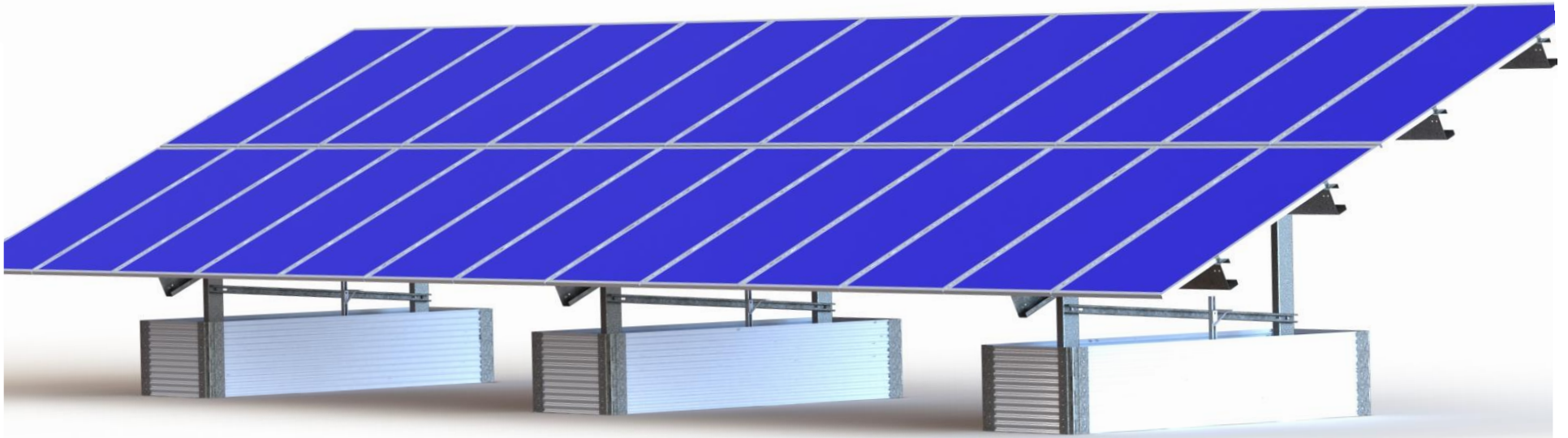




CORE - INSTALLATION MANUAL ***BALLASTED PORTRAIT SYSTEM***



ETL CLASSIFIED



Intertek

UL2703 Classified for Bonding and Grounding

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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.

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.

	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 fastener torquing & marking is required per specification.
	Denotes that adjustment or positioning can be performed.
	Denotes that leveling and/or alignment is required.

Figure 1: Information and Safety Symbol Legend.

2. Tools and Hardware

a) Tools

		 Power Drill	 Laser Level or String Line
3/4" Socket	1/2" Hex Bolt / Nut		
9/16" Socket	3/8" Hex Bolt / Nut		
1/2" Socket	5/16" Hex Bolt / Nut		
 Torque Wrench		 Tape Measure	 Compass
 Level		 Square	

Figure 2: Tools Required for installation.

b) Hardware

Various A-Frame Connections – (HDG or Magni 565)

- A** 1/2"–13 Serrated Flange Bolt, 1" Length, Gr. 5
1/2"–13 Serrated Flange Nut, Gr. 5

Various Bracketry Connections – (HDG or Magni 565)

- B** 3/8"–16 Carriage Bolt, 1" Length, Gr. 5
3/8"–16 Serrated Flange Nut, Gr. 5

Mid-Clamps to Purlin Connections – (18-8 SS or ASTM F594C)

- C** 5/16"-18 x 2-1/2" Bolt, Carriage, (*3" required for PV Heights > 40mm*)
5/16"–18 Serrated Flange Nut (or Hex Nut)
5/16" or a 3/8" Washer, Flat, 1" OD
5/16" or a 3/8" Washer, Lock, 0.680" OD

End-Clamps to Purlin Connections – (18-8 SS or ASTM F594C)

- D** 5/16"–18 Serrated Flange Bolt (or Hex Head Bolt), 1.0" Length
5/16"-18 Serrated Flange Nut (or Hex Nut)
5/16" or a 3/8" Washer, Flat, 1" OD
5/16" or a 3/8" Washer, Lock, 0.680" OD

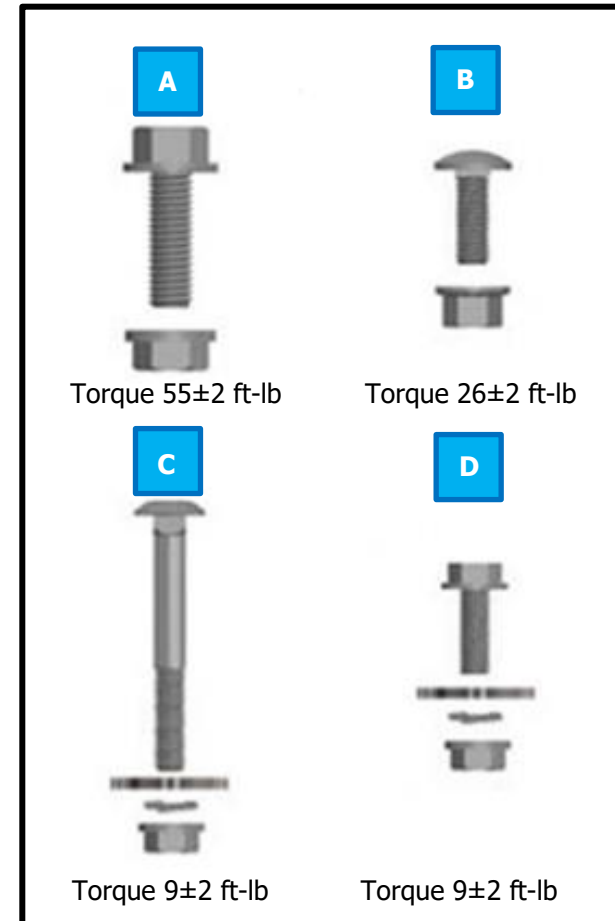
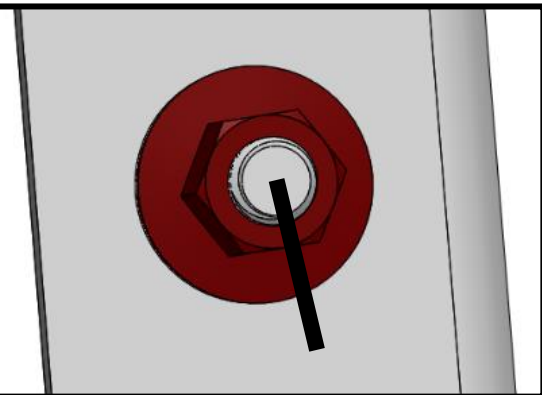


Figure 3: Hardware required for installation.

Important: All fasteners are to be torqued marked, using a sharpie, once torqued to specifications, to indicate that the step is completed. Torque markings should propagate across all components as shown.



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 (**Error! Reference source not found.**).
- Contractors are responsible to make sure all OSHA guidelines and local guidelines are followed, including all state regulations.
- All parts removed from packaging must be visually inspected for any damage or before its use in installation.
- When either in original packaging or removed, products 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.

Important: Parts supplied to site are labelled and coded to indicate part number and table type, it is strongly recommended to maintain proper staging on the laydown area to avoid mixing them or blocking them.

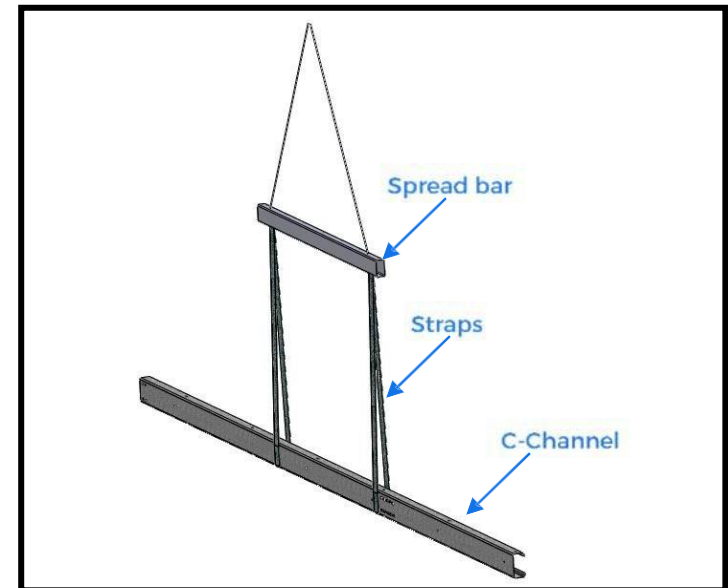


Figure 4: Proper way for lifting beams.

4. Racking Overview

a) Concrete Ballasted

1. Back Leg
2. Front Leg
3. Brace
4. North-South Beam
5. East-West Bracket
6. East-West Beam
7. Mid Clamp
8. End Clamp
9. PV Module
10. Ballast or Basket Assembly
11. Base Plate (Gabion Basket Only)

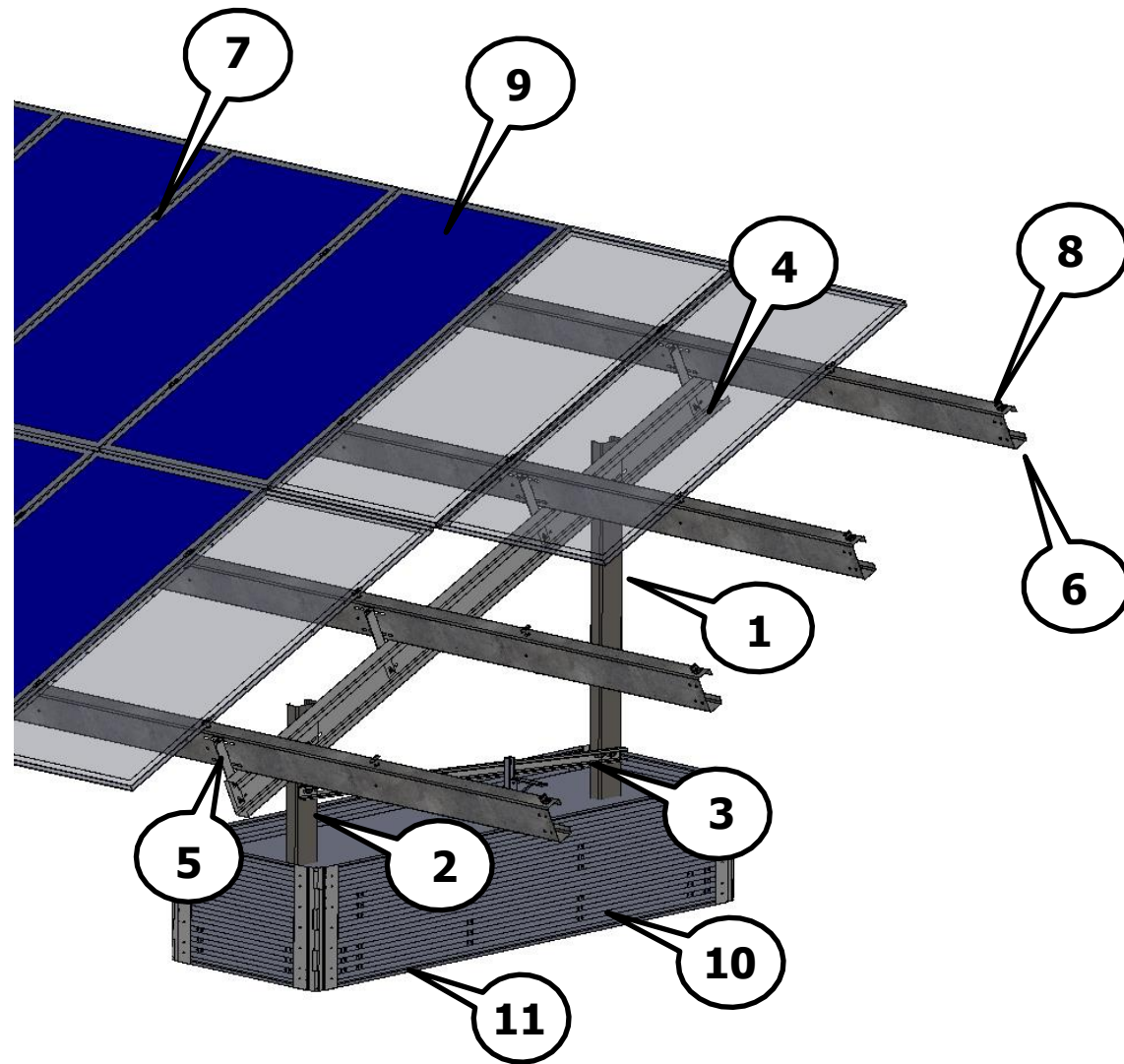


Figure 5: Ballasted Dual leg racking overview.

c) Foundation Options

Ballast options

1. Pour-in-Concrete Ballasted Tub
2. Geo-Ballasted Basket (Gabion Stone)
3. Pre-cast Ballasted Block

For either selection, follow the assembly and set-up instructions as outlined in the manufacturer's installation instructions. Also, consider the recommendation that are 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 to be level relative with the surrounding grade in the E-W and N-S directions.

Pouring of the concrete into the tub must 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 type of ballast is required, please contact Polar Racking for more information.

Foundation Guidelines

- I. Installation of East West beams is to be completed only after ballast material has been added and all table posts are within required tolerances.
- II. Proper compaction of stone is required for Gabion basket ballasts.

For Gabion basket ballasted systems, the mesh of the basket must be below the foot bracket and resting above the base plate.

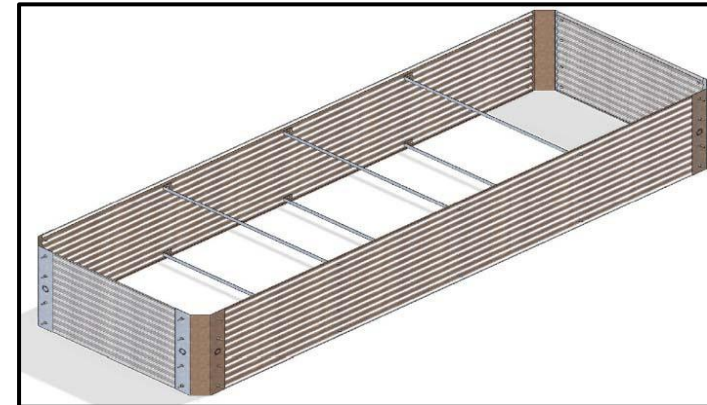


Figure 6: Assembled concrete tub ballast.

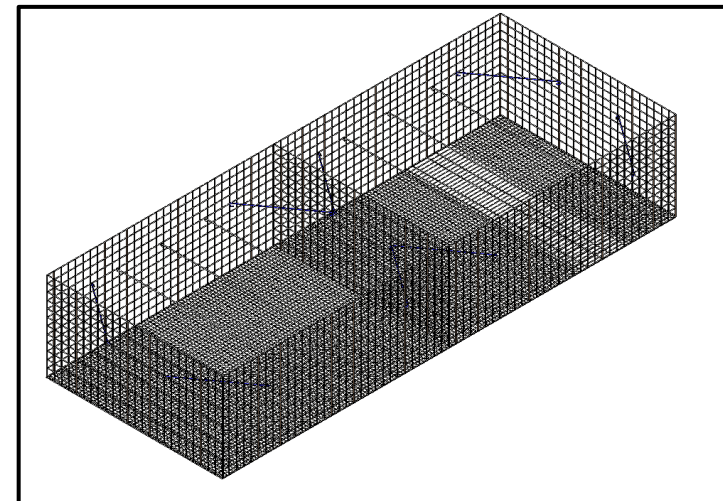


Figure 7: Assembled gabion basket tub.

d) Leg & Ballast Installation Tolerances

- Make sure all posts within assembled A-frames are installed within 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".
 - Optimal Height is defined as setting the post at the best height within tolerance to allow for the greatest range of later posts with respect to grade changes under the table. To install a post to optimal height considers the future post requirements to keep the table level and consistent to those around it.
- North – South Alignment: ± 1 inch (25 mm)
- East – West Spacing: ± 2 inches (51 mm)
- Height: ± 2 inches (51 mm)
- Plumbness: $\pm 1^\circ$
- Rotation: $\pm 2^\circ$

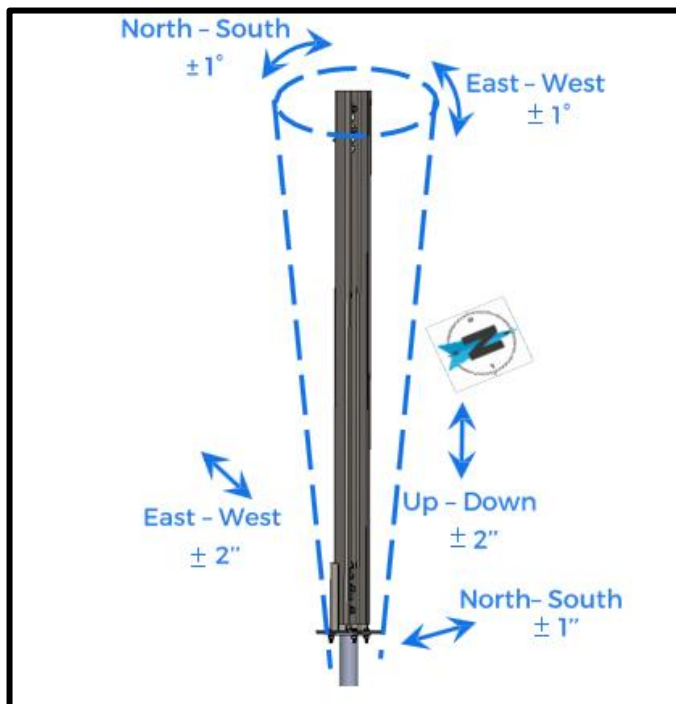


Figure 9: C-Channel Leg installation tolerances.

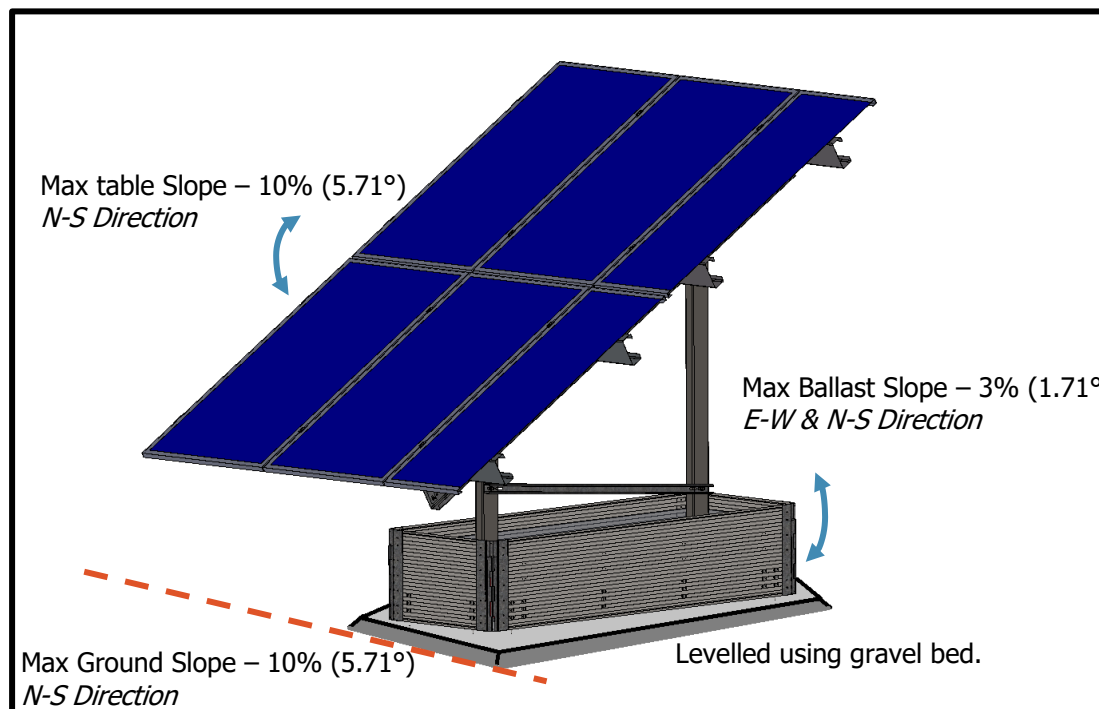


Figure 8: Ballast and table tolerances.

e) Racking Tolerances and Adjustability

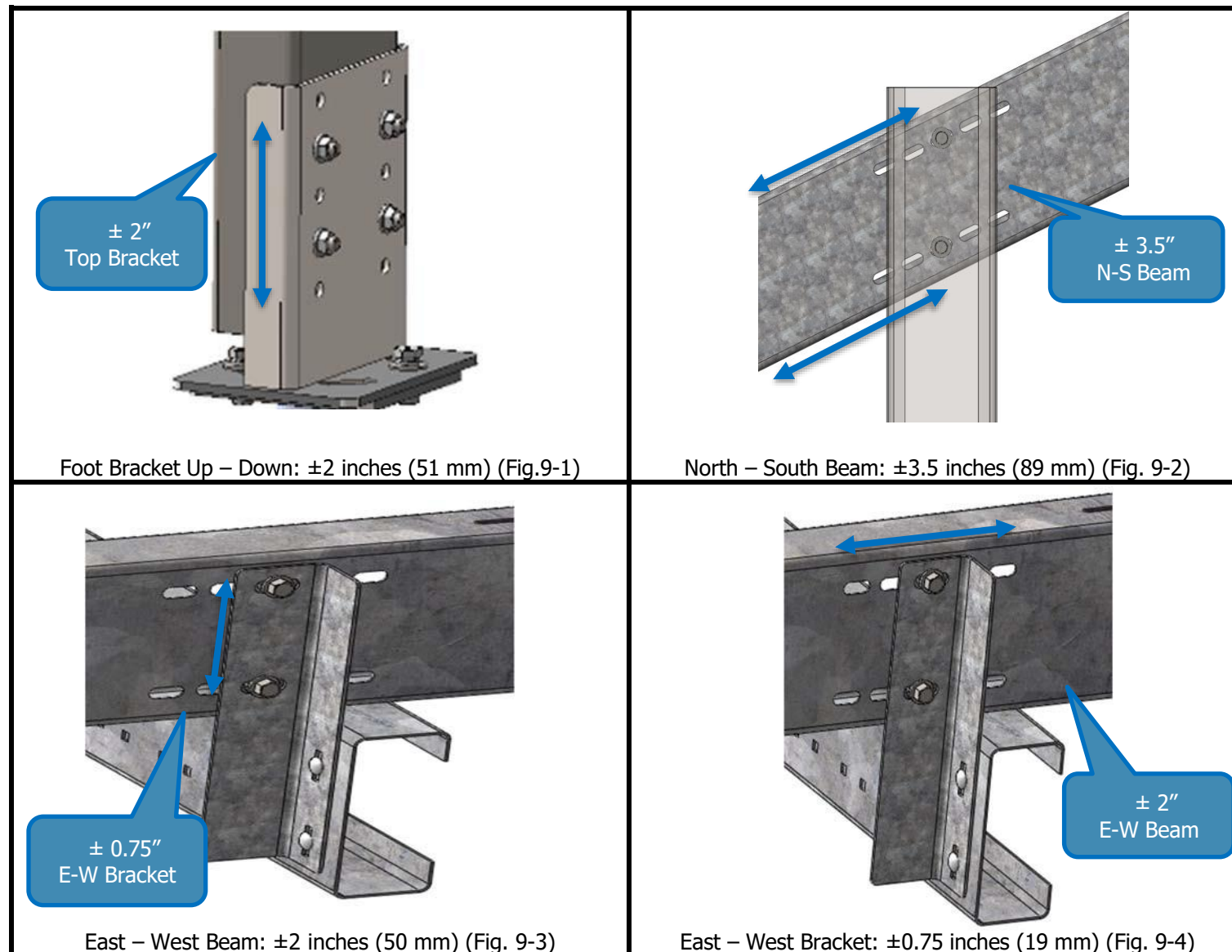


Figure 10: Rack Tolerance and Adjustability for Dual Legs.

5. Installation Instructions

a) A-Frame Construction

Note: Refer to Polar Racking structural drawings for foundation type, optimal height, minimum embedment, and spacing. Ensure 'Post Spacing' is measured from center to center and at the of foundations. Make sure all other pile adaptors are installed within specified tolerances.

Note: For ballasts provided by others, please ensure that all legs are properly fastened or secured to the tub/form. Always follow the instruction from the manufacturer while ensuring that all criteria outlined in the section "A-Frame Construction" are met.

STEP 1. Install both the short and long legs into foot brackets by hand-tightening four bolts and nuts (1/2") in the center of the hole pack. Installing in the center allows for the adjustability up or down later in installation if required. Place the leg assemblies on levelled ground within the future ballast location. Repeat this step for all A-frames on the table.

Important: For Gabion basket installations only, start by placing down the base plate and then the assembled basket or bottom mesh before then placing the foot brackets on top of both, fasten the base plate to the foot bracket using the same 1/2" fasteners underneath. Additionally, STEP 3 (Installing braces) should be completed before the addition of any material to the basket.

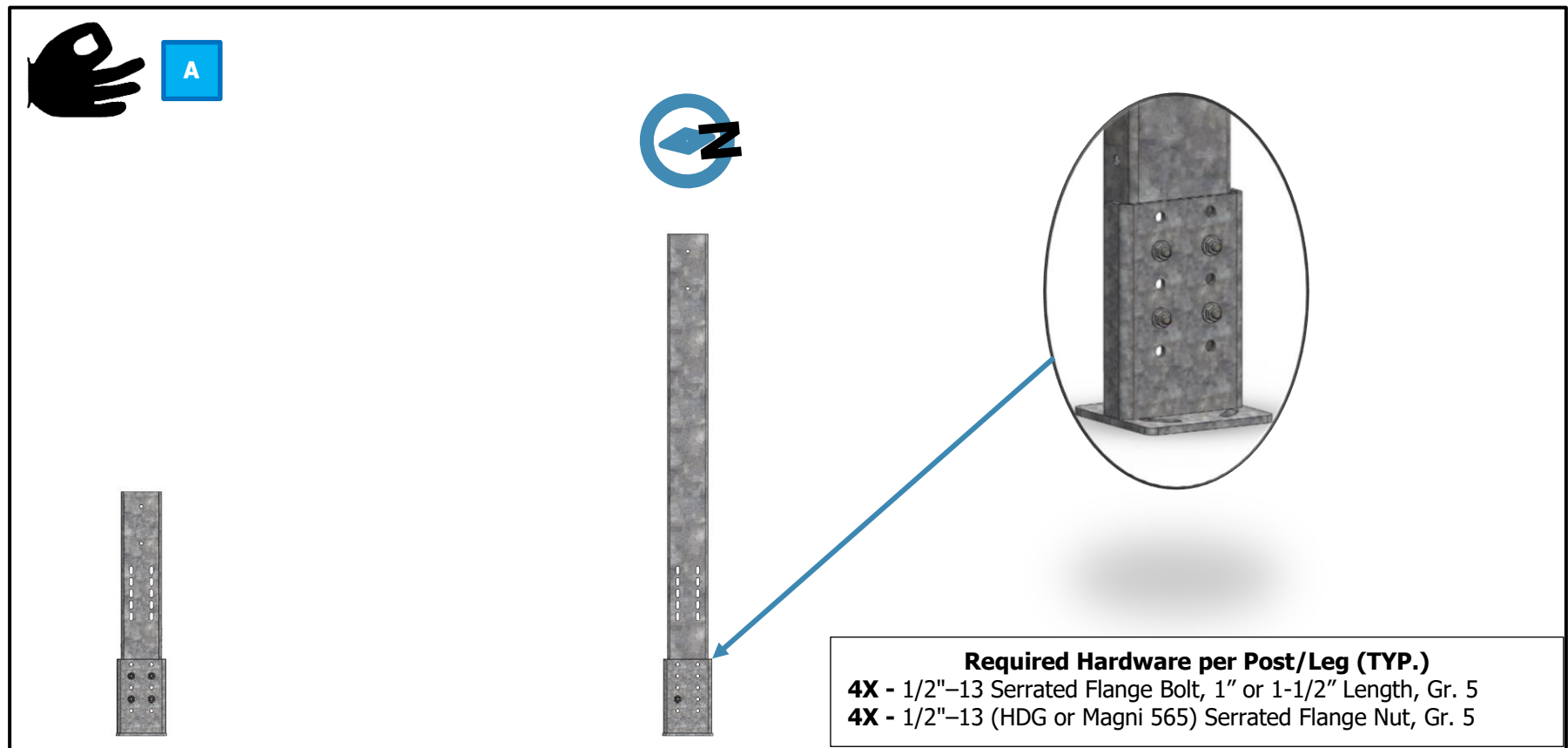


Figure 11: Foot bracket installation.

STEP 2.

Place a string line between the first and last A-frame on the north side and align vertically all middle posts until they are all levelled. Repeat the same process for the south legs. Again, using a string line between the first and last A-frame, align all posts horizontally in the north-south direction and ensure that both the legs are spaced as per the *site-specific engineering drawings*. Once all dimensions are satisfied and in tolerance, proceed to set a temporary support to hold legs in place while torquing fasteners.

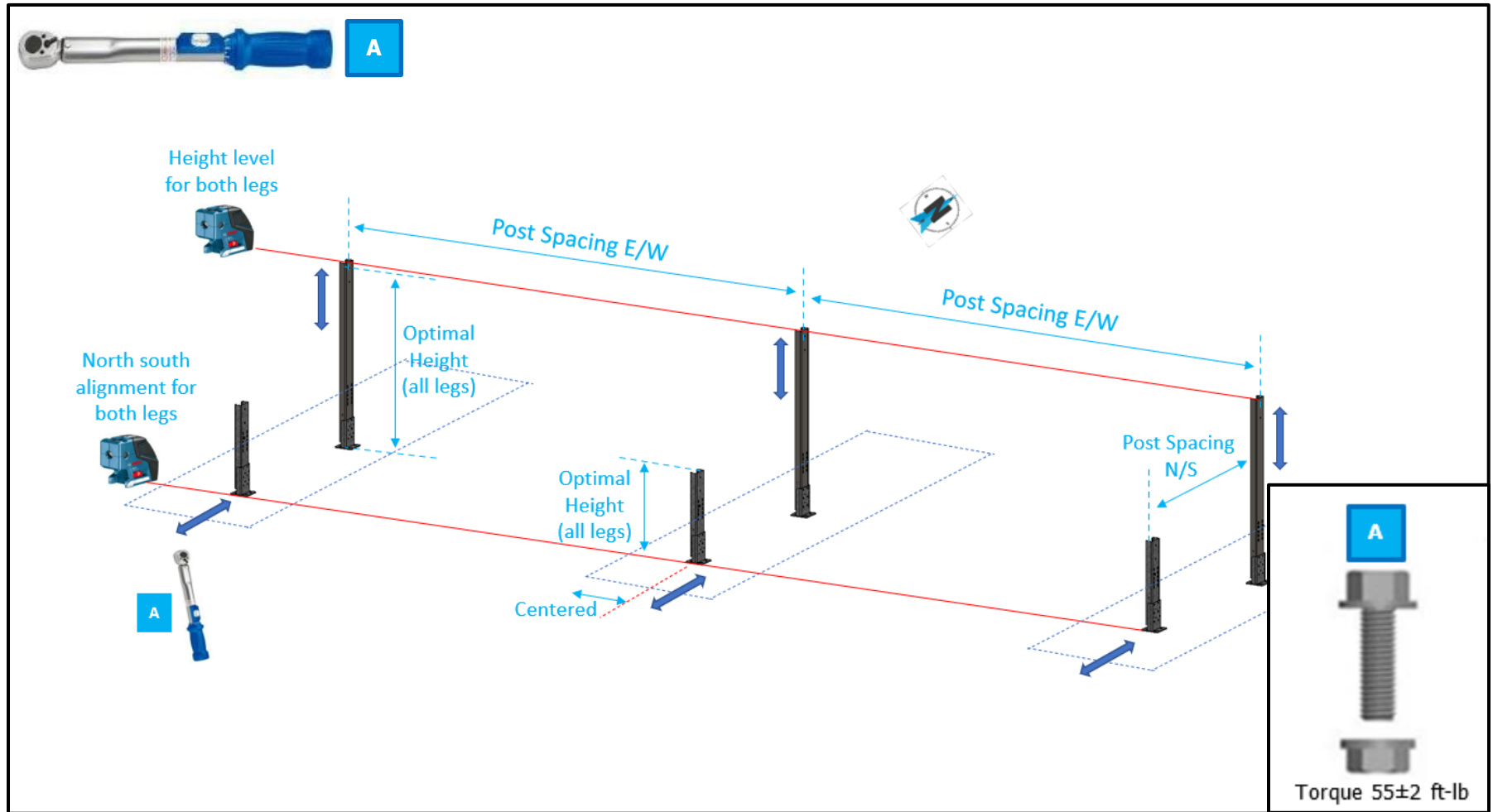


Figure 12: Post Layout & Installation.

QUALITY CHECK:

Proceed to install all rebar (or bracing in the case of Gabion baskets) as per indicated on *site-specific engineering drawings* and tighten using steel wire to prevent them from moving during the pour of the concrete or stone. Material is only to be poured once no further adjustment is required and all Quality checks have been completed.

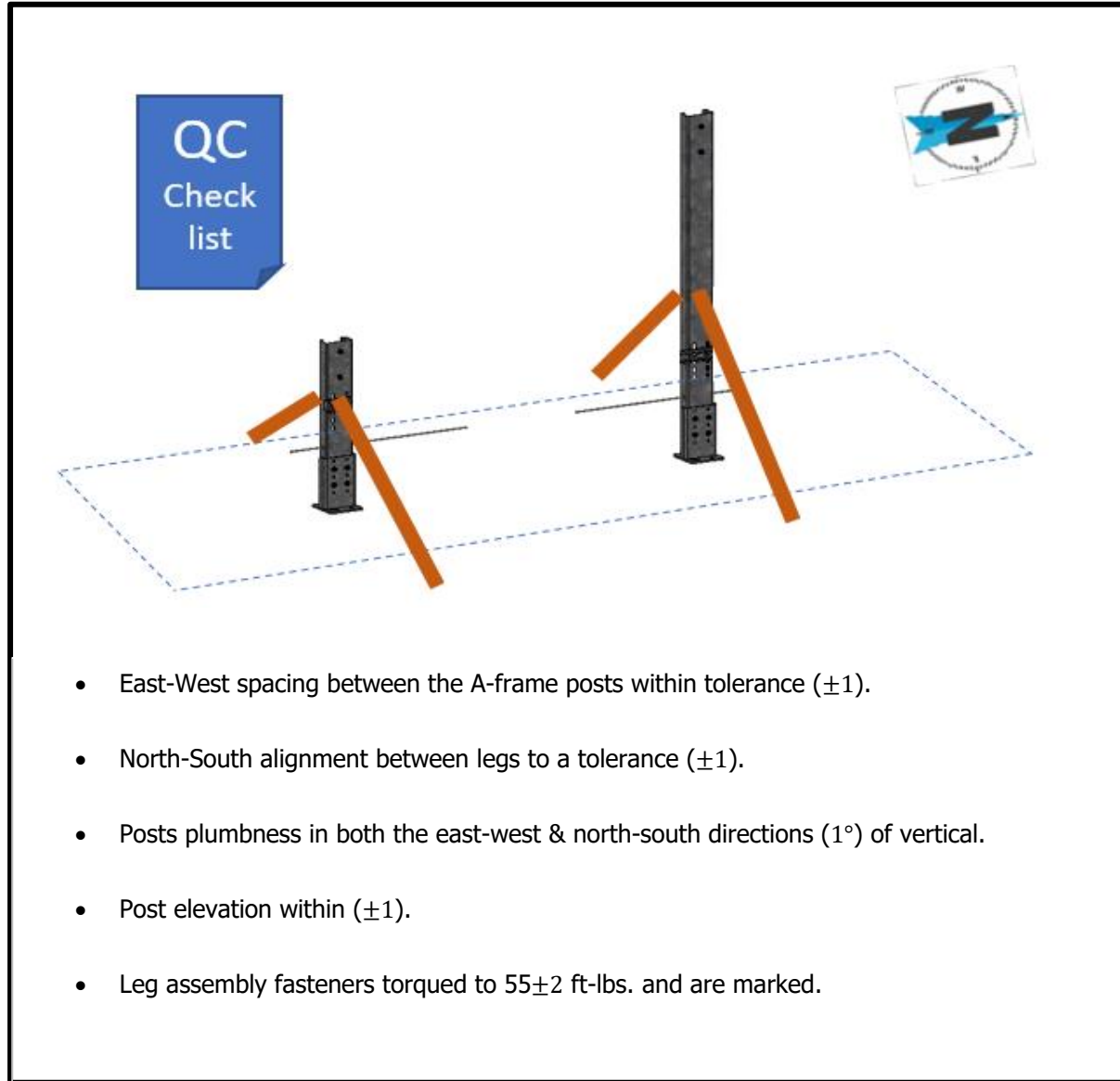


Figure 13: Post Installation (QC Checklist and Concrete Pour).

- STEP 3.** Grab the brace and install it in between the legs at the outermost slots as in the below figure with 2 bolts and nuts (1/2"). **(Number of braces depends on the design loads. Check the *site-specific structural drawings* provided).**

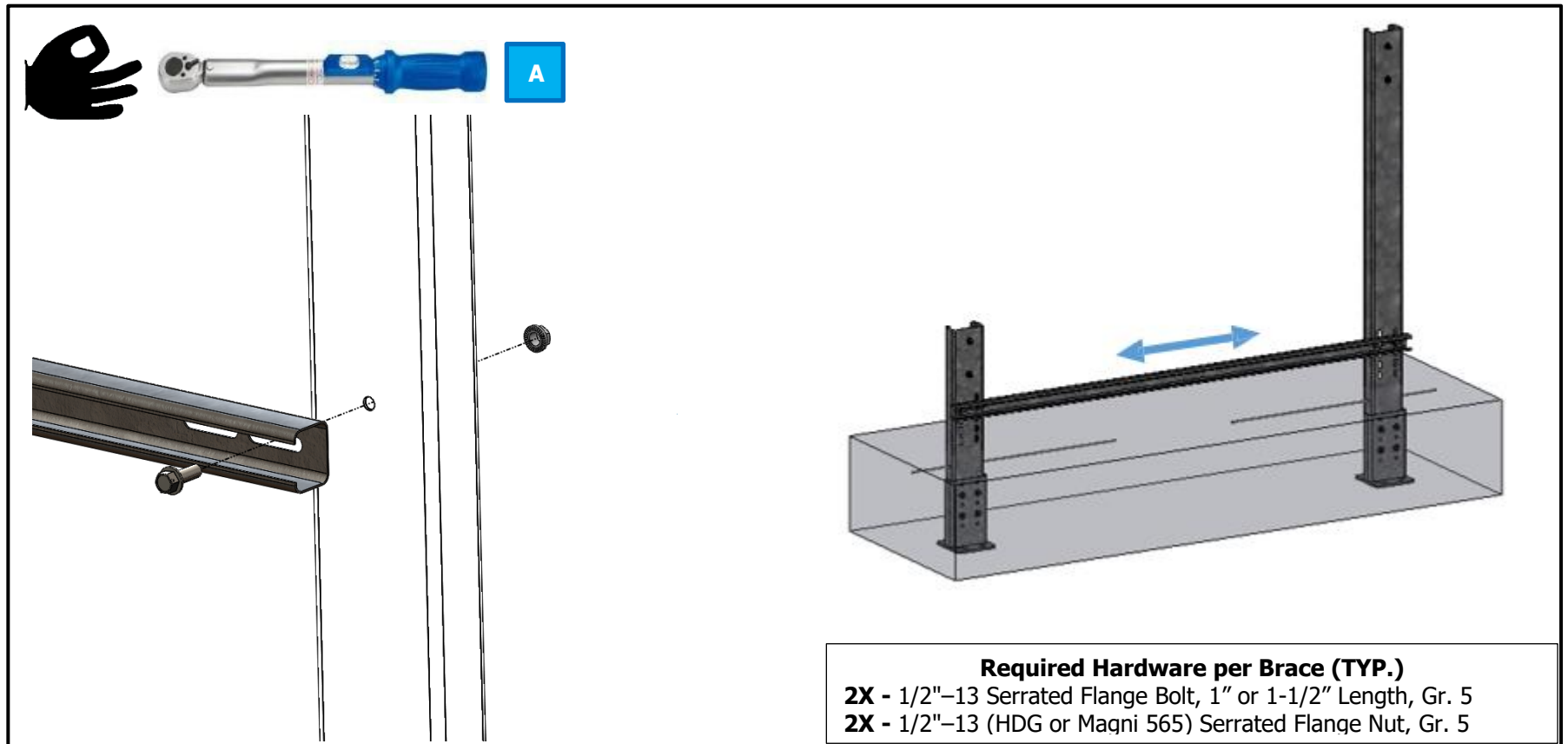


Figure 14: Brace installation.

STEP 4.

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 by hand-tightening it with two bolts and nuts. Position the unfixed end of the North-South beam to the front leg and hand-tighten install with another pair of bolts & nuts.

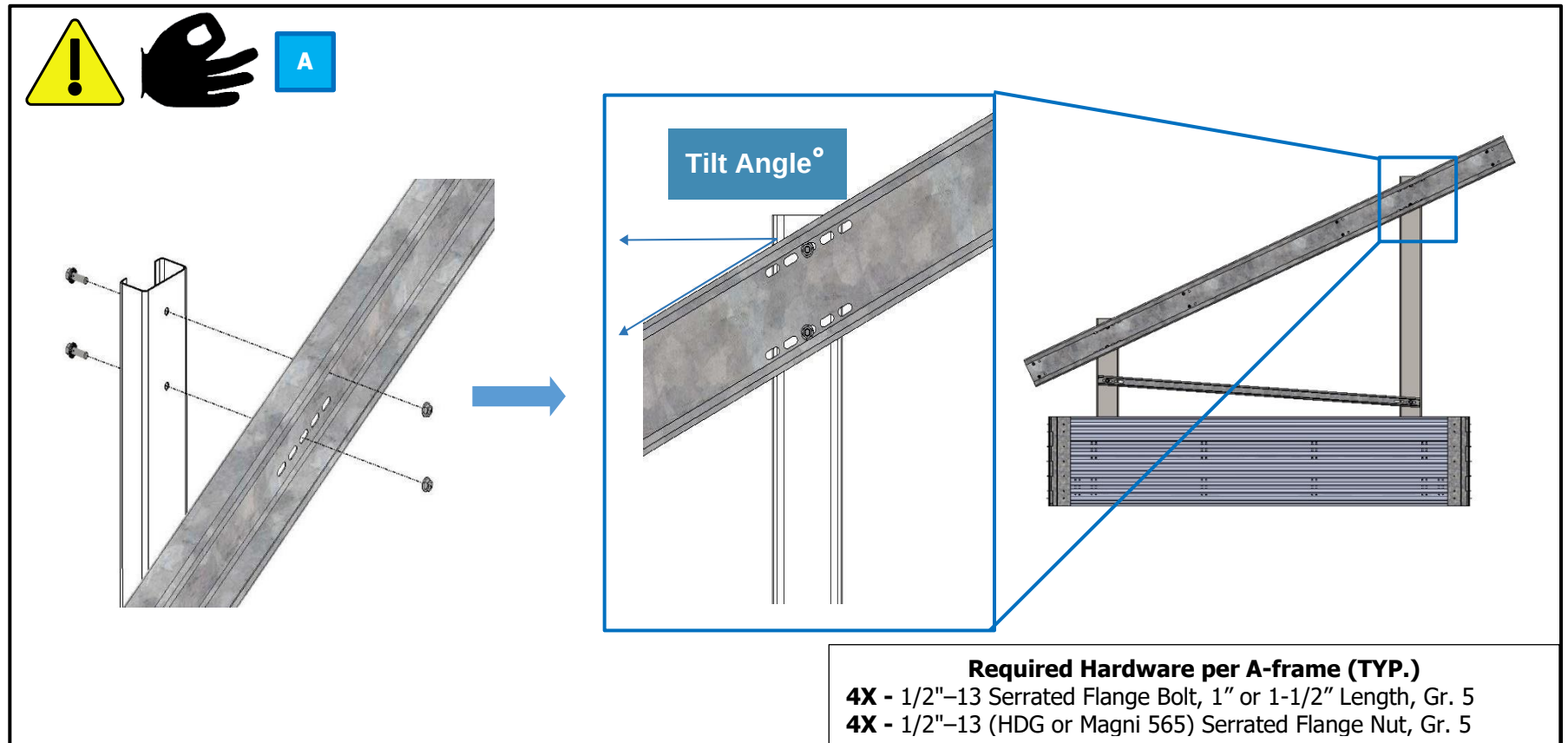


Figure 15: North-South beam installation.

STEP 5.

Align the leading edge of all North-South Beams for the table at the required tilt angle and torque all A-frame fasteners as per specifications shown in section 2-b of this document.

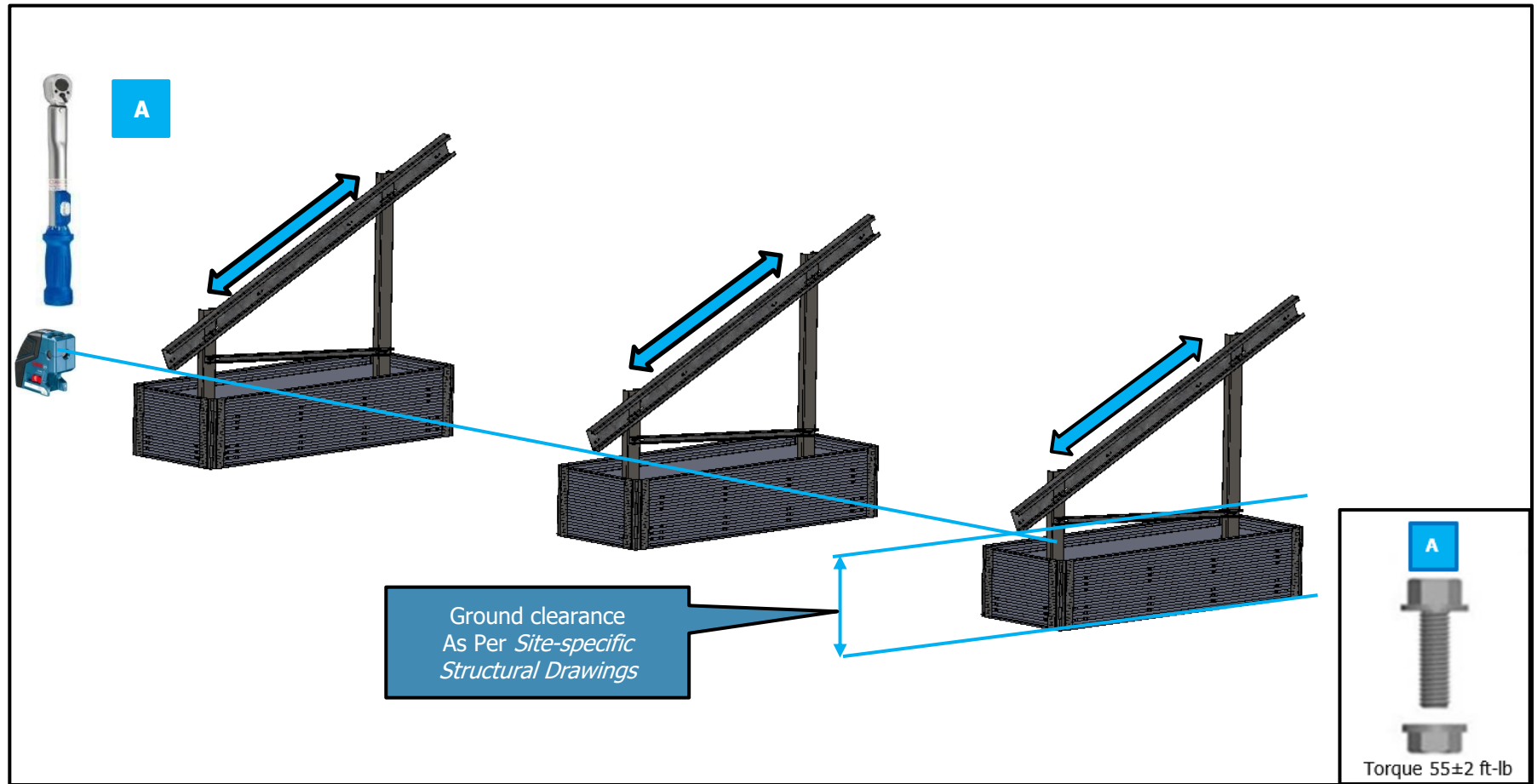


Figure 16: A-Frame alignment.

b) Typical Tabletop Construction

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

Note: Step 3 is not applicable to tables using a single set of East-West beams.

Note: All steps herein will omit visual inclusion of the tub or basket foundation for clarity.

STEP 1.

Install 4 East-West Brackets to each North-South Beam by hand-tightening fasteners using 2 bolts & nuts (3/8") per bracket as shown in the figure below.

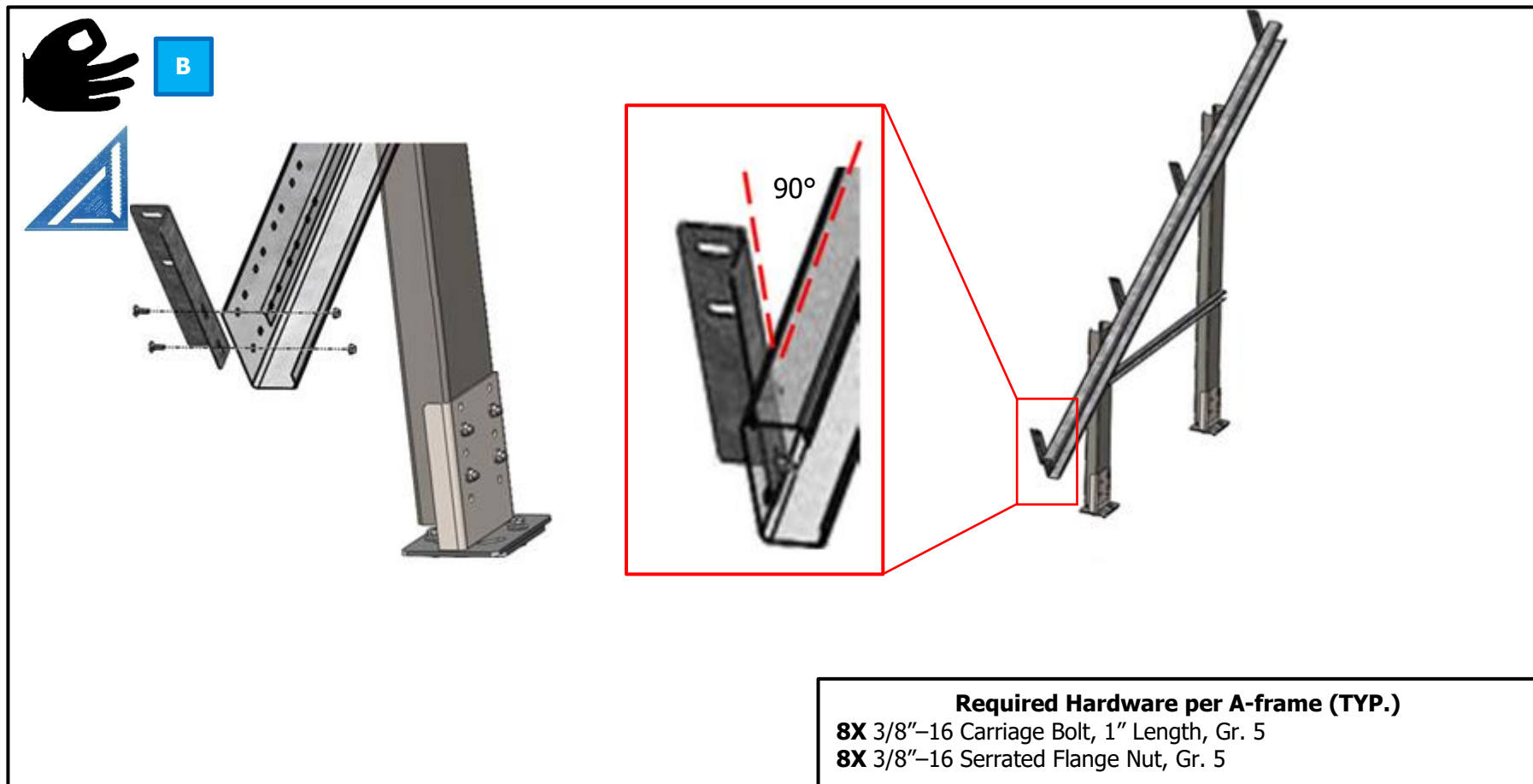


Figure 17: East-West bracket installation.

STEP 2.

Grab each East-West beam 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. Hand-tighten 2 nuts and bolts (1/2") 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. Check that all cantilevered ends of the east-west beams are aligned.

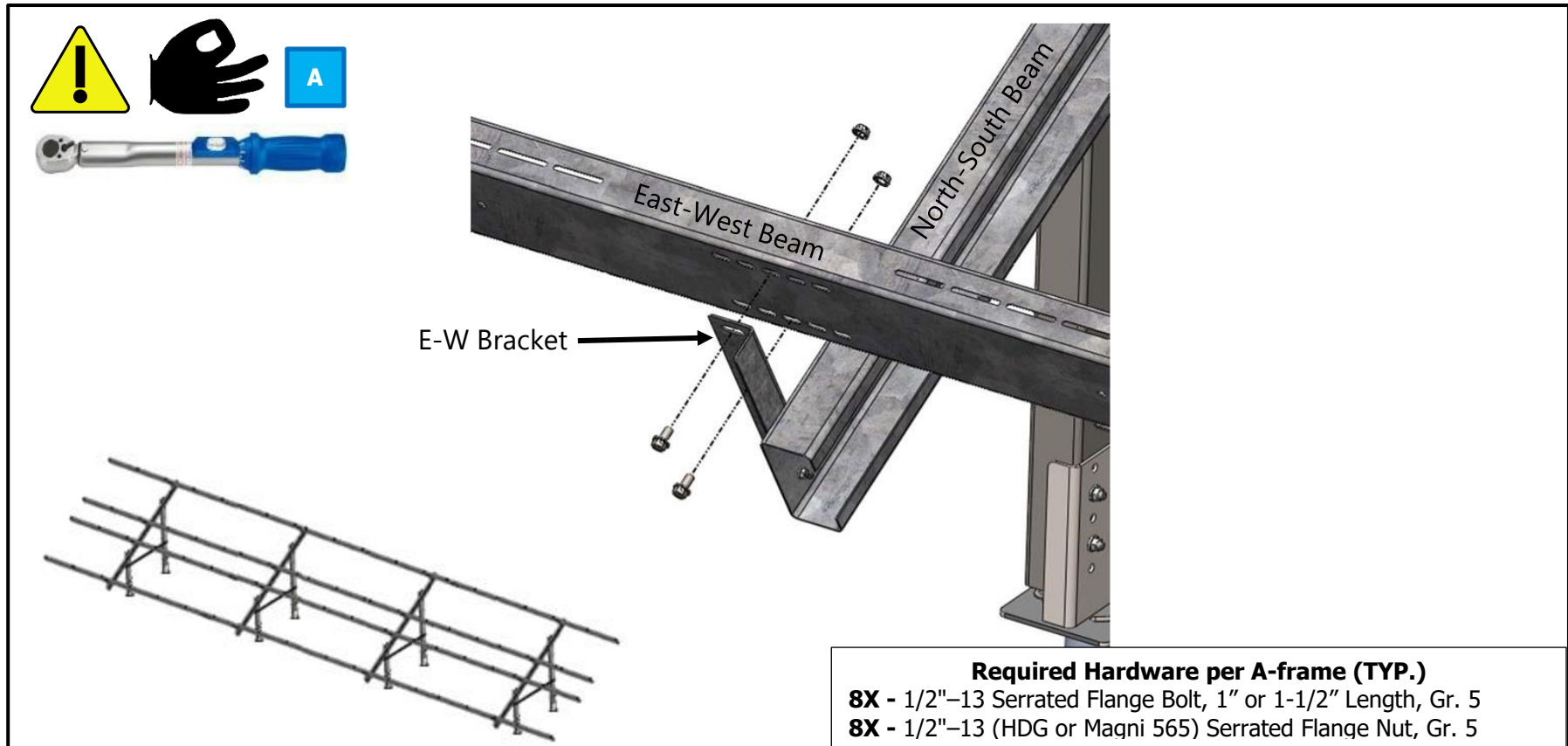


Figure 18: East-West Beam installation

STEP 3.

Mate the east-west beams with a splice as shown in the figure below, leaving minimum 10 mm gap. Use 8 nuts and bolts (3/8") on the web of the east-west beam. After all beams and splices are populated and ensuring that the table is adjusted and square, torque the fasteners as per IFC drawings and section 2-b above.

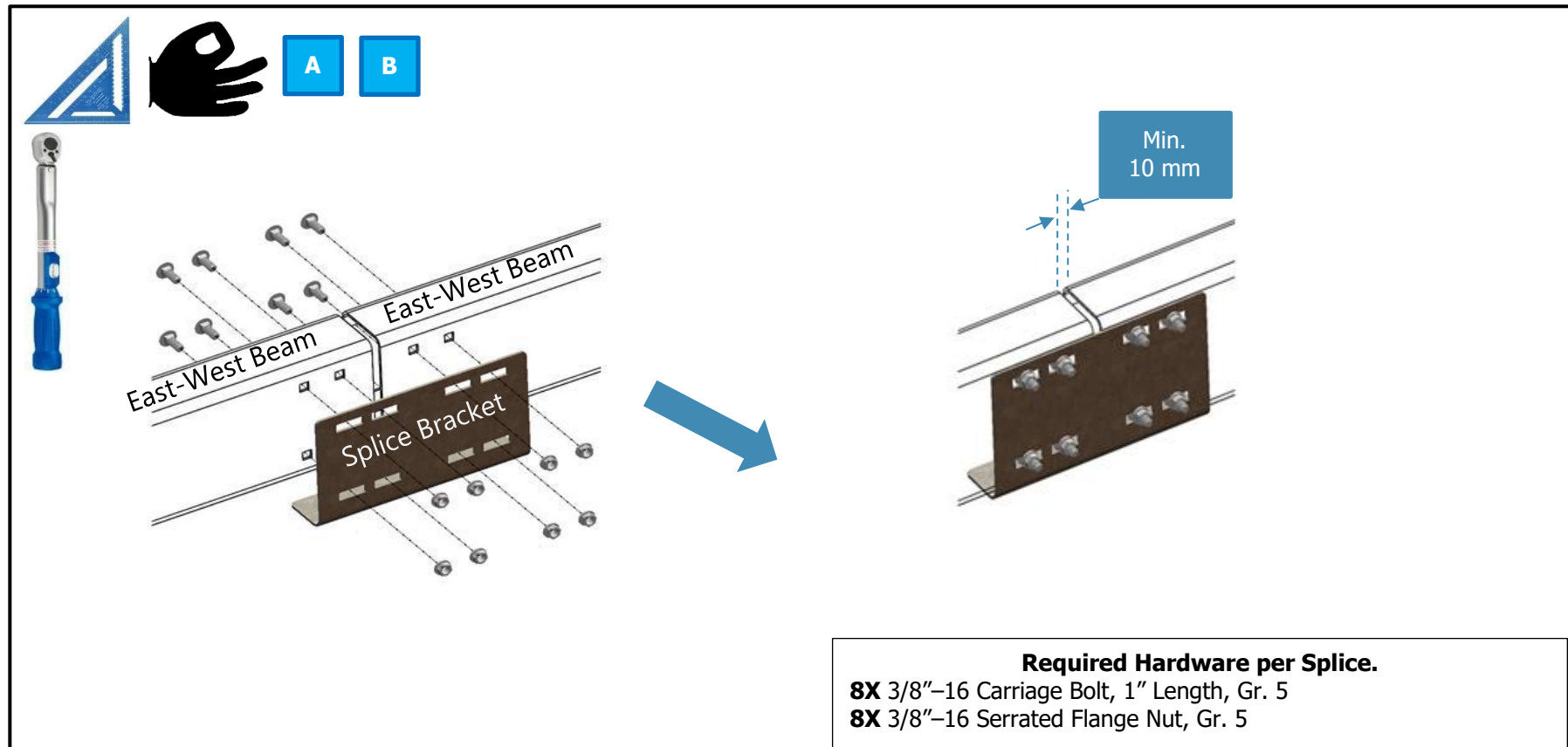


Figure 19: Splice beam installation.

c) PV Module Installation (Top Clamps)

STEP 1.

Start with the South row and the **most easterly** module; position the module on purlins. Check that distance "A" & "B" match with the IFC drawing tables for the corresponding selected PV module width. Fix the first end module with two end-clamps as shown in the figure below using one bolt, washer, lock washer, and nut per clamp. Ensure the vertical wall of the end clamp and the solar module frame are flush and no gap is present. 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.**

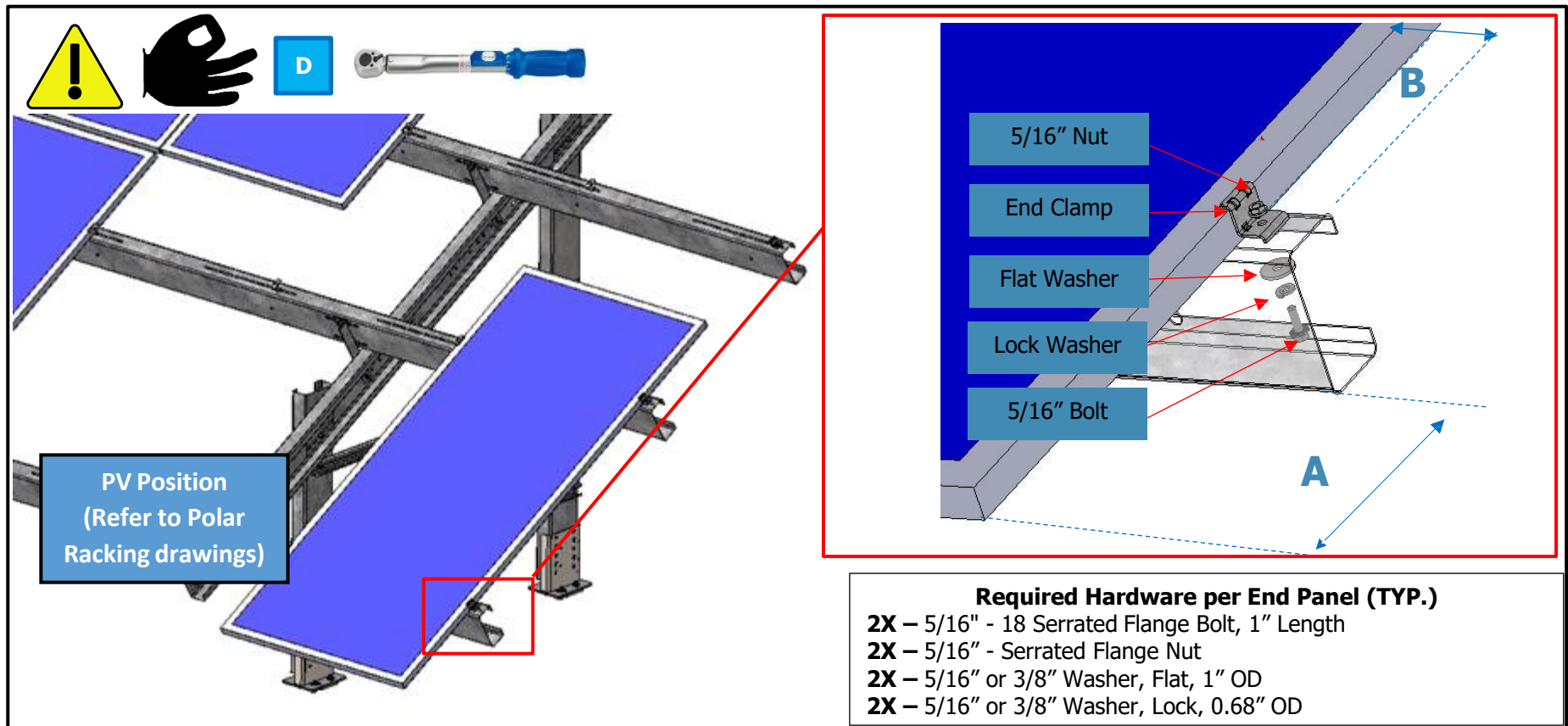


Figure 20: Module to End clamp connection.

STEP 2.

Hand tighten the two Intermodule-clamps as shown in the figure below and the IFC drawings provided. Use one carriage bolt, flat washer, lock washer, and flange nut (5/16") to attach each mid clamp. 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.**

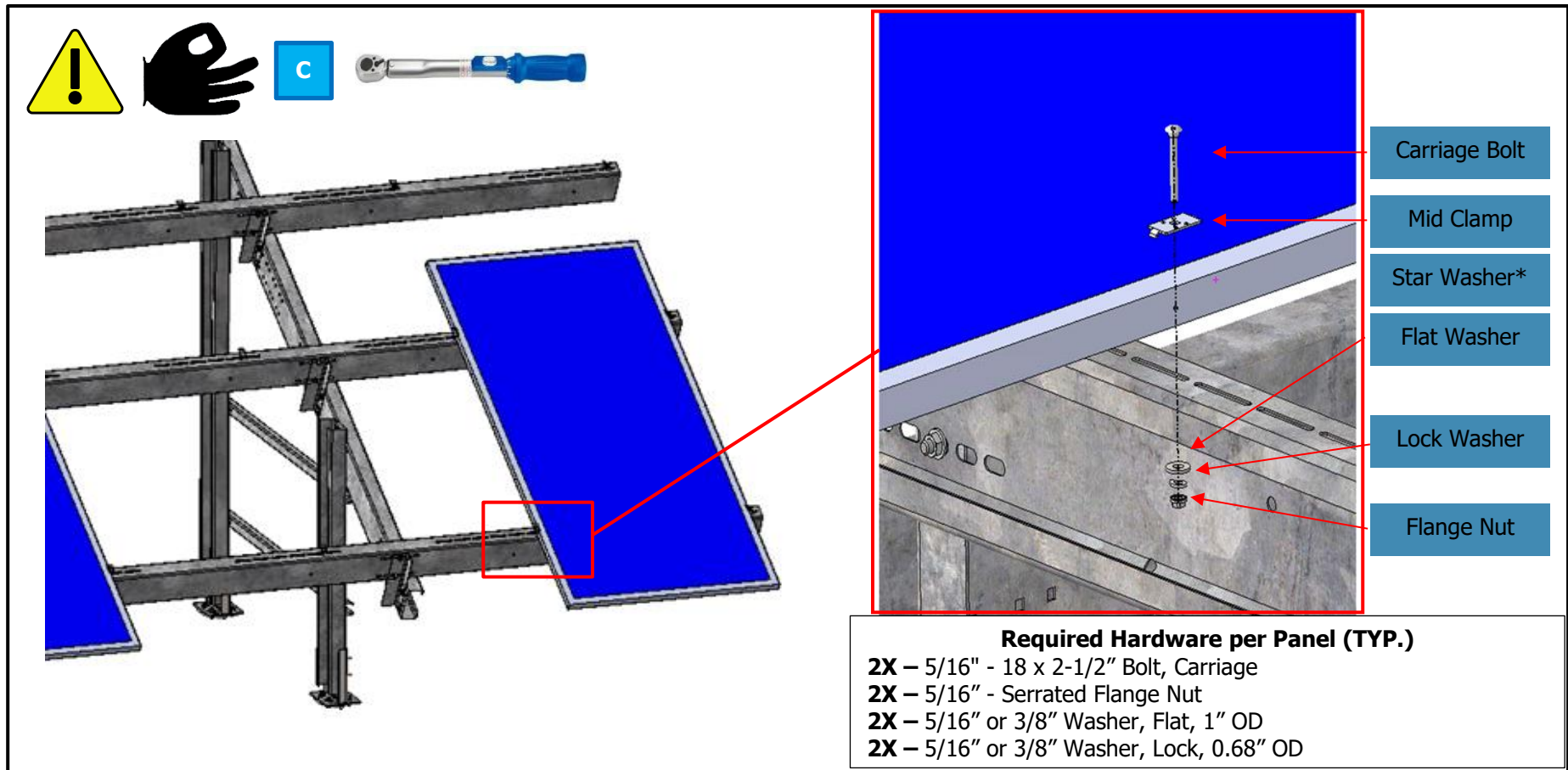


Figure 21: Intermodule connection details.

***Note:** A bonding or star washer is required between the module frame and east-west beam if the clamps are not self-grounding. Only 1 is required per panel, further details are provided in section e) Bonding and Grounding

STEP 3.

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 to be only used once more at the end of each table 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.**

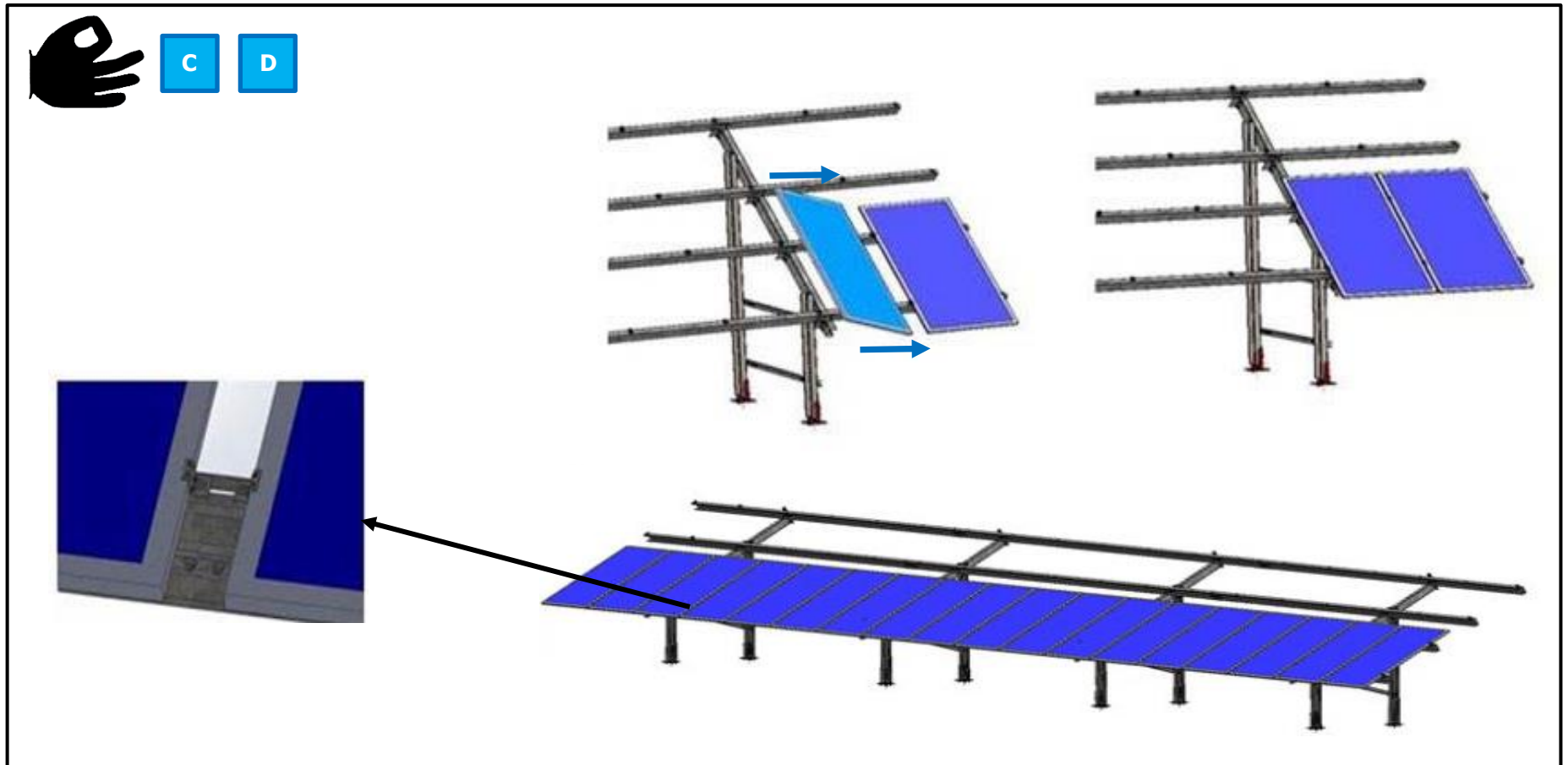


Figure 22: Modules Installation (first row).

STEP 4.

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.

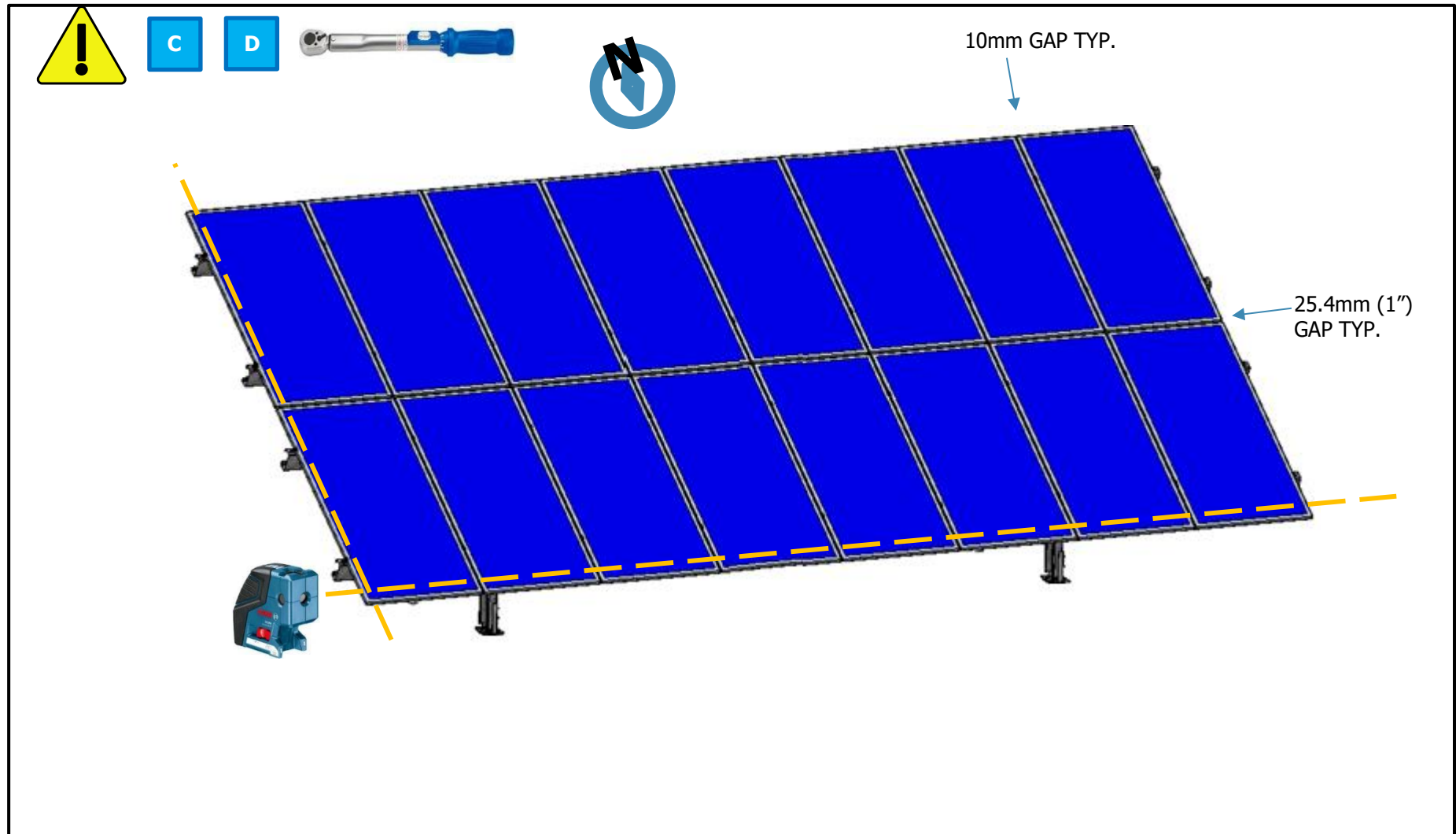


Figure 23: Full Table Installation.

d) PV Module Installation (Direct Mount)

STEP 1.

Start with the South row and the most easterly module. Position the module on the purlins as per the *site-specific structural drawings*. Install all 4 bolts by inserting the bolt from the underside of the module frame, and using one flange bolt, washer, and nut (5/16"). At least one star washer or grounding clip is required between each PV module and east-west beam (see section "Star Washer or Grounding Clip (Direct Mounting)" for more detail).

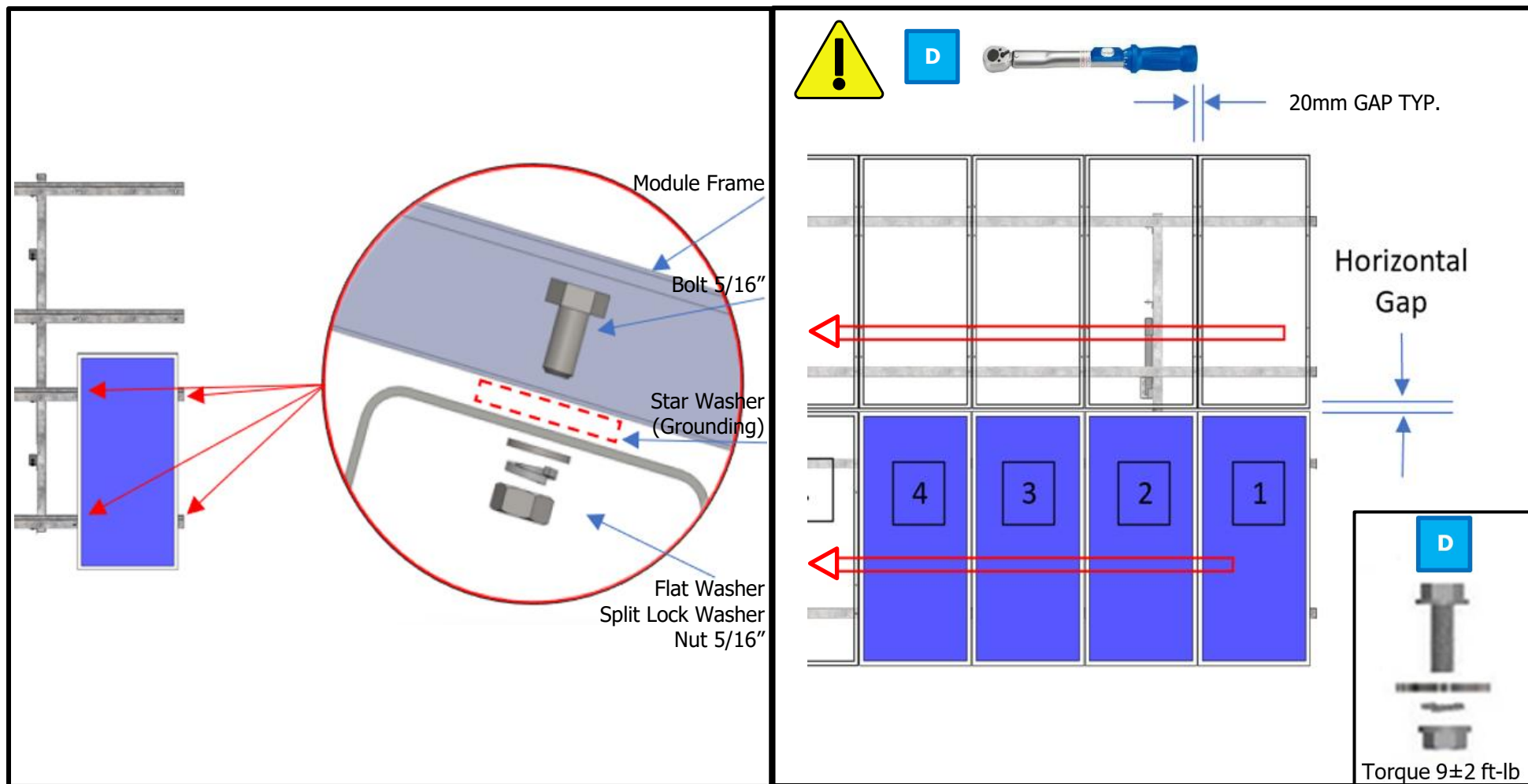


Figure 24: Direct Fastening Connection & Sequence.

e) Bonding and Grounding

A full row of modules is bonded together via purlins and splice plates (Figure 31). If necessary, tables can be grounded together using typical grounding lugs and ground wire as specified by a local Authority having Jurisdiction (AHJ). It's the installer's responsibility to make sure the bonding washers are installed properly as per the IFC drawings and this installation manual. It is the installer's responsibility to check local codes and the AHJ to verify electrical requirements. For effective electrical bonding, bonding components SHOULD NOT be re-used. In the event of module replacement or system rectifications new grounding components are required.

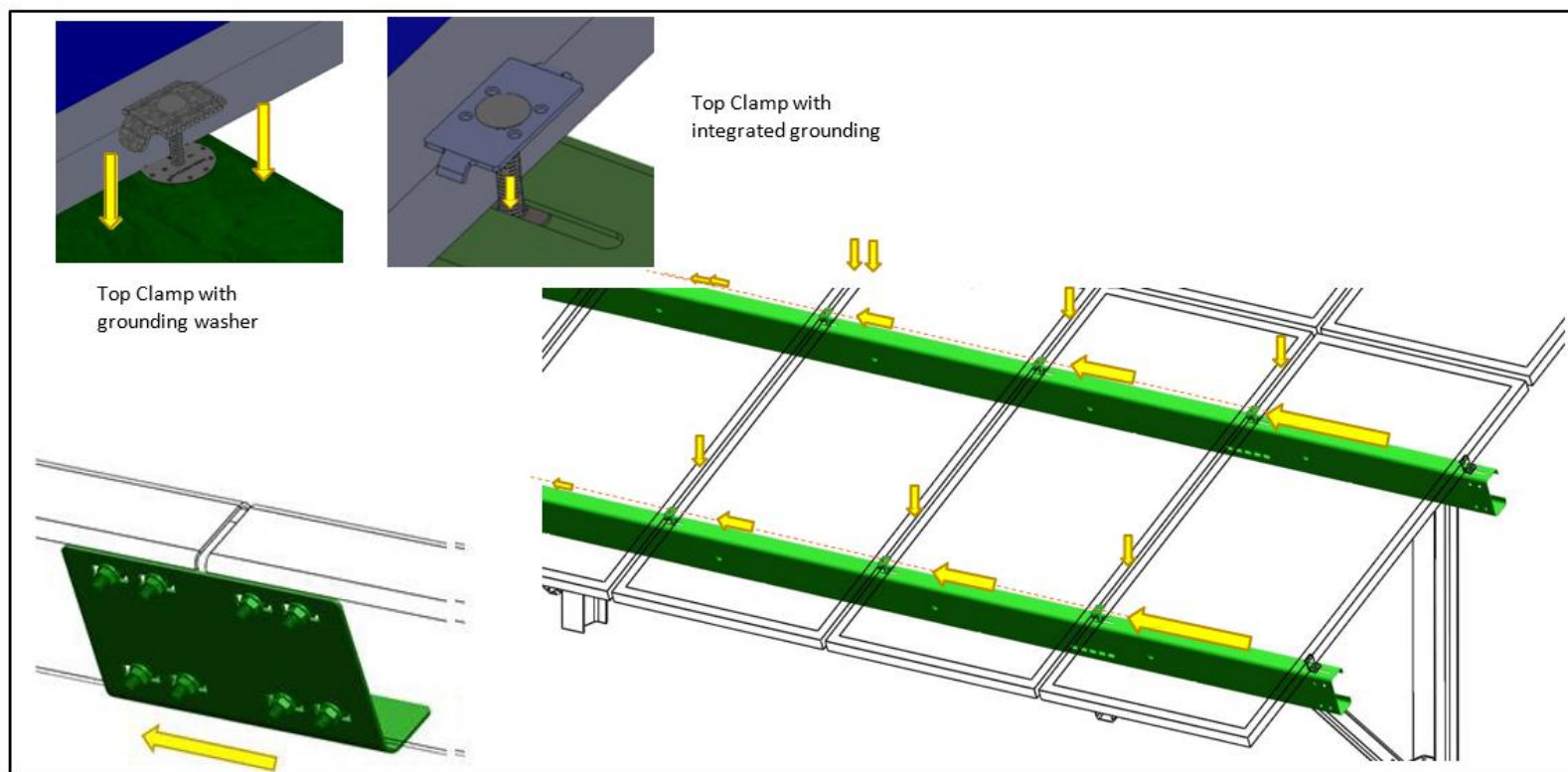


Figure 25: Typical table bonding path.

Grounding using Intermodule Clamps (Top Clamps)

When using self-grounding inter-module clamps a grounding washer is not required, since the grounding path will be achieved through the inter-module clamp itself. Typical location of inter-module clamps is shown below in green. The gap between modules is to be less than 21.34mm for standard top clamps, and less than 10mm when using self-grounding inter-module clamp or star washer.

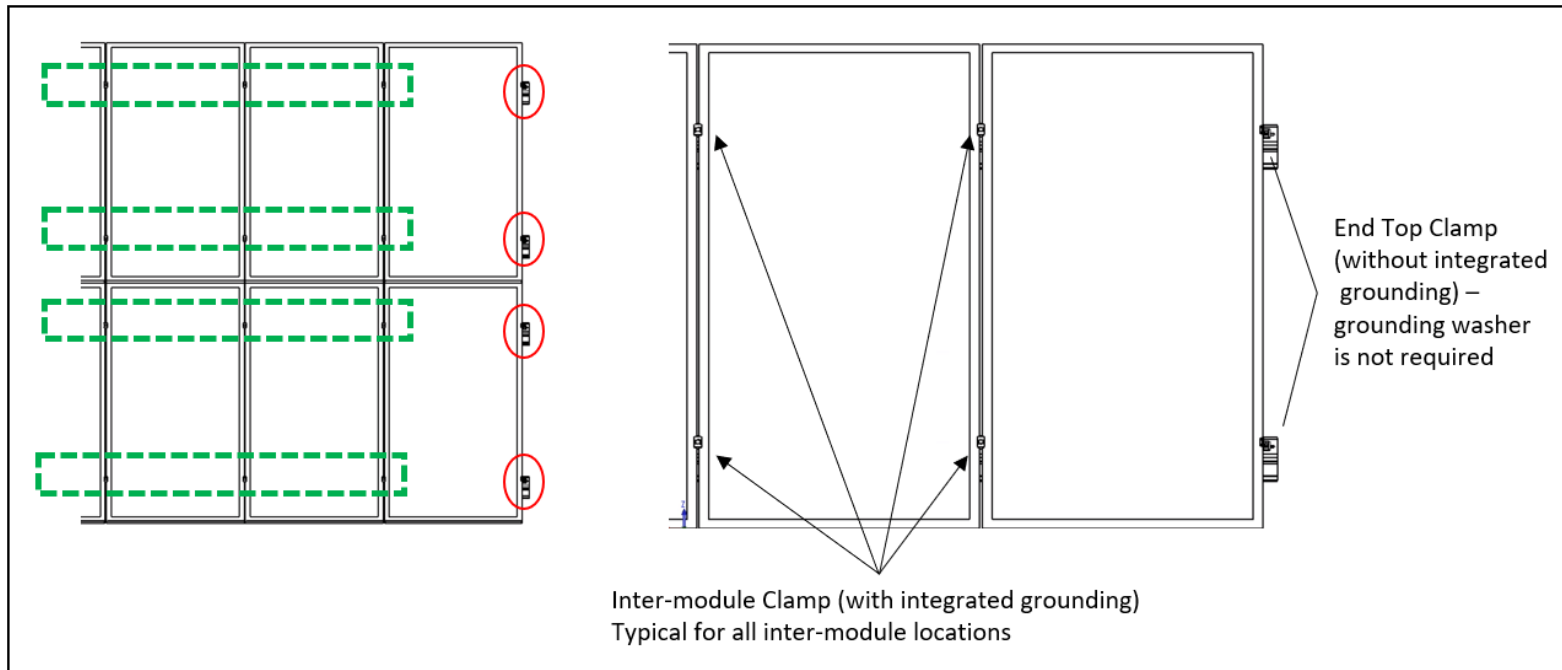


Figure 26: Inter-module clamp with integrated grounding – TYP. layout.

Star Washer or Grounding Clip (Direct Mounting)

When using star washers or grounding clips they must be installed on the underside of the module frame and above the top of the E-W beams, at least one grounding point is required per module. Typical location for star washer is shown in Figure 30.

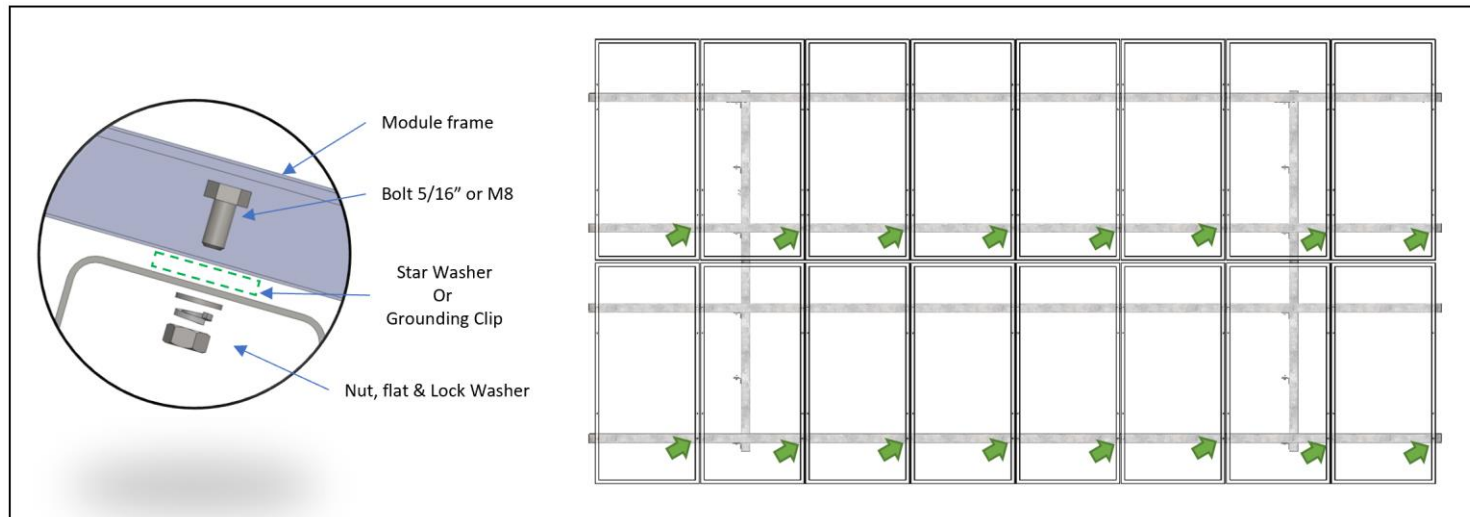


Figure 27: Direct fastener to module using star washer or grounding clips (IlSCO SBC-516)

d) Wire Management

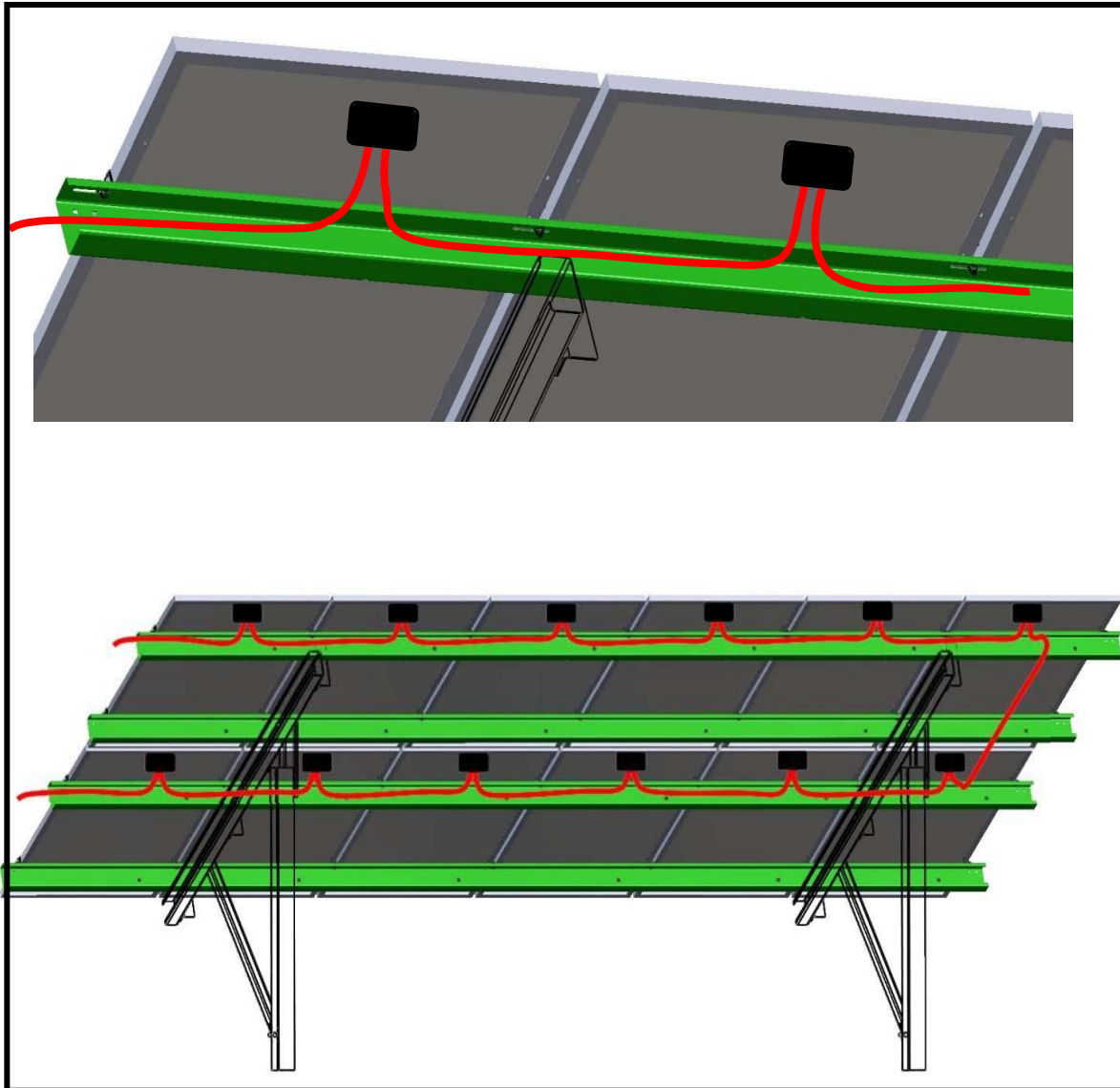


Figure 28: Wire Management.

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: Clear 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. "XXX" IS THE MODULE POWER RATING	MANUFACTURER	MODEL. "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;	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.
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 be M, P, M(BL)-HC, P-HC, M(DG), or M(DGT); and "zz" can be blank, HV, F-B, or F-BH	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-A5 - Where "a" can be N2W, N2T, or S2W
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.	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/HH/ or BP; "d" can be M or Blank.
Canadian Solar	CSbY-XXXZ Where "b" can be 3, 6, or 7; "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, MS-SD	Panasonic	SC(XXX) B2
		Seraphim	SRP-(XXX)BMA-BG
		SEG	SEG-(XXX)BMA-BG
CSUn	CSUN XXX a-b Where "a" can be 60 or 72; "b" can be P or M.	S-Energy	SD20/25-72BDE (XXX)
ET Solar	ET-YZZZZXXXAA Where "Y" can be P, L, or M; "ZZZ" can be 660, 6608H, 672, 672BH, 754BH, 766BH, 772BH; and "AA" can be GL, TB, TW, WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO, or BBAC	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, 180, or 181, and "Z" is blank or B
GCL	GCL-a-(XXX)-b Where "a" can be M3, M6, P3, or P6; "b" can be 72, or 72H	Sunpower	E20-(320-327)-COM
Hansol	ND-AN3 (300, 305, 310, 315, 320, 325, 330) HS (290, 295, 300, 305, 310, 315, 320, 325, 330) ME-V001	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
Heliene	72-a (XXX) Where "a" can be M, P, BLK	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 72-144.

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.

Inspection of the racking (10%) must also be conducted after any severe weather event and recorded in an inspection log. A severe weather event is defined as any environmental event, such as wind, ice, or snow, that is within 80% of the system capacity as specified on the *site-specific structural drawings*.

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 when installed on the piles. Improper installation could result in injury or damage to people and property including, but not limited to, the installer(s), buildings, 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.



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Polar Racking Inc. ("Polar") warrants to the original purchaser ("Purchaser") of its racking Product(s) ("Products") 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 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/or defects due to poor workmanship, however, it 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.

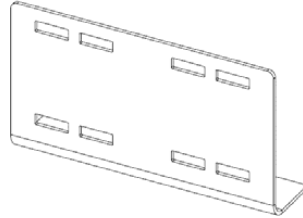
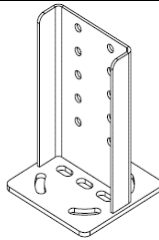
How Do You Get Service?

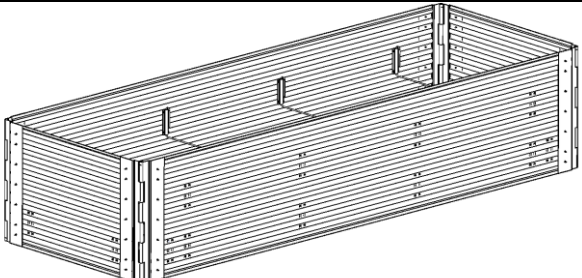
To be eligible for service under this warranty you must immediately notify Polar, in writing, upon learning of any defects of its Products by either calling the phone number listed above or writing to the address listed above and explaining the nature of defect. If appropriate, arrangement for service 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.

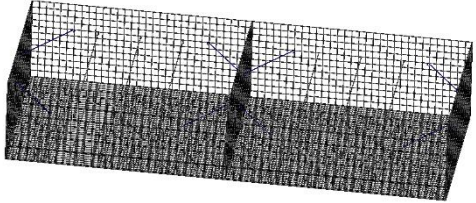
Polar will not be held responsible for any modification or alterations made to any approved design layout and/ or specification provided by Polar. Any and all proposed changes must first be reviewed and approved in writing by Polar's Engineering team. By acceptance of this document, the Purchaser acknowledges that they understand and agree to/with the above statement and any and all limitations detailed in this warranty.

APPENDIX 1. CORE RACK COMPONENTS

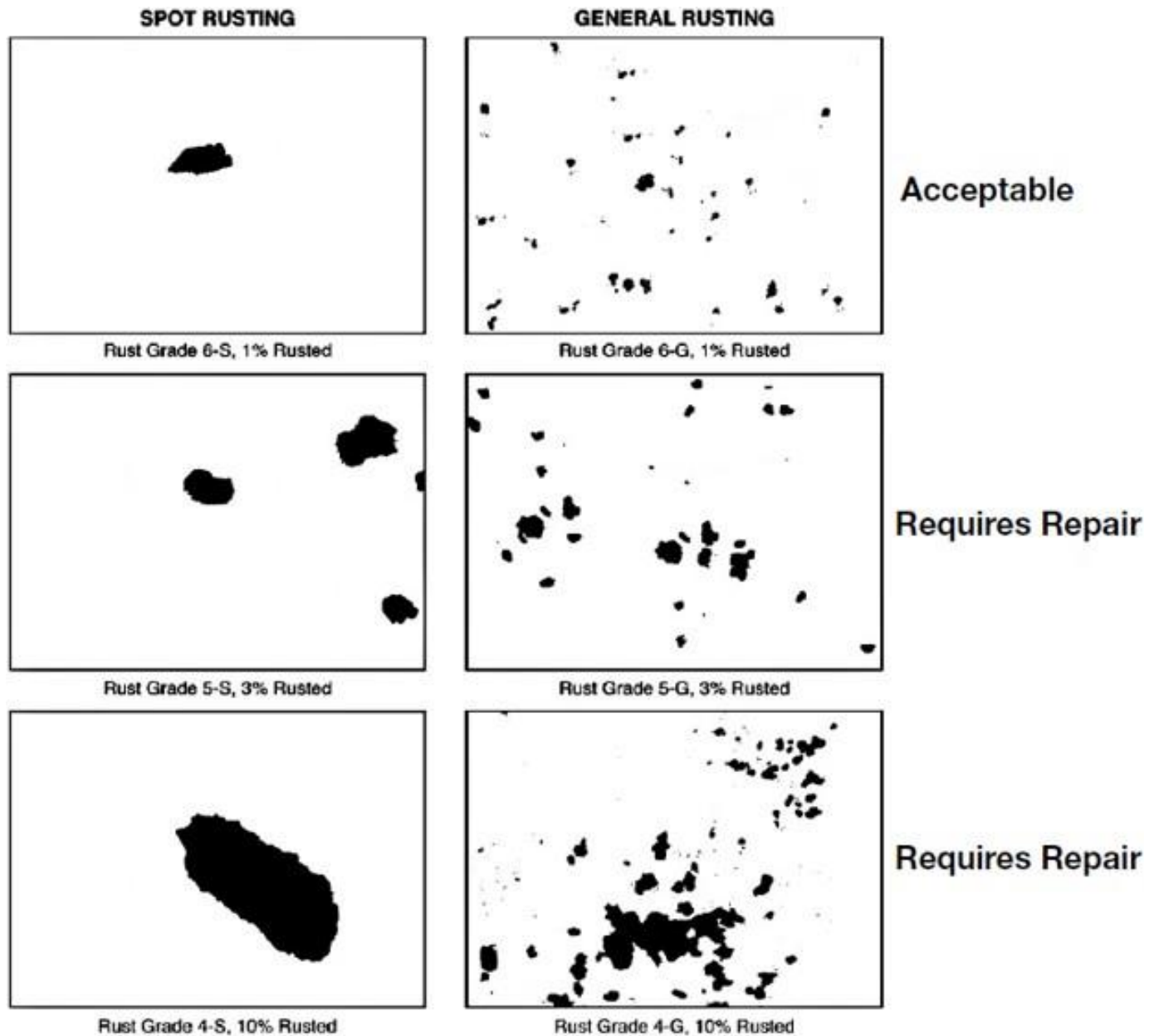
Table 2: CORE - Portrait Rack Components

Item no.	Name	Technical data	Used in	Photo
1	8" East-West Bracket	Material: 50 KSI min. Prime Steel. Finish: Hot Dipped Galvanized ASTM A123, Grade 75 Details: Length 370mm for 8" beam. Thickness: Ga10	All	
2	8" Splice	Material: 50 KSI min. Prime Steel. Finish: Hot Dipped Galvanized ASTM A123, Grade 75 Details: Length 203.2mm for 8" beam. Thickness: Ga10	Table Chord Lengths > 12m	
3	Foot Bracket	Material: 50 KSI min. Prime Steel. Finish: Hot Dipped Galvanized ASTM A123, Grade 75 Details: 250x190x288mm (LxWxH) Thickness: Plate: 8mm; Leg: 5mm.	All	
4	North-South Beam	Material: 50 KSI min. Prime Steel. Finish: G90 Pre-galvanized ASTM 653 Details: 3.5"x8" Standard C Shape Thickness: Ga16 – Ga12	All	
5	Brace	Material: 50 KSI min. Prime Steel. Finish: G90 Pre-galvanized ASTM 653 Details: 2"x2.5" Standard C Shape Thickness: Ga16 – Ga12	All	
6	East-West Beam	Material: 50 KSI min. Prime Steel. Finish: G90 Pre-galvanized ASTM 653 Details: 3"x6" Standard C Shape Thickness: Ga16 – Ga12	All	

7	Legs	Material: 50 KSI min. Prime Steel. Finish: G90 Pre-galvanized ASTM 653 Details: 3"x6" Standard C Shape Thickness: Ga16 – Ga12	All	
11	End-Clamps	Material: 50 KSI min. Prime Steel. Finish: G90 Pre-galvanized ASTM 653 Details: Height: 30-50mm Thickness: Ga10.	Top Clamp	
12	Mid-Clamps	Material: 50 KSI min. Prime Steel. Finish: G90 Hot Dipped Galvanized ASTM 653 Details: Length: 50mm. Thickness: Ga10.	Top Clamp	
13	Grounding Lug	Manufacturer: ILSCO - SGB-4 Description: UL 467 Compliant with use of 4-14AWG solid copper conductors, assembly consists of: tin-plated, solid copper lay – in lug with SS set screw, torqued at 35 in-lbs. NOT POLAR SUPPLIED	See Grounding Details	
14	IlSCO Grounding Clip	Manufacturer: ILSCO - SBC-16 Material: S304 Stainless Steel. Details: M8 or 5/16" Hardware.	See Grounding Details	
15	Star Washer	Material: S304 Stainless steel. Details: M6	All	
17	Pre-Assembled Tub	Material: Mild Carbon Steel – Pre-galvanized G90 (Z275) Reinforcement Deformed Bars – Min Fy = 260 MPa Description: Hinged concrete tub with reinforcement bars. See <i>Structural Package</i> for dimensions.	Concrete Ballasted	

18	Rebar	NOT POLAR SUPPLIED Diameter: M10	Concrete Ballasted	
19	Gabion Basket Assembly	Materials: Steel Wire – 525-700 N/mm ² – G90 Galvanized. Details: DIA. 4.5mm±0.03. Mesh Size 50x50mm. 17.5% Weld Depth & <2mm Edge. ASTM 974 – 97. Spiral Wire: DIA. 4.0mm	Geo-ballasted	

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	

Notes:

APPENDIX 4. DISCLAIMER

NOTICE: This Document (e.g., Installation Manual for a PRU-D / PRU Ground Mounted Racking Structure) is provided by Polar Racking as an example of the type of installation and/or maintenance instructions which Polar Racking may provide under a valid written agreement to supply related products. All information provided in this Document is provided on an "AS IS" basis, without warranty of any kind. Except as expressly provided for in a written agreement for the supply of related products, Polar Racking makes no warranty, express or implied, with respect to any and all information provided in this Document including, without limitation, implied warranties of merchantability, fitness for a particular purpose, or freedom from infringement, whether arising by law, custom or otherwise. Polar Racking shall not be liable for any and all problems or claims arising from or in connection with, among others, any and all instructions, technical information and/or products not supplied by Polar Racking including, without limitation, any and all electrical connectors, drive units, PV panels, grounding components or fasteners. Further, if and to the extent any express warranty is provided in a written agreement for the supply of products, such warranties will be conditioned upon, among other items, **(i)** the removal from original packaging and proper installation of such products within six (6) months of the date of delivery; **(ii)** the protection of such products from environmental elements, including but not limited to mud, snow, ice and dirt; **(iii)** the clear designation of product lay down areas; **(iv)** the offloading, handling and storage of the products by authorized and trained personnel only; **(v)** the quarantine of suspect products for review by Polar Racking prior to their installation; and **(vi)** the maintenance of the products in accordance with instructions to be mutually agreed in such written agreement. Nothing in this document shall create any obligation and/or liability, express or implied, on Polar Racking with respect to any products and/ or instructions regarding such products.

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