summary, CORE FLEX Replacement Kit, Single Post to Dual Leg							
Part Number	**Description**	**Profile**	**Finish**	**Length (mm)**	**Sheet Thickness (ga)**	**Sheet Thickness (mm)**	**Quantity**
900799001	Foot Bracket Assembly, 8" Beam, 4x150mm Bolt Circle, HDG	8" Beam	HDG	-	-	-	4
301182001	Table Leg, Back, C8x3.5x1.5, 2387 mm, 1.80mm THK, G90, 30° tilt	C8x3.5x1.5	G90	2,387	-	1.8	2
301181001	Table Leg, Front, C8x3.5x1.5, 1392 mm, 1.80mm THK, G90, 30° tilt	C8x3.5x1.5	G90	1,392	-	1.8	2
100064002	Bolt, Hex Flange, Serrated, 1/2"-13 x 1-1/2", Gr. 5, Magni 565	-	Magni 565	-	-	-	32
100063002	Nut, Hex Flange, Serrated, 1/2"-13, Gr. 5, Magni 565	-	Magni 565	-	-	-	28
100011004	Washer, Flat, 1/2" x 1.375" O.D., Steel, HDG	-	Magni 565	-	-	-	14

Quantity Summary, CORE FLEX Replacement Kit, Dual Leg to Single Post							
Part Number	**Description**	**Profile**	**Finish**	**Length (mm)**	**Sheet Thickness (ga)**	**Sheet Thickness (mm)**	**Quantity**
300177001	Bracket, Bottom, 5.5" & 5.563" O.D., 6 mm THK, HDG	5.5" & 5.563" O.D.	HDG	-	-	6	2
300176001	Bracket, Top, Back, 5.5" & 5.563" O.D., 4.76 mm THK, HDG	5.5" & 5.563" O.D.	HDG	-	-	4.76	2
300175001	Bracket, Top, Front, 5.5" & 5.563" O.D., 15-35°, 4.76 mm THK, HDG	5.5" & 5.563" O.D.	HDG	-	-	4.76	2
300230XXX*	Foundation* (Designed by others)	-	-	-	-	-	2
100035012	U-Bolt, 1/2"-13 x 5-5/8" x 7-13/16", 3" Thread Length, Gr. 5, Magni 565	-	Magni 565	-	-	-	2

APPENDIX 5 – DISCLAIMER

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Revision log

Revision	Date	Description
A	29-MAY/2023	PRELIMINARY
B	12-JUN/2023	REVISION 1