

circuit breaker 3VA6 UL frame 800 breaking capacity class H 65kA @ 480 V 3-pole, line protection ETU350, LSI,  $I_n=800A$  overload protection  $I_r=320A \dots 800A$  short circuit protection  $I_{sd}=1,5 \dots 10 \times I_r$ ,  $I_i=10 \times I_n$



| Model                                                                                                                 |                             |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Product brand name                                                                                                    | SENTRON                     |
| Product designation                                                                                                   | Molded-case circuit breaker |
| Product designation / according to UL file                                                                            | HMAE                        |
| Product version                                                                                                       | System protection           |
| Design of the load switch / acc. to UL 489 / Heating, Air Conditioning, and Refrigeration circuit breaker (HACR Type) | Yes                         |
| Design of the overcurrent release                                                                                     | ETU350                      |
| Protective function of the overcurrent release                                                                        | LSI                         |
| Number of poles                                                                                                       | 3                           |
| General technical data                                                                                                |                             |
| Rated insulation voltage $U_i$                                                                                        | 600 V                       |
| Max. rated operational voltage $U_e$ with AC 50/60Hz                                                                  | 600 V                       |
| Power loss [W] / maximum                                                                                              | 231 W                       |
| Active power loss / for rated value of the current / at AC / in hot operating state / per pole                        | 77 W                        |
| Mechanical service life (switching cycles) / typical                                                                  | 10 000                      |

|                                                                           |         |
|---------------------------------------------------------------------------|---------|
| Electrical endurance (switching cycles) / at AC-1 / at 380/415 V 50/60 Hz | 5 800   |
| Electrical endurance (switching cycles) / at AC-1 / at 690 V 50/60 Hz     | 4 000   |
| Electrical endurance (switching cycles) / at 480 V / at 50/60 Hz          | 5 800   |
| Electrical endurance (switching cycles) / at 600 V / at 50/60 Hz          | 4 000   |
| Neutral conductors / upgradeable/retrofitable                             | No      |
| Ground fault monitoring version                                           | Without |
| Product function                                                          |         |
| • communication function                                                  | No      |
| • other measurement function                                              | No      |

#### Current

|                                                  |       |
|--------------------------------------------------|-------|
| Marking / acc. to UL 489 / 100%-rated breaker    | No    |
| Max. rated operational current of the frame size | 800 A |
| Rated continuous current I <sub>u</sub>          | 800 A |

#### Switching capacity according to IEC 60947

|                                                                        |        |
|------------------------------------------------------------------------|--------|
| Switching capacity class of the circuit breaker                        | H      |
| Maximum short-circuit current breaking capacity (I <sub>cu</sub> )     |        |
| • at 240 V                                                             | 110 kA |
| • at 415 V                                                             | 85 kA  |
| • at 690 V                                                             | 35 kA  |
| Operational short-circuit current breaking capacity (I <sub>cs</sub> ) |        |
| • at 240 V                                                             | 110 kA |
| • at 415 V                                                             | 85 kA  |
| • at 690 V                                                             | 19 kA  |
| Short-circuit current making capacity (I <sub>cm</sub> )               |        |
| • at 240 V                                                             | 242 kA |
| • at 415 V                                                             | 187 kA |
| • at 690 V                                                             | 74 kA  |

#### Switching capacity according to UL 489

|                           |        |
|---------------------------|--------|
| Breaking capacity current |        |
| • at 240 V                | 150 kA |
| • at 480 V                | 65 kA  |
| • at 600 V                | 35 kA  |

#### Adjustable parameters

|                                                         |       |
|---------------------------------------------------------|-------|
| Adjustable response value current / I <sub>r</sub> min. | 315 A |
| Adjustable response value current / I <sub>r</sub> max. | 800 A |
| Adjustable response value time / t <sub>r</sub> min.    | 0.5   |
| Adjustable response value time / t <sub>r</sub> max.    | 17    |

|                                                                         |         |
|-------------------------------------------------------------------------|---------|
| Adjustable response value current / I <sub>sd</sub> min.                | 1 200 A |
| Adjustable response value current / I <sub>sd</sub> max.                | 8 000 A |
| Adjustable response value time / t <sub>sd</sub> min.                   | 0.04 s  |
| Adjustable response value time / t <sub>sd</sub> max.                   | 0.4 s   |
| Adjustable response value current / I <sub>i</sub> min.                 | 8 000 A |
| Adjustable response value current / I <sub>i</sub> max.                 | 8 000 A |
| Ground fault protection can be switched ON/OFF                          | Yes     |
| Ground fault protection / tripping switchable / I <sub>2t</sub> =ON/OFF | No      |

### Mechanical Design

|             |         |
|-------------|---------|
| Height [in] | 12.6 in |
| Height      | 328 mm  |
| Width [in]  | 8.3 in  |
| Width       | 210 mm  |
| Depth [in]  | 4.7 in  |
| Depth       | 120 mm  |

### Auxiliary circuit

|                                                |   |
|------------------------------------------------|---|
| Number of CO contacts / for auxiliary contacts | 0 |
|------------------------------------------------|---|

### Environmental conditions

|                                    |        |
|------------------------------------|--------|
| Protection class IP / on the front | IP40   |
| Ambient temperature                |        |
| • during operation / minimum       | -25 °C |
| • during operation / maximum       | 70 °C  |
| • during storage / minimum         | -40 °C |
| • during storage / maximum         | 80 °C  |

### Certificates

|                                                                                        |     |
|----------------------------------------------------------------------------------------|-----|
| Reference code / acc. to DIN EN 81346-2                                                | Q   |
| Certificate of suitability / as approval for NAVAL (no combat vessels) / Supplement SB | Yes |

### General Product Approval

[Miscellaneous](#)

### Further information

**Information- and Downloadcenter (Catalogs, Brochures,...)**

<http://www.siemens.com/lowvoltage/catalogs>

**Industry Mall (Online ordering system)**

<https://mall.industry.siemens.com/mall/en/en/Catalog/product?mlfb=3VA6580-6HN32-0AA0>

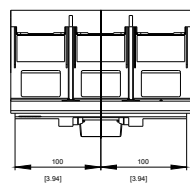
**Service&Support (Manuals, Certificates, Characteristics, FAQs,...)**

<https://support.industry.siemens.com/cs/ww/en/ps/3VA6580-6HN32-0AA0>

[http://www.automation.siemens.com/bilddb/cax\\_en.aspx?mlfb=3VA6580-6HN32-0AA0](http://www.automation.siemens.com/bilddb/cax_en.aspx?mlfb=3VA6580-6HN32-0AA0)

<http://www.siemens.com/cax>

<http://www.siemens.com/specifications>



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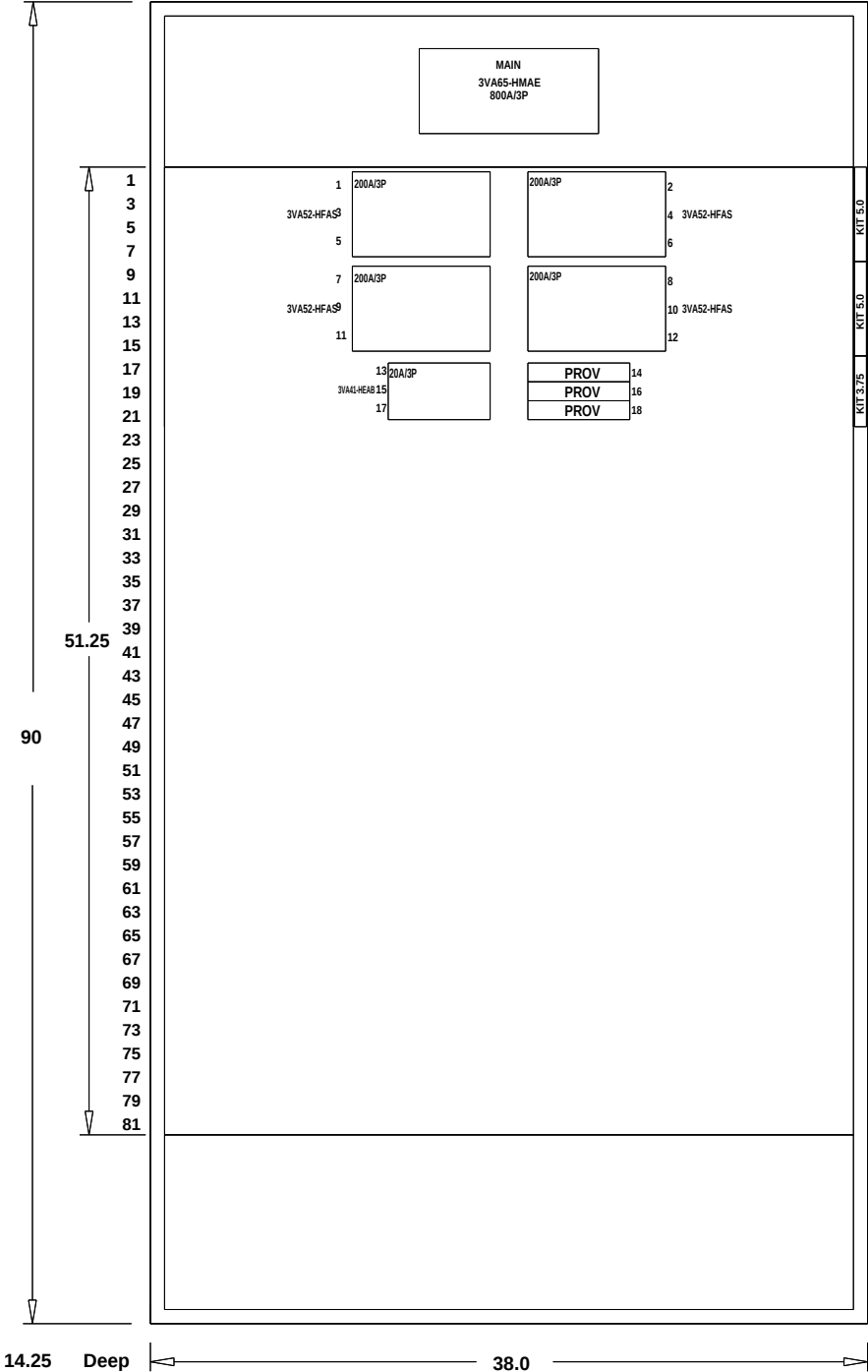
07/06/2020

PANELBOARD NOTES

SECTION :1 OF 1  
PANEL TYPE :P5  
CATALOG NUMBER :P5E90WO800ATS  
ENCLOSURE :3R Outdoor  
SYSTEM VOLTAGE :480Y/277 3Ø 4W Wye AC  
IR RATING :65 K AIC  
MAIN BUS :800 A  
BUS MATERIAL :Tin Plated Aluminum  
FEED :Top  
MOUNTING :Surface  
SE LABEL :Yes  
SERIES RATED :No  
CONDUIT AREA :36.000 x 12.25  
\*INDICATES POSITIONING NUMBERS TO HELP WITH THE  
MANUAL PLACEMENT OF BREAKERS ON THE MECHANICAL VIEW  
NOTE:THE DIMENSIONS ON THE LEFT ARE FOR THE MINIMUM  
SIZE UL LISTED ENCLOSURE REQUIRED FOR THIS  
INTERIOR. REFER TO SPEEDFAX FOR ACTUAL ENCLOSURE  
DIMENSIONS

PANELBOARD COMPONENTS

Main :  
1 - 800A /3P-3VA65-HMAE SS MAIN BREAKER  
1-ETU350 LSI - Rotary Switch  
1-3VA Mechanical (2)4/0-600Kcmil Cu/Al Lug  
1-(2)4/0-600Kcmil Cu/Al  
1-Breaker Sensor: 800  
1-Breaker Trip: 800  
1-Shunt Trip Left (STL32) 110-127 VAC / VDC Catalog  
# 3VA99780BL32  
1-Lug Catalog #: 3VA95730JB23  
Branches :  
4 - 200A /3P-3VA52-HFAS  
1-Mechanical (1)#6 AWG- 350 KCMIL AL / CU Lug  
1-Lug Catalog #: 3VA92330JB12  
3 - GB PROVISION  
1 - 20A /3P-3VA41-HEAB  
1-3VA Mechanical (1)#14-3/0 AL / CU Lug  
Options :  
1-Std Stl/Al Gnd Connector  
1-Master NP Secured -Adhesive  
1-Card Holder-Std Plastic Sleeve  
1-No Front  
1-Al/Cu Branch Connector  
1-Certification - UL



|                                                   |  |                                         |                               |
|---------------------------------------------------|--|-----------------------------------------|-------------------------------|
| JOB<br>testerino                                  |  |                                         |                               |
| P.O.<br>=                                         |  | CUST.<br>NORTH COAST ELECTRIC COMPANY   |                               |
| CONTR<br>NORTH COAST ELECTRIC CO 4808806          |  | CONSULT<br>NORTH COAST ELECTRIC COMPANY |                               |
| TIE<br>=                                          |  | BY<br>armaax00c                         | ENG. LOC.<br>=                |
| S.O.<br>=                                         |  | DATE<br>4-10-2024                       | DESIGNATION<br>ALASKA 800A P5 |
| DWG. NO.<br>armaax00c_07261901_00_00_M00-528000-1 |  |                                         |                               |
| Siemens Industry, Inc.                            |  | APP.<br>=                               | MFG. LOC.<br>=                |
| Norcross, Georgia                                 |  | APP.<br>=                               | DWG. FILE<br>=                |
|                                                   |  | SHEET 1 OF 1                            |                               |
|                                                   |  | REV.<br>1                               |                               |

|     |           |                 |           |
|-----|-----------|-----------------|-----------|
| 1   | 0         | armaax00c041024 | 4-10-2024 |
| NO. | REVISIONS | DRAWN BY        | DATE      |



# 1500V DUAL-FUSED COMBINER

## ABOUT

The Shoals™ 1500V Dual-Fused Combiner series is designed for your floating ground array and is utilized to combine one or more strings per circuit when the fuse size does not exceed 32A.

Lab-proven under full load during static heating sequence testing with fuses installed, the 1500V Dual-Fused Combiner is designed for maximum durability and years of uninterrupted, real-world service.

## FEATURES

- Finger-safe fuse holders
- 400A, 1500V disconnect, 100% load-break rated
- Plated bus bars rated for 90°C, Cu/Al
- 2-hole NEMA 1/2" x 1-3/4" mounting configuration
- Breather vent reduces internal condensation
- Safety shield covers all live components
- Designed for ease of cable installation
- Surge protection device, Type I
- NEMA 4X pad-lockable enclosure
- Standard 5-year warranty
- ETL certified to UL1741

## OPTIONS

- Pre-terminated whips with connectors
- Pre-punched conduit knockouts
- Pre-installed NEMA 4X glands
- Pre-installed HDG uni-strut
- Pre-installed HDG mounting kits
- Pre-installed drain vent

| TECHNICAL INFORMATION            | STG.CBC.xx.CyAHNC21K0-DF <sup>(a)</sup> |
|----------------------------------|-----------------------------------------|
| Max. System Voltage              | 1500 VDC                                |
| Rated Output Current             | 400A                                    |
| Max. Short Circuit Current (Isc) | 20.5A                                   |
| Max. Overcurrent Protection      | 32A                                     |
| Number of Input Circuits         | 12, 16, 18, 20, or 24                   |
| Positive Input Wire Size         | 6-14 AWG                                |
| Negative Input Wire Size         | 4-14 AWG                                |
| Positive Output Wire Size        | Up to (1) 750 MCM or (2) 600 MCM        |
| Negative Output Wire Size        | Up to (1) 750 MCM or (2) 600 MCM        |
| Ground Wire Size                 | (2) 1/0-14 AWG and (18) 4-14 AWG        |
| Enclosure Rating                 | Type 4X                                 |
| Max. Ambient Temp. Rating        | 50°C                                    |
| Enclosure Size (H x W x D)       | 36" x 30" x 10" <sup>(b)</sup>          |
| Approximate Weight               | 115 lbs                                 |

(a) xx = number of inputs (12, 16, 18, 20, or 24)

y = "M" for 12, "L" for 16, "K" for 18, or "J" for 20 and 24

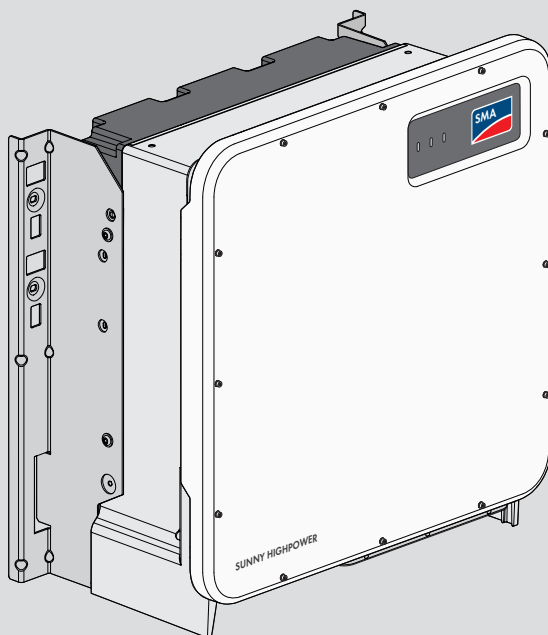
(b) Dimension refers to trade size. See project drawings for exact dimensions.

Product design and specification subject to change or modification without notice.



# SUNNY HIGHPOWER PEAK3-US

SHP 125-US-20 / SHP 150-US-20



eManual



ENGLISH

Quick Reference Guide

ESPAÑOL

Instrucciones breves

FRANÇAIS

Notice résumée



SHPxxx-US-20-IS-xx-11 | 114686-00.01 | Version 1.1

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You can download the current warranty conditions from the Internet at [www.SMA-Solar.com](http://www.SMA-Solar.com).

### Software licenses

The licenses for the installed software modules (open source) can be found in the user interface of the product.

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As of: 4/9/2020

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# 1 Information on this Document

## 1.1 Validity

This document is valid for:

- SHP 125-US-20 (Sunny Highpower PEAK3)
- SHP 150-US-20 (Sunny Highpower PEAK3)

## 1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing, repairing and using electrical devices and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, standards and directives
- Knowledge of and compliance with this document and all safety information

## 1.3 Content and Structure of this Document

This document contains safety information as well as graphical instructions on installing and commissioning (see page 31). Observe all information and carry out the actions illustrated graphically in this document in the specified order.

The latest version of this document and the comprehensive manual for installation, commissioning, configuration and decommissioning are to be found in PDF format and as eManual at [www.SMA-Solar.com](http://www.SMA-Solar.com). You will find the QR code that links to the eManual on the title page of this document. You can also call up the eManual via the user interface of the product.

Illustrations in this document are reduced to the essential information and may deviate from the real product.

## 1.4 Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

|                                                                                                  |
|--------------------------------------------------------------------------------------------------|
| <b>⚠ DANGER</b>                                                                                  |
| Indicates a hazardous situation which, if not avoided, will result in death or serious injury.   |
| <b>⚠ WARNING</b>                                                                                 |
| Indicates a hazardous situation which, if not avoided, could result in death or serious injury.  |
| <b>⚠ CAUTION</b>                                                                                 |
| Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |

| NOTICE                                                                      |
|-----------------------------------------------------------------------------|
| Indicates a situation which, if not avoided, can result in property damage. |

## 1.5 Symbols in the Document

| Symbol                                                                            | Explanation                                                                             |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|  | Information that is important for a specific topic or goal, but is not safety-relevant  |
|  | Section in which the installation and commissioning process is illustrated graphically. |

# 2 Safety

## 2.1 Intended Use

The Sunny Highpower is a transformerless PV inverter. It converts the direct current from the PV array into grid-compliant three-phase current and feeds it into the utility grid via a separate transformer.

The product is intended for use in commercial, industrial or business sectors.

The product is suitable for operation in a chemically active environment in accordance with IEC 60721-3-4 as per Class 4C2.

The product is suitable for indoor and outdoor use.

The product must only be operated with PV modules of protection class II in accordance with IEC 61730, application class A. The PV modules must be compatible with this product.

The product must only be operated with PV arrays (PV modules and cabling) that are approved by the electrical standards applicable on-site and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.

The product may only be operated in connection with a suitable medium-voltage transformer. The low-voltage side must be configured in a star formation and the neutral point must be grounded (for information about the requirements of the medium-voltage transformer, consult the technical information "Important Requirements for Medium-Voltage Transformers" under [www.SMA-Solar.com](http://www.SMA-Solar.com)).

### No galvanic isolation

The product is not equipped with a transformer and therefore has no galvanic isolation.

- Do not operate grounded PV modules together with the product. If grounded PV modules are connected to the product, an event will occur. The event will be displayed, along with the associated message, in the event list on the user interface of the product.
- Only ground the mounting frames of the PV modules.

PV modules with a high capacity to ground may only be used if their coupling capacity does not exceed 32 µF.

To protect the PV system against excessive reverse currents under fault conditions, a DC-side overcurrent protective device must be connected in accordance with the *National Electrical Code*® to prevent any short-circuit currents that exceed the ampacity of the DC electric circuit or the maximum series fuse rating of the PV modules. Typically, string fuses are used if more than two strings are connected in parallel.

All components must remain within their permitted operating ranges and their installation requirements at all times.

The product is approved for the US and Canadian market.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

Alterations to SMA products, e.g., changes or modifications, are only permitted with the express written permission of and according to the instructions from SMA Solar Technology AG. Unauthorized alterations can be dangerous and lead to personal injury. In addition, an unauthorized alteration will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as the intended use.

The enclosed documentation is an integral part of this product. Keep the documentation in a convenient, dry place for future reference and observe all instructions contained therein.

This document does not replace and is not intended to replace any local, state, provincial, federal or national laws, regulations or codes applicable to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

The type label must remain permanently attached to the product.

## 2.2 IMPORTANT SAFETY INSTRUCTIONS

### SAVE THESE INSTRUCTIONS

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronic devices, there are residual risks despite careful construction. To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

**⚠ DANGER****Danger to life due to electric shock when live components or DC cables are touched**

When exposed to light, the PV modules generate high DC voltage which is present in the DC cables. Touching live DC cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Install external DC load-break switch (e.g., a PV junction box including a load-break switch) between the inverter and PV array.
- Disconnect the PV array from the inverter via an external DC load-break switch (e.g. via a PV junction including a load-break switch). Switch off and secure the DC load-break switch against reconnection.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- Wear suitable personal protective equipment for all work on the product.

**⚠ DANGER****Danger to life due to electric shock when touching live system components in case of a ground fault**

If a ground fault occurs, parts of the system may still be live. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- Touch the cables of the PV array on the insulation only.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.
- Ensure that no voltage is present and wait five minutes before touching any parts of the PV system or the product.

**⚠ DANGER****Danger to life due to electric shock in case of overvoltages and if surge protection is missing**

Overvoltages (e. g. in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, ensure that there is suitable surge protection at the network cable transition from the product outdoors to the network inside the building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

**⚠ WARNING****Danger to life due to fire or explosion**

In rare cases, an explosive gas mixture can be generated inside the product under fault conditions. In this state, switching operations can cause a fire inside the product or explosion. Death or lethal injuries due to hot or flying debris can result.

- In the event of a fault, do not perform any direct actions on the product.
- Ensure that unauthorized persons have no access to the product.
- Disconnect the PV array from the inverter via an external disconnection device. If there is no disconnecting device present, wait until no more DC power is applied to the inverter.
- Disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.
- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).

**⚠ WARNING****Risk of injury due to toxic substances, gases and dusts.**

In rare cases, damages to electronic components can result in the formation of toxic substances, gases or dusts inside the product. Touching toxic substances and inhaling toxic gases and dusts can cause skin irritation, burns or poisoning, trouble breathing and nausea.

- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).
- Ensure that unauthorized persons have no access to the product.

### WARNING

#### **Danger to life due to fire when failing to observe torque specifications on live bolted connections**

Failure to follow the specified torques reduces the ampacity of live bolted connections and the contact resistances increase. This can cause components to overheat and catch fire. Death or lethal injuries can result.

- Ensure that live bolted connections are always tightened with the exact torque specified in this document.
- Only use suitable tools when working on the device.
- Avoid repeated tightening of live bolted connections as this may result in inadmissibly high torques.

### WARNING

#### **Danger to life due to electric shock from destruction of the measuring device due to overvoltage**

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement range designed for the maximum AC and DC voltage of the inverter.

### CAUTION

#### **Risk of burns due to hot enclosure parts**

Some parts of the enclosure can get hot during operation. Touching hot enclosure parts can result in burn injuries.

- During operation, do not touch any parts other than the enclosure lid of the inverter.
- Wait until the inverter has cooled down before touching the enclosure.

### CAUTION

#### **Risk of injury due to weight of product**

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.
- Transport the product using the carrying handles or hoist. Take the weight of the product into account.
- Use all carrying handles provided during transport with carrying handles.
- Do not use the carrying handles as attachment points for hoist equipment (e.g. straps, ropes, chains). Insert eye bolts into threads provided on top of the product to attach the hoist system.

## NOTICE

### Damage to the enclosure seal in subfreezing conditions

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below -5 °C (23 °F).
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).

## NOTICE

### Damage to the product due to sand, dust and moisture ingress

Sand, dust and moisture penetration can damage the product and impair its functionality.

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.
- Close tightly all enclosure openings.
- Only use listed rain-tight or liquid-tight conduit fittings to attach the conduits to the product.

## NOTICE

### Damage to the inverter due to electrostatic discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

## NOTICE

### Damage to the product due to cleaning agents

The use of cleaning agents may cause damage to the product and its components.

- Clean the product and all its components only with a cloth moistened with clear water.



### Electrical installations (for North America)

All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation (e.g. *National Electrical Code*® ANSI/NFPA 70 or *Canadian Electrical Code*® CSA-C22.1.).

- Before connecting the product to the utility grid, contact your local grid operator. The electrical connection of the product must be carried out by qualified persons only.
- Ensure that the cables or conductors used for electrical connection are not damaged.

### 3 Symbols on the Product

| Symbol                                                                            | Explanation                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Beware of electrical voltage<br>The product operates at high voltages.                                                                                                                                                                                     |
|  | Beware of hot surface<br>The product can get hot during operation.                                                                                                                                                                                         |
|  | Observe the documentation<br>Observe all documentation supplied with the product.                                                                                                                                                                          |
|  | Inverter<br>Together with the green LED, this symbol indicates the operating state of the inverter.                                                                                                                                                        |
|  | Observe the documentation<br>Together with the red LED, this symbol indicates an error.                                                                                                                                                                    |
|  | Data transmission<br>Together with the blue LED, this symbol indicates the status of the network connection.                                                                                                                                               |
|  | FCC designation<br>The product complies with the requirements of the applicable FCC standards.                                                                                                                                                             |
|  | UL 62109-1 and CAN/CSA-C22.2 No. 62109-1:16 are the standards applied by Underwriters Laboratories to the product to certify that it meets the requirements of the <i>National Electrical Code</i> ®, the <i>Canadian Electrical Code</i> ® and IEEE 1547. |

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### Garantía de SMA

En [www.SMA-Solar.com](http://www.SMA-Solar.com) podrá descargar las condiciones de garantía actuales.

### Licencias de software

Encontrará las licencias del software (de código abierto) utilizado en la interfaz de usuario del producto.

### Marcas registradas

Se reconocen todas las marcas registradas, incluso si no están señaladas por separado. La falta de señalización no implica que la mercancía o las marcas sean libres.

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Versión: 09/04/2020

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# 1 Indicaciones sobre este documento

## 1.1 Área de validez

Este documento es válido para:

- SHP 125-US-20 (Sunny Highpower PEAK3-US)
- SHP 150-US-20 (Sunny Highpower PEAK3-US)

## 1.2 Grupo de destinatarios

Las actividades descritas en este documento deben realizarlas exclusivamente especialistas que han de contar con esta cualificación:

- Conocimientos sobre los procedimientos y el funcionamiento de un inversor
- Formación sobre la gestión de peligros y riesgos relativos a la instalación, reparación y manejo de equipos eléctricos y plantas
- Formación profesional para la instalación y la puesta en marcha de equipos eléctricos y plantas
- Conocimiento de las leyes, normativas y directivas aplicables
- Conocimiento y seguimiento de este documento y de todas sus indicaciones de seguridad

## 1.3 Contenido y estructura del documento

Este documento contiene información relevante de seguridad e instrucciones gráficas para la instalación y la puesta en funcionamiento (consulte la página 31). Tenga en cuenta toda la información y siga los pasos representados con imágenes en el orden indicado.

Encontrará la versión actual de este documento así como las instrucciones detalladas para la instalación, puesta en marcha, configuración y puesta fuera de servicio en formato PDF en y como eManual [www.SMA-Solar.com](http://www.SMA-Solar.com). Encontrará el código QR con el enlace al eManual en la portada del documento. También puede acceder al e-Manual a través de la interfaz de usuario del producto.

Las imágenes en este documento han sido reducidas a lo esencial y pueden diferir del producto original.

## 1.4 Niveles de advertencia

Cuando se trate con el producto pueden darse estos niveles de advertencia.

### PELIGRO

Representa una advertencia que, de no ser observada, causa la muerte o lesiones físicas graves.

### ADVERTENCIA

Representa una advertencia que, de no ser observada, puede causar la muerte o lesiones físicas graves.

|                                                                                                               |
|---------------------------------------------------------------------------------------------------------------|
| <b>⚠ ATENCIÓN</b>                                                                                             |
| Representa una advertencia que, de no ser observada, puede causar lesiones físicas leves o de gravedad media. |
| <b>PRECAUCIÓN</b>                                                                                             |
| Representa una advertencia que, de no ser observada, puede causar daños materiales.                           |

## 1.5 Símbolos del documento

| Símbolo                                                                           | Explicación                                                                                     |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|  | Información importante para un tema u objetivo concretos, aunque no relevante para la seguridad |
|  | Capítulo en el que se presenta de forma gráfica la instalación y la puesta en marcha            |

# 2 Seguridad

## 2.1 Uso previsto

El Sunny Highpower es un inversor fotovoltaico sin transformador que transforma la corriente continua de un generador fotovoltaico en corriente alterna trifásica apta para la red e inyecta en la red pública a través de un transformador separado.

El producto no está destinado para su uso en entornos comerciales e industriales.

El producto es adecuado para su uso en un ambiente químicamente activo conforme con la norma IEC 60721-3-4 de la clase 4C2 y

El producto es apropiado para utilizarse en exteriores e interiores.

El producto solo debe utilizarse con módulos fotovoltaicos de la clase de protección II según la norma IEC 61730, tipo de aplicación A. Los módulos fotovoltaicos empleados deben ser apropiados para el funcionamiento con este producto.

El producto solo debe utilizarse con generadores fotovoltaicos (módulos fotovoltaicos y cableado) que estén autorizados según las normativas eléctricas vigentes en el lugar y el *National Electrical Code*® ANSI/NFPA 70 o el *Canadian Electrical Code*® CSA C22.1.

El producto solamente debe utilizarse con un transformador de media tensión apropiado. El lado de baja tensión debe conectarse de forma neutral. El punto neutro debe conectarse a tierra (Encontrará los requisitos del transformador de media tensión en la información técnica "Important Requirements for Medium-Voltage Transformers" en [www.SMA-Solar.com](http://www.SMA-Solar.com)).

### Ninguna separación galvánica

El producto no dispone de transformador, por lo que no cuenta con separación galvánica.

- No utilice junto con el producto ningún módulo fotovoltaico conectado a tierra. Si se conectan al producto módulos fotovoltaicos conectados a tierra, se produce un evento. El evento se muestra con el aviso correspondiente en el listado de eventos de la interfaz de usuario del producto.
- Ponga a tierra solamente los bastidores de montaje de los módulos fotovoltaicos.

Los módulos fotovoltaicos con una gran capacidad a tierra solo deben utilizarse cuando su capacidad de acoplamiento no supere los 32  $\mu\text{F}$ .

Según el *National Electrical Code*®, para proteger la planta fotovoltaica frente a corrientes inversas demasiado altas en caso de error, debe estar conectado un dispositivo de protección contra sobrecorriente del lado de CC para evitar corrientes de cortocircuito que superen la corriente admisible del circuito eléctrico de CC o los valores de los fusibles de los módulos fotovoltaicos. Si se conectan más de dos strings en paralelo, normalmente se utilizan fusibles de string.

Deben respetarse en todo momento el rango de funcionamiento admisible y los requisitos de instalación de todos los componentes.

El producto está autorizado para el mercado de EE. UU. y Canadá.

Utilice siempre los productos de SMA de acuerdo con las indicaciones de la documentación adjunta y observe las leyes, reglamentos, reglas y normas vigentes. Cualquier otro uso puede causar lesiones al usuario o daños materiales.

Para realizar cualquier intervención en los productos de SMA, como modificaciones o remodelaciones, deberá contar con el permiso expreso y por escrito y deberá seguir las instrucciones de SMA Solar Technology AG. Los cambios no autorizados pueden ser peligrosos y pueden causar daños personales. Además, los cambios no autorizados conllevan la pérdida de los derechos de garantía, así como la extinción de la autorización de operación. Queda excluida la responsabilidad de SMA Solar Technology AG por los daños derivados de dichos cambios.

Cualquier uso del producto distinto al descrito en el uso previsto se considerará inadecuado.

La documentación adjunta es parte integrante del producto. La documentación debe leerse, observarse y guardarse en un lugar accesible en todo momento y seco.

Este documento no sustituye en ningún caso a cualquier legislación, reglamento o norma regional, federal, provincial o estatal aplicables a la instalación, la seguridad eléctrica y el uso del producto. SMA Solar Technology AG no asume responsabilidad alguna relativa al cumplimiento o al incumplimiento de la legislación o las disposiciones relacionadas con la instalación del producto.

La placa de características debe estar en el producto en todo momento.

## 2.2 Indicaciones importantes para la seguridad

Conservar instrucciones

Este capítulo contiene indicaciones de seguridad que deben observarse siempre en todos los trabajos que se realizan.

Este producto se ha construido en cumplimiento de los requisitos internacionales relativos a la seguridad. A pesar de estar cuidadosamente contruidos, existe un riesgo residual como con todos los equipos eléctricos. Para evitar daños personales y materiales y garantizar el funcionamiento permanente del producto, lea detenidamente este capítulo y cumpla siempre las indicaciones de seguridad.

### PELIGRO

#### **Peligro de muerte por descarga eléctrica por contacto con cables de CC conductores de tensión**

Cuando recibe luz, los módulos fotovoltaicos producen una alta tensión de CC que se acopla a los cables de CC. Tocar los cables de CC conductores de tensión puede causar la muerte o lesiones mortales por descarga eléctrica.

- No toque piezas o cables conductores de tensión descubiertos.
- Instalar el interruptor-seccionador de CC externo (p. ej. caja de conexiones fotovoltaica con interruptor-seccionador) entre el inversor y el generador fotovoltaico.
- Desconectar el generador fotovoltaico del inversor a través de un interruptor-seccionador de CC (p. ej. a través de una caja de conexiones fotovoltaica con interruptor-seccionador). Para esto apagar el interruptor-seccionador de potencia de CC y asegurarlo contra cualquier reconexión.
- Antes de cualquier trabajo, desconecte el punto de conexión de la tensión y asegure el producto contra cualquier reconexión accidental.
- Utilice equipamientos de protección personal adecuado cuando realice trabajos en el producto.

### PELIGRO

#### **Peligro de muerte por descarga eléctrica si se tocan partes de la planta bajo tensión en caso de fallo a tierra**

En caso de fallo a tierra los componentes de la planta pueden estar bajo tensión. El contacto con componentes conductores de tensión o cables puede causar la muerte o lesiones mortales por descarga eléctrica.

- Antes de cualquier trabajo, desconecte el punto de conexión de la tensión y asegure el producto contra cualquier reconexión accidental.
- Agarre los cables del generador fotovoltaico únicamente por el aislamiento.
- No toque las piezas de la base ni del bastidor del generador fotovoltaico.
- No conecte strings con un fallo a tierra al inversor.
- Desconecte de la tensión y espere 5 minutos antes de tocar los componentes de la planta fotovoltaica o del producto.

## PELIGRO

### **Peligro de muerte por descarga eléctrica en caso de sobretensión y si no hay protección contra sobretensión**

Si no hay una protección contra sobretensión, las sobretensiones (por ejemplo, en caso de que caiga un rayo) pueden transmitirse a través del cable de red o de otros cables de datos al edificio y a otros equipos conectados a la misma red. El contacto con componentes conductores de tensión o cables puede causar la muerte o lesiones mortales por descarga eléctrica.

- Asegúrese de que todos los equipos de la misma red estén integrados en la protección contra sobretensión existente.
- En caso de instalar los cables de red a la intemperie, en el paso de los cables de red del producto desde el exterior a la red en el edificio asegúrese de que haya una protección contra sobretensión adecuada.
- La interfaz ethernet del producto está clasificada como "TNV-1" y protege contra sobretensiones de hasta 1,5 kV.

## ADVERTENCIA

### **Peligro de muerte por fuego y explosión**

En infrecuentes casos aislados, puede producirse en caso de error una mezcla de gas inflamable en el interior del producto. En este estado puede producirse un incendio en el interior del producto o una explosión durante las actividades de conmutación. Piezas calientes o que salen despedidas pueden causar lesiones que pongan en peligro la vida o incluso la muerte.

- En caso de avería, no lleve a cabo maniobras directas en el producto.
- Asegúrese de que las personas no autorizadas no tienen acceso al producto.
- Desconecte el generador fotovoltaico del inversor a través de un dispositivo de desconexión. Si no hay ningún seccionador, espere hasta que no haya más potencia de CC en el inversor.
- Desconecte el disyuntor de CA y, si este ya se ha disparado, déjelo desconectado y asegúrelo contra cualquier reconexión.
- Lleve a cabo los trabajos en el producto (como la localización de errores o los trabajos de reparación) solo con equipamiento de protección personal para el tratamiento de sustancias peligrosas (por ejemplo, guantes de protección, protecciones oculares y faciales y respiratorias).

**⚠ ADVERTENCIA****Peligro de lesiones por sustancias tóxicas, gases y polvos.**

En algunos casos aislados, en el interior del producto pueden existir sustancias tóxicas, gases y polvos debidos a daños en los componentes electrónicos. El contacto con sustancias tóxicas y la inhalación de gases y polvos tóxicos puede causar irritación de la piel, quemaduras, dificultades respiratorias y náuseas.

- Lleve a cabo los trabajos en el producto (como la localización de errores o los trabajos de reparación) solo con equipamiento de protección personal para el tratamiento de sustancias peligrosas (por ejemplo, guantes de protección, protecciones oculares y faciales y respiratorias).
- Asegúrese de que las personas no autorizadas no tienen acceso al producto.

**⚠ ADVERTENCIA****Peligro de muerte debido al fuego por inobservancia de los pares de apriete en uniones roscadas conductoras de tensión**

Si no se respetan los pares de apriete indicados, se reduce la corriente admisible de las uniones roscadas conductoras de tensión y las resistencias de contacto aumentan. Como consecuencia, los componentes pueden sobrecalentarse y originar un incendio. Esto puede causar lesiones que pongan en peligro la vida o incluso la muerte.

- Asegúrese de que las uniones roscadas conductoras de tensión cumplan siempre con los pares de apriete indicados en este documento.
- Utilice para todos los trabajos únicamente las herramientas adecuadas.
- Evite reapretar las uniones roscadas conductoras de tensión para que los pares de apriete no sean más elevados de lo permitido.

**⚠ ADVERTENCIA****Peligro de muerte por descarga eléctrica en caso de daño irreparable en un equipo de medición por una sobretensión**

Una sobretensión puede dañar un equipo de medición y provocar que exista tensión en la carcasa del equipo de medición. Tocar la carcasa del equipo de medición bajo tensión puede causar la muerte o lesiones mortales por descarga eléctrica.

- Utilice únicamente equipos de medición cuyo rango de medición esté diseñado para las tensiones máximas de CA y CC del inversor.

**⚠ ATENCIÓN****Peligro de quemaduras por contacto con las partes calientes de la carcasa**

Las partes de la carcasa pueden calentarse durante el funcionamiento. Tocar partes calientes de la carcasa puede producir quemaduras.

- Durante el funcionamiento, toque únicamente la tapa de la carcasa del inversor.
- Antes de tocar la carcasa, espere a que el inversor se haya enfriado.

## **⚠ ATENCIÓN**

### **Peligro de lesiones por el peso del producto**

Existe peligro de lesiones al levantar el producto de forma inadecuada y en caso de caerse durante el transporte o el montaje.

- Transporte y eleve el producto con cuidado. Tenga en cuenta el peso del producto.
- Utilice equipamientos de protección personal adecuado cuando realice trabajos en el producto.
- Transporte el producto con ayuda de asas de transporte o aparejo elevador. Tenga en cuenta el peso del producto.
- Utilice siempre para el transporte con asas todas las asas de transporte suministradas.
- No utilice las asas de transporte para fijar el aparejo elevador (p.ej. cintas, cuerdas, cadenas). Para fijar el aparejo elevador se deben enroscar armellas en la rosca prevista en la parte superior del producto.

## **PRECAUCIÓN**

### **Daños en la junta de la carcasa en caso de congelación**

Si abre el producto en caso de congelación, puede dañarse la junta de la carcasa. Podría penetrar humedad y dañar el producto.

- Abra el producto únicamente si la temperatura ambiente no es inferior a -5 °C (23 °F).
- Si tiene que abrir el producto en condiciones de congelación, elimine antes de hacerlo cualquier posible formación de hielo en la junta de la carcasa (por ejemplo, deritiéndolo con aire caliente).

## **PRECAUCIÓN**

### **Daños en el producto provocados por arena, polvo y humedad**

Si penetra arena, polvo y humedad, el producto podría resultar dañado y sus funciones podrían verse limitadas.

- Abra el producto solamente si la humedad del aire se encuentra dentro de los valores límite y si el entorno está libre de arena y polvo.
- No abra el producto en caso de tormenta de arena o de precipitaciones.
- Cierre herméticamente todas las aberturas en la carcasa.
- Para fijar los conductos para cables al producto utilice solamente manguitos con certificación resistentes a la lluvia o humedad.

## **PRECAUCIÓN**

### **Daños en el inversor por descarga electrostática**

Si toca componentes electrónicos, puede dañar o destruir el inversor debido a una descarga electrostática.

- Póngase a tierra antes de tocar cualquier componente.

PRECAUCIÓN

**Daños en el productos debido a detergentes de limpieza**

Si utiliza productos de limpieza, puede dañar el producto y componentes del producto.

- Limpie el producto y todos los componentes del producto únicamente con un paño humedecido con agua limpia.

i

**Instalaciones eléctricas (válido para América del Norte)**

La instalación debe llevarse a cabo de conformidad con la legislación, las disposiciones, los reglamentos y las normas vigentes en el lugar (p.ej. *National Electrical Code*® ANSI/NFPA 70 o *Canadian Electrical Code*® CSA-C22.1.).

- Antes de realizar la conexión eléctrica del producto a la red pública, póngase en contacto con su operador de red en el lugar. La conexión eléctrica del producto puede realizarla únicamente personal especializado.
- Es necesario asegurarse de que los cables o conductores utilizados en la conexión eléctrica no estén dañados.

3 Símbolos del producto

| Símbolo                                                                             | Explicación                                                                                             |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|    | Advertencia de tensión<br>El producto funciona con tensiones altas.                                     |
|    | Advertencia de superficie caliente<br>El producto puede calentarse durante el funcionamiento.           |
|   | Tenga en cuenta la documentación<br>Tenga en cuenta toda la documentación suministrada con el producto. |
|  | Inversor<br>Junto con el led verde, este símbolo indica el estado de funcionamiento del inversor.       |
|  | Tenga en cuenta la documentación<br>Junto con el led rojo, este símbolo indica un error.                |
|  | Transferencia de datos<br>Junto con el led azul, este símbolo indica el estado de la conexión de red.   |

| Símbolo                                                                           | Explicación                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Señalización FCC<br>El producto cumple con los requisitos de las normas FCC aplicables.                                                                                                                                                                            |
|  | UL 62109-1 y CAN/CSA-C22.2 No. 62109-1:16 son las normativas empleadas en un producto por Underwriters Laboratories para certificar que el producto cumple las normas del <i>National Electrical Code</i> ®, del <i>Canadian Electrical Code</i> ® y de IEEE 1547. |

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L'exclusion susmentionnée des garanties implicites peut ne pas être applicable à tous les cas.

Les spécifications peuvent être modifiées sans préavis. Tous les efforts ont été mis en œuvre pour que ce document soit élaboré avec le plus grand soin et tenu aussi à jour que possible. SMA Solar Technology AG avertit toutefois les lecteurs qu'elle se réserve le droit d'apporter des modifications aux présentes spécifications sans préavis ou conformément aux dispositions du contrat de livraison existant, dès lors qu'elle juge de telles modifications opportunes à des fins d'amélioration du produit ou d'expériences d'utilisation. SMA Solar Technology AG décline toute responsabilité pour d'éventuelles pertes ou d'éventuels dommages indirects ou accidentels causés par la confiance placée dans le présent matériel, comprenant notamment les omissions, les erreurs typographiques, les erreurs arithmétiques ou les erreurs de listage dans le contenu de la documentation.

### Garantie SMA

Vous pouvez télécharger les conditions de garantie actuelles sur le site [www.SMA-Solar.com](http://www.SMA-Solar.com).

### Licences logicielles

Vous trouverez les licences pour les modules logiciels utilisés (open source) sur l'interface utilisateur du produit.

### Marques déposées

Toutes les marques déposées sont reconnues, y compris dans les cas où elles ne sont pas explicitement signalées comme telles. L'absence de l'emblème de la marque ne signifie pas qu'un produit ou une marque puisse être librement commercialisé(e).

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# 1 Remarques relatives à ce document

## 1.1 Champ d'application

Ce document est valable pour les :

- SHP 125-US-20 (Sunny Highpower PEAK3-US)
- SHP 150-US-20 (Sunny Highpower PEAK3-US)

## 1.2 Groupe cible

Les opérations décrites dans le présent document doivent uniquement être réalisées par un personnel qualifié. Ce dernier doit posséder les qualifications suivantes :

- Connaissances relatives au mode de fonctionnement et à l'exploitation d'un onduleur
- Formation au comportement à adopter face aux dangers et risques encourus lors de l'installation, la réparation et la manipulation d'appareils et installations électriques
- Formation à l'installation et à la mise en service des appareils et installations électriques
- Connaissance des lois, normes et directives pertinentes
- Connaissance et respect du présent document avec toutes les consignes de sécurité

## 1.3 Contenu et structure du document

Le présent document contient des informations relatives à la sécurité ainsi que des instructions graphiques concernant l'installation et la mise en service (voir page 31). Veuillez tenir compte de toutes les informations fournies et exécuter les actions représentées graphiquement dans le présent document dans l'ordre donné.

Vous trouverez la version la plus récente de ce document ainsi que les instructions complètes pour l'installation, la mise en service, la configuration et la mise hors service du produit au format PDF et comme eManual sur [www.SMA-Solar.com](http://www.SMA-Solar.com). Vous trouverez le code QR contenant le lien vers l'eManual sur la page de titre de ce document. Vous trouverez également l'eManual utilisée sur l'interface utilisateur du produit.

Les illustrations du présent document sont réduites aux détails essentiels et peuvent différer du produit réel.

## 1.4 Niveaux de mise en garde

Les niveaux de mise en garde suivants peuvent apparaître en vue d'un bon maniement du produit.

|                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div> <b>DANGER</b></div> <div>Indique une mise en garde dont le non-respect entraîne des blessures corporelles graves, voire la mort.</div>                  |
| <div> <b>AVERTISSEMENT</b></div> <div>Indique une mise en garde dont le non-respect peut entraîner des blessures corporelles graves, voire la mort.</div>     |
| <div> <b>ATTENTION</b></div> <div>Indique une mise en garde dont le non-respect peut entraîner des blessures corporelles légères ou de moyenne gravité.</div> |
| <div><b>PRUDENCE</b></div> <div>Indique une mise en garde dont le non-respect peut entraîner des dommages matériels.</div>                                                                                                                     |

## 1.5 Symboles utilisés dans le document

| Symbole                                                                           | Explication                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|  | Information importante sur un thème ou un objectif précis, mais ne relevant pas de la sécurité |
|  | Chapitre comprenant une représentation graphique de l'installation et de la mise en service    |

# 2 Sécurité

## 2.1 Utilisation conforme

Le Sunny Highpower est un onduleur photovoltaïque sans transformateur qui transforme le courant continu du générateur photovoltaïque en courant alternatif conforme au réseau et qui injecte ce dernier dans le réseau électrique public à l'aide d'un transformateur séparé.

Le produit est conçu pour être utilisé dans les domaines professionnel, industriel ou commercial.

Le produit est adapté pour une utilisation aux environnements chimiquement actifs conformément à la norme CEI 60721-3-4, classe 4C2.

Le produit est adapté pour une utilisation en intérieur comme en extérieur.

Le produit ne doit être exploité qu'avec des panneaux photovoltaïques de la classe de protection II selon IEC 61730, classe d'application A. Les panneaux photovoltaïques utilisés doivent convenir à une utilisation avec ce produit.

Le produit ne doit être utilisé qu'avec des générateurs photovoltaïques (panneaux photovoltaïques et câblage) qui sont homologués conformément aux normes électriques en vigueur sur le lieu d'installation ainsi qu'au *National Electrical Code*® ANSI/NFPA 70 ou le *Canadian Electrical Code*® CSA C22.1.

Le produit doit être mis en service uniquement en combinaison avec un transformateur moyenne tension approprié. Le côté basse tension doit être câblé en étoile et le point neutre mis à la terre (pour les exigences relatives au transformateur moyenne tension voir l'information technique « Important Requirements for Medium-Voltage Transformers » sur [www.SMA-Solar.com](http://www.SMA-Solar.com)).

### **Pas de séparation galvanique**

Le produit n'a pas de transformateur et ne dispose donc pas de séparation galvanique.

- N'utilisez pas de panneaux photovoltaïques mis à la terre avec le produit. Si des panneaux photovoltaïques mis à la terre sont raccordés au produit, un événement survient. Cet événement s'affiche sur l'interface utilisateur du produit, dans la liste des événements, accompagné du message correspondant.
- Mettez à la terre uniquement le cadre de montage des panneaux photovoltaïques.

Les panneaux photovoltaïques d'une grande capacité à la terre ne doivent être utilisés que si leur capacité de couplage ne dépasse pas 32  $\mu$ F.

Afin de protéger l'installation photovoltaïque contre les courants de retour trop élevés en cas de survenue d'un dysfonctionnement, il est impératif, conformément au *National Electrical Code*®, de raccorder un dispositif de protection contre les surintensités côté DC pour éviter d'éventuels courants de court-circuit dépassant la capacité de charge du courant du circuit électrique DC ou la capacité des fusibles des panneaux photovoltaïques. Normalement, on utilise des fusibles string lorsque le nombre de strings branchés en parallèle est supérieur à deux.

La plage de fonctionnement autorisée et les exigences pour les installations de tous les composants doivent être respectées en toutes circonstances.

Le produit est homologué pour les marchés américain et canadien.

Utilisez des produits SMA exclusivement en conformité avec la documentation fournie ainsi qu'avec les lois, dispositions, prescriptions, normes et directives en vigueur sur le site. Tout autre usage peut compromettre la sécurité des personnes ou entraîner des dommages matériels.

Les interventions sur les produits SMA (modifications ou transformations, par exemple) ne sont autorisées qu'après accord écrit et les instructions de SMA Solar Technology AG. Toute intervention non autorisée peut être dangereuse et risque de provoquer des dommages corporels. Toute intervention non autorisée entraîne également l'annulation de la garantie légale et commerciale et, en règle générale, le retrait de l'autorisation d'exploitation. SMA Solar Technology AG décline toute responsabilité en cas de dommages résultant d'une telle intervention.

Toute utilisation du produit différente de celle décrite dans l'utilisation conforme est considérée comme non conforme.

Les documents joints font partie intégrante du produit. Les documents doivent être lus, respectés, rester accessibles à tout moment et conservés dans un endroit sec.

Ce document ne remplace pas et n'a pas pour objet de remplacer les législations, prescriptions ou normes régionales, territoriales, provinciales, nationales ou fédérales ainsi que les dispositions et les normes s'appliquant à l'installation, à la sécurité électrique et à l'utilisation du produit. SMA Solar Technology AG décline toute responsabilité pour la conformité ou non-conformité à ces législations ou dispositions en relation avec l'installation du produit.

La plaque signalétique doit être apposée en permanence sur le produit.

## 2.2 Consignes de sécurité importantes

Conserver ces instructions

Ce chapitre contient les consignes de sécurité qui doivent être respectées lors de tous les travaux effectués.

Le produit a été conçu et testé conformément aux exigences de sécurité internationale. En dépit d'un assemblage réalisé avec le plus grand soin, comme pour tout appareil électrique/électronique, il existe des risques résiduels. Lisez ce chapitre attentivement et respectez en permanence toutes les consignes de sécurité pour éviter tout dommage corporel et matériel, et garantir un fonctionnement durable du produit.

### DANGER

#### **Danger de mort par choc électrique en cas de contact avec des câbles DC conducteurs**

En cas d'ensoleillement, les panneaux photovoltaïques produisent des hautes tensions continues dans les câbles DC. Le contact avec des câbles DC sous tension entraîne des blessures graves, voire la mort par choc électrique.

- Ne touchez pas aux composants conducteurs ou aux câbles dénudés.
- Installez l'interrupteur-sectionneur DC externe (par exemple boîte de jonction PV avec interrupteur-sectionneur) entre l'onduleur et le générateur photovoltaïque.
- Coupez le générateur photovoltaïque de l'onduleur via un interrupteur-sectionneur DC externe (par exemple via une boîte de jonction PV avec interrupteur-sectionneur). Désactivez l'interrupteur-sectionneur DC et sécurisez-le contre toute remise en marche.
- Mettez hors tension le produit et sécurisez-le avant toute intervention.
- Portez toujours un équipement de protection individuelle adapté lors de toute intervention sur le produit.

### DANGER

#### **Danger de mort par choc électrique au contact de parties de l'installation sous tension en cas de défaut à la terre**

En cas de défaut à la terre, des parties de l'installation peuvent être sous tension. Le contact avec des composants conducteurs ou des câbles peut entraîner la mort ou des blessures mortelles due à un choc électrique.

- Mettez hors tension le produit et sécurisez-le avant toute intervention.
- Touchez les câbles du générateur photovoltaïque uniquement au niveau de l'isolation.
- Ne touchez pas les éléments de la sous-construction et du châssis du générateur photovoltaïque.
- Ne raccordez pas de strings photovoltaïques avec un défaut à la terre à l'onduleur.
- Après la mise hors tension, attendez cinq minutes avant de toucher des parties de l'installation photovoltaïque ou du produit.

## ⚠ DANGER

### **Danger de mort par choc électrique en cas de surtension en l'absence de protection contre les surtensions**

En l'absence de protection contre les surtensions, les surtensions (provoquées par exemple par un impact de foudre) peuvent se propager par les câbles réseau ou d'autres câbles de communication dans le bâtiment et dans les appareils raccordés au même réseau. Le contact avec des composants conducteurs ou des câbles peut entraîner la mort ou des blessures mortelles due à un choc électrique.

- Assurez-vous que tous les appareils appartenant au même réseau sont intégrés dans la protection contre les surtensions existante.
- Lors de la pose des câbles réseau à l'extérieur, assurez-vous qu'une protection contre les surtensions adéquate est présente au point de transition des câbles réseau entre le produit à l'extérieur et le réseau à l'intérieur du bâtiment.
- L'interface Ethernet du produit est classée « TNV-1 » et offre une protection contre les surtensions jusqu'à 1,5 kV.

## ⚠ AVERTISSEMENT

### **Danger de mort par incendie et explosion**

Dans de rares cas, les mélanges gazeux inflammables peuvent être générés dans le produit en cas de dysfonctionnement. Les opérations de commutation risquent, dans ce cas, de provoquer un incendie ou une explosion dans le produit. Il peut en résulter la mort ou des blessures pouvant engager le pronostic vital par projection d'objets ou présence d'objets brûlants.

- En cas de dysfonctionnement, n'exécutez pas d'actions directes sur le produit.
- Assurez-vous que les personnes non autorisées ne peuvent pas accéder au produit.
- Déconnectez le générateur photovoltaïque de l'onduleur via un dispositif de sectionnement externe. En l'absence de tout dispositif séparateur, patientez jusqu'à ce qu'il n'y ait plus de puissance DC sur l'onduleur.
- Coupez le disjoncteur miniature AC ou si celui-ci s'est déjà déclenché, laissez-le désactivé et sécurisez-le contre tout réenclenchement.
- Lors de l'exécution de travaux sur le produit (recherche d'erreurs, réparations, par ex.), portez toujours un équipement de protection individuelle conçu pour manipuler des matières dangereuses (gants de protection, protection des yeux et du visage et masque respiratoire).

**⚠ Avertissement****Risque de blessures dû à des substances, gaz et poussières toxiques**

Dans de rares cas, des dommages de pièces électroniques peuvent générer des substances, gaz et poussières toxiques dans le produit. Le contact avec des substances toxiques ainsi que l'inhalation de gaz et de poussières toxiques peuvent causer des irritations cutanées, des brûlures, des problèmes respiratoires et la nausée.

- Lors de l'exécution de travaux sur le produit (recherche d'erreurs, réparations, par ex.), portez toujours un équipement de protection individuelle conçu pour manipuler des matières dangereuses (gants de protection, protection des yeux et du visage et masque respiratoire).
- Assurez-vous que les personnes non autorisées ne peuvent pas accéder au produit.

**⚠ Avertissement****Danger de mort par incendie dû au non-respect des couples de serrage sur les raccords vissés conducteurs de courant**

Le non-respect des couples de serrage exigés diminue la capacité de charge du courant des vissages conducteurs de courant et les résistances de contact augmentent. Les composants peuvent alors surchauffer et prendre feu. Il peut en résulter la mort ou des blessures pouvant engager le pronostic vital.

- Assurez-vous que les vissages conducteurs de courant sont toujours serrés au couple de serrage indiqué dans ce document.
- N'utilisez pour tous les travaux que des outils adaptés.
- Évitez de resserrer les vissages conducteurs de courant, car les couples de serrage en résultant pourraient être inadmissibles.

**⚠ Avertissement****Danger de mort par choc électrique lors de la destruction d'un appareil de mesure due à une surtension**

Une surtension peut endommager un appareil de mesure et créer une tension au niveau du boîtier de l'appareil de mesure. Le contact avec le boîtier sous tension de l'appareil de mesure entraîne des blessures graves, voire la mort par choc électrique.

- Utilisez uniquement des appareils de mesure dont les plages de mesure sont conçues pour la tension AC et DC maximale de l'onduleur.

**⚠ Attention****Risque de brûlure dû au contact de composants chauds du boîtier**

Des pièces du boîtier peuvent devenir très chaudes en cours de service. Le contact avec les composants chauds du boîtier peut provoquer des brûlures.

- Ne touchez que le couvercle du boîtier de l'onduleur pendant le fonctionnement.
- Avant de toucher le boîtier, attendez que l'onduleur ait refroidi.

## ATTENTION

### Risque de blessure dû au poids du produit

Il existe un risque de blessure en cas de soulèvement incorrect et de chute du produit lors du transport et du montage.

- Le produit doit être transporté et soulevé avec précaution. Prenez en compte le poids du produit.
- Portez toujours un équipement de protection individuelle adapté lors de toute intervention sur le produit.
- Transportez le produit à l'aide des poignées ou des accessoires de levage. Prenez en compte le poids du produit.
- Pour un transport effectué au moyen des poignées, utilisez toujours toutes les poignées de transport livrées.
- Ne pas utiliser les poignées de transport pour fixer les accessoires de levage (comme les sangles, cordes ou chaînes). Pour fixer les accessoires de levage, il est nécessaire de visser les vis à œillet dans les filetages situés sur la partie supérieure du produit.

## PRUDENCE

### Risque d'endommagement du joint du boîtier en raison du gel

Si vous ouvrez le produit quand il gèle, le joint pourra être endommagé. De l'humidité peut alors pénétrer dans le produit et l'endommager.

- N'ouvrez le produit que si la température ambiante n'est pas inférieure à -5 °C (23 °F).
- Si vous devez ouvrir le produit quand il gèle, éliminez tout d'abord la glace qui a pu s'accumuler sur le joint du boîtier (par exemple en la faisant fondre avec de l'air chaud).

## PRUDENCE

### Endommagement du produit par pénétration de sable, de poussière et d'humidité

La pénétration de sable, de poussière et d'humidité dans le produit peut endommager celui-ci ou altérer son fonctionnement.

- N'ouvrez le produit que si l'humidité de l'air est comprise dans les limites indiquées et si l'environnement est exempt de sable et de poussière.
- N'ouvrez pas le produit en cas de tempête de sable ou de précipitations.
- Obturez hermétiquement toutes les ouvertures de boîtier.
- Pour fixer les tuyaux à câbles sur le produit, utilisez uniquement des manchons étanches à l'eau ou résistants à l'humidité listés.

| PRUDENCE                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Endommagement de l'onduleur par une décharge électrostatique</b><br>En touchant les composants électroniques, vous pouvez endommager, voire détruire l'onduleur par décharge électrostatique. <ul style="list-style-type: none"><li>Reliez-vous à la terre avant de toucher un composant.</li></ul>                             |
| PRUDENCE                                                                                                                                                                                                                                                                                                                           |
| <b>Endommagement du produit par des produits nettoyants</b><br>Dû à l'utilisation de produits nettoyants, le produit et des parties de celui-ci peuvent être endommagés. <ul style="list-style-type: none"><li>Nettoyez le produit et toutes les parties du produit uniquement avec un chiffon humidifié à l'eau claire.</li></ul> |

-  **Installations électriques (pour l'Amérique du Nord)**  
L'installation doit être réalisée conformément aux législations, dispositions, prescriptions et normes (par exemple *National Electrical Code*® ANSI/NFPA 70 ou *Canadian Electrical Code*® CSA-C22.1.) en vigueur sur place.
  - Avant de réaliser le raccordement électrique du produit au réseau électrique public, adressez-vous à votre exploitant de réseau local. Le raccordement électrique du produit ne doit être effectué que par du personnel qualifié.
  - Assurez-vous que les câbles ou conducteurs utilisés pour le raccordement électrique ne soient pas endommagés.

3 Symboles sur le produit

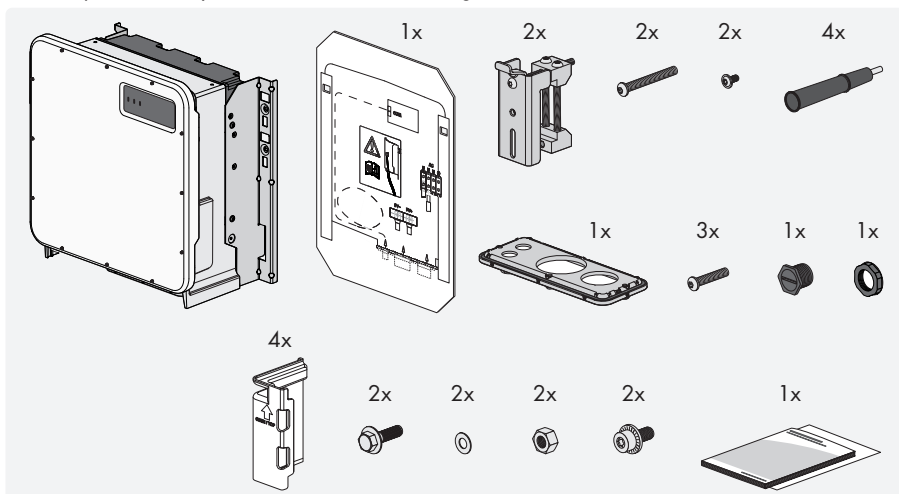
| Symbole                                                                             | Explication                                                                                                            |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|   | Avertissement de tension électrique dangereuse<br>Le produit fonctionne avec des tensions élevées.                     |
|  | Avertissement de surface brûlante<br>Au cours du fonctionnement, le produit peut devenir brûlant.                      |
|  | Respectez la documentation<br>Suivez toutes les informations données dans les documentations fournies avec le produit. |
|  | Onduleur<br>Le symbole et la DEL verte indiquent l'état de fonctionnement de l'onduleur.                               |
|  | Respectez la documentation<br>Le symbole et la DEL rouge indiquent une erreur.                                         |

| Symbole                                                                           | Explication                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Transmission de données<br>Le symbole et la DEL bleue indiquent l'état de la connexion réseau.                                                                                                                                                                          |
|  | Marquage FCC<br>Le produit est conforme aux exigences des normes FCC en vigueur.                                                                                                                                                                                        |
|  | UL 62109-1 et CAN/CSA-C22.2 No. 62109-1:16 sont les normes appliquées au produit par Underwriters Laboratories pour certifier que le produit remplit les exigences du <i>National Electrical Code</i> ®, du <i>Canadian Electrical Code</i> ® et de la norme IEEE 1547. |

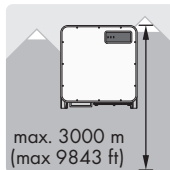
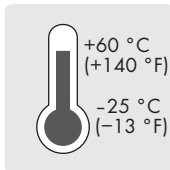
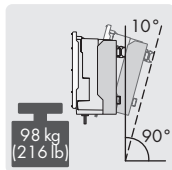
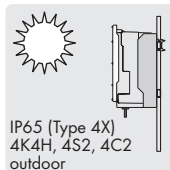
# Instructions



**en** Scope of Delivery **es** Contenido de la entrega **fr** Contenu de la livraison

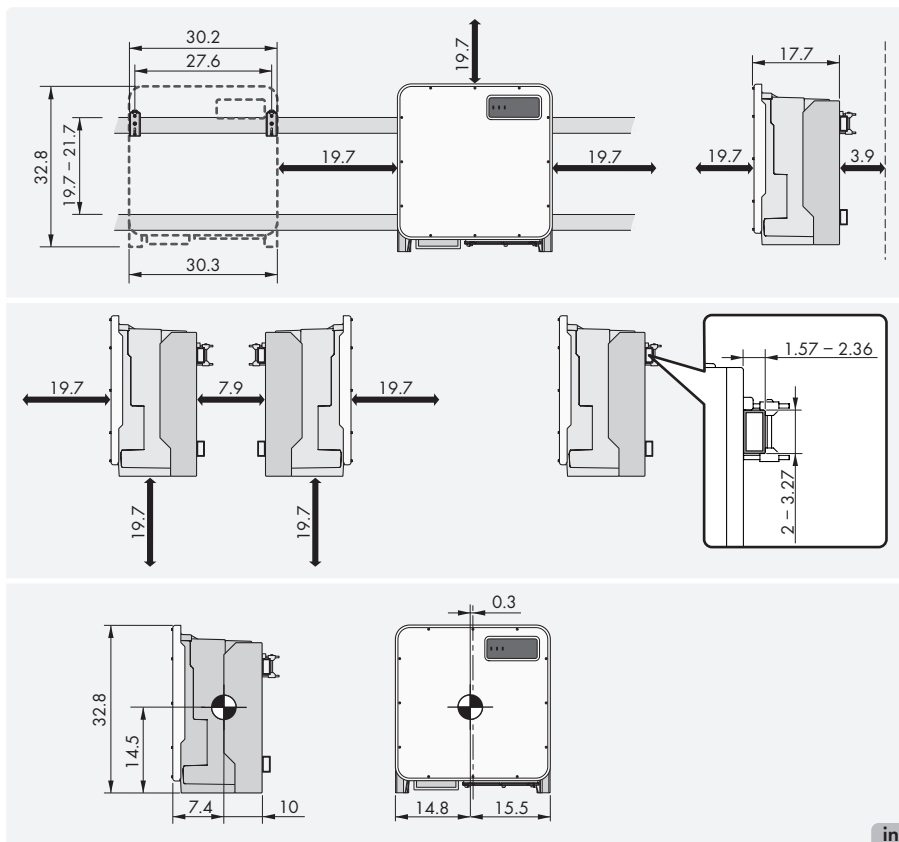


**en** Mounting location **es** Lugar de montaje **fr** Lieu de montage



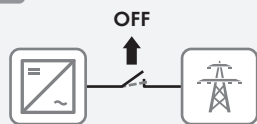


**en** Mounting and Connection Preparation **es** Preparación del montaje y la conexión  
**fr** Préparatifs pour le montage et le raccordement

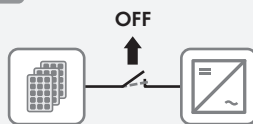


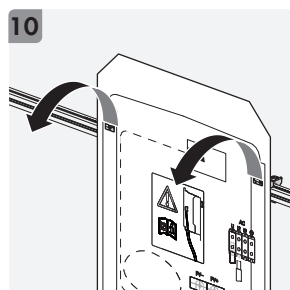
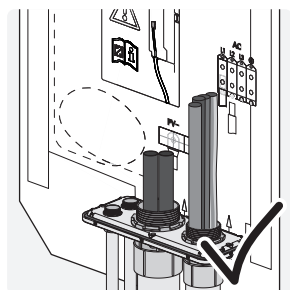
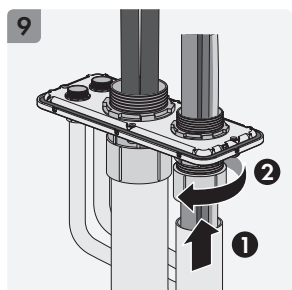
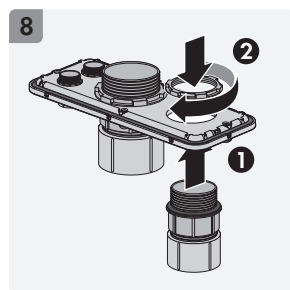
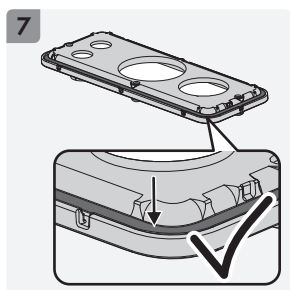
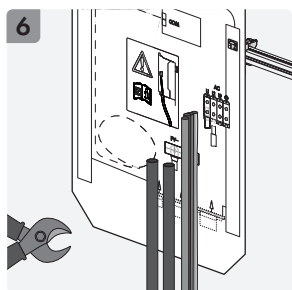
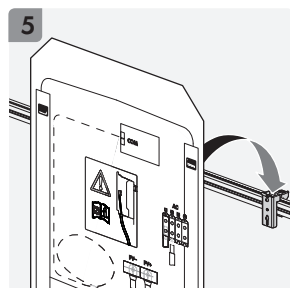
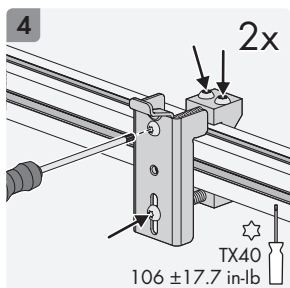
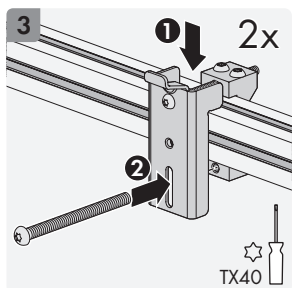
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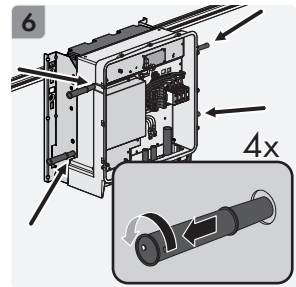
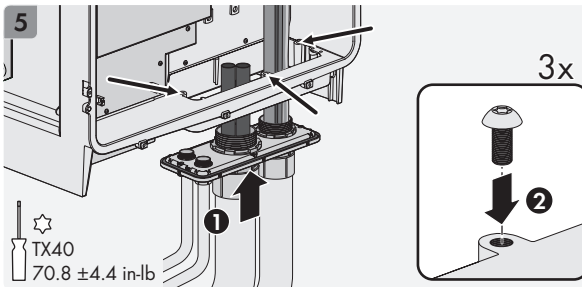
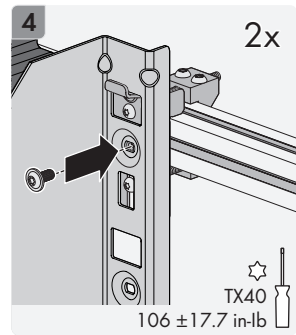
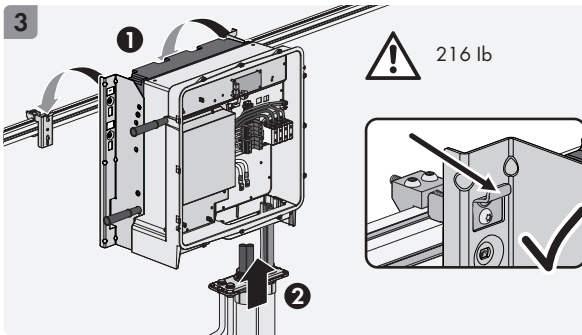
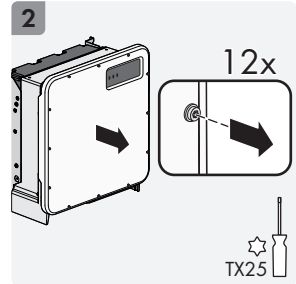
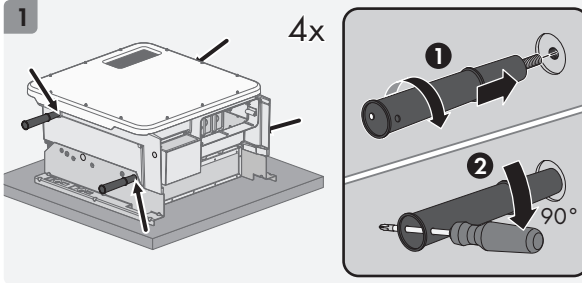
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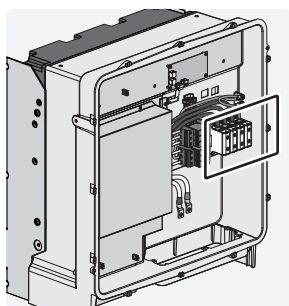
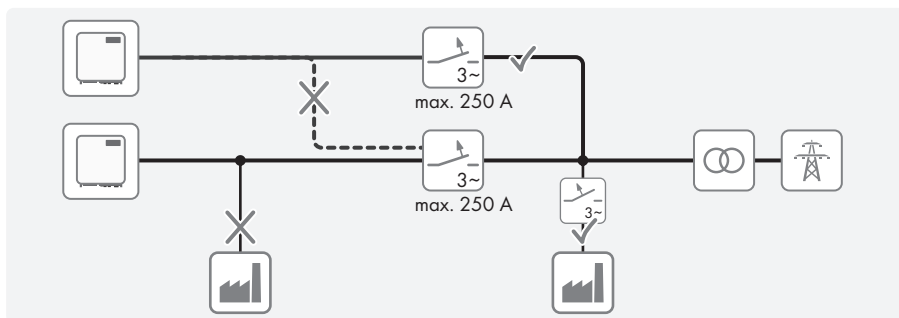




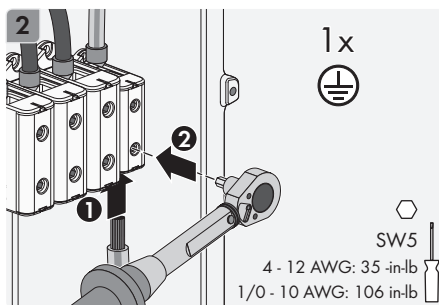
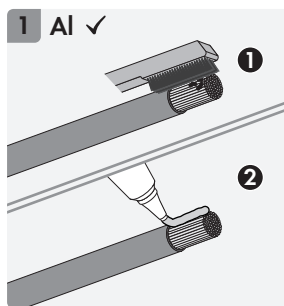
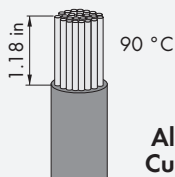


en Mounting es Montaje fr Montage



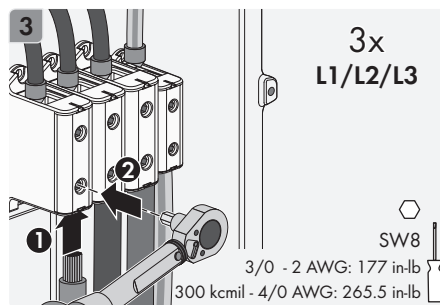


L1-L3: 300 kcmil - 1 AWG  
PE: Al: 1/0 - 4 AWG  
Cu: 1/0 - 6 AWG



1x  
⏏

SW5  
4 - 12 AWG: 35 in-lb  
1/0 - 10 AWG: 106 in-lb



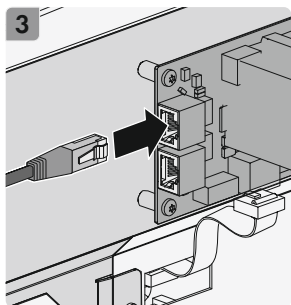
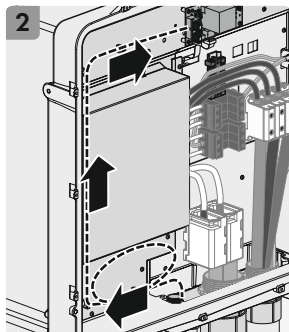
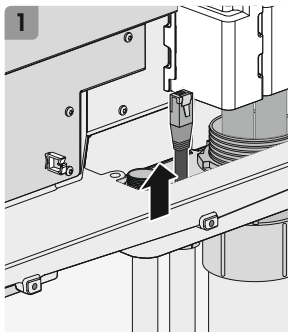
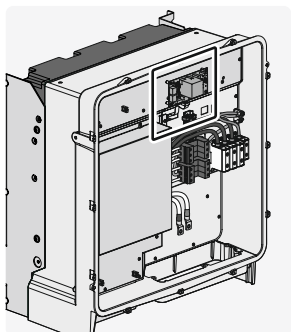
3x  
L1/L2/L3

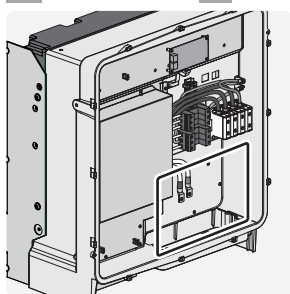
SW8  
3/0 - 2 AWG: 177 in-lb  
300 kcmil - 4/0 AWG: 265.5 in-lb

| AC                          | SHP 125-20                          | SHP 150-20     |
|-----------------------------|-------------------------------------|----------------|
| $P_{AC}$ (@ 230 V, 50 Hz)   | 125000 W                            | 150000 W       |
| $S$ (@ $\cos \varphi = 1$ ) | 125000 VA                           | 150000 VA      |
| $V_{AC,r}$                  | 480 V                               | 600 V          |
| $V_{AC, range}$             | 422 V to 528 V                      | 480 V to 690 V |
| $I_{AC}$                    | 151 A                               | 145 A          |
| $I_{AC, max}$               | 151 A                               |                |
| $f_{AC}$                    | 50 Hz / 60 Hz                       |                |
| $\cos \varphi$              | 0.0 overexcited to 0.0 underexcited |                |



en Connecting the network es Conexión de la red fr Connexion au réseau

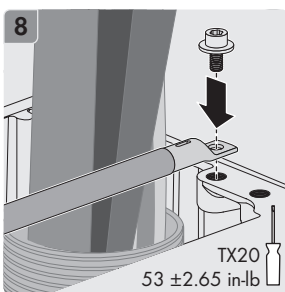
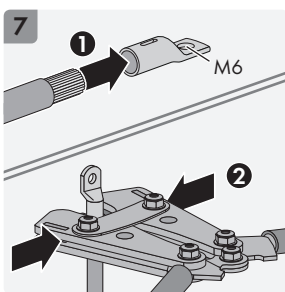
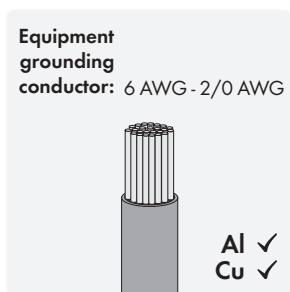
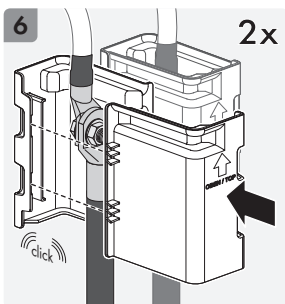
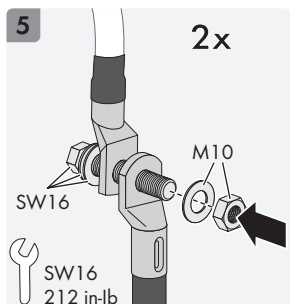
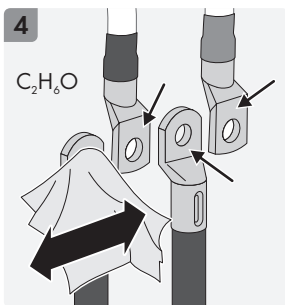
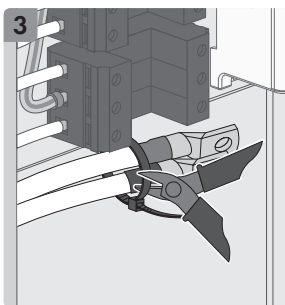
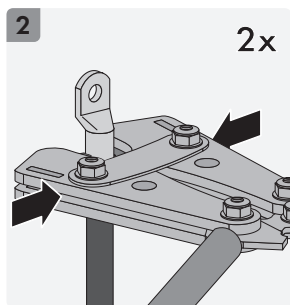
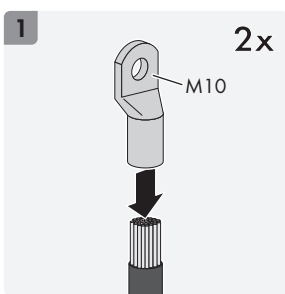




DC+/DC-: 600 kcmil - 3/0 AWG

90 °C

Al ✓  
Cu ✓



DC

SHP 125-US-20

SHP 150-US-20

Max. generator power

187500 Wp

225000 Wp

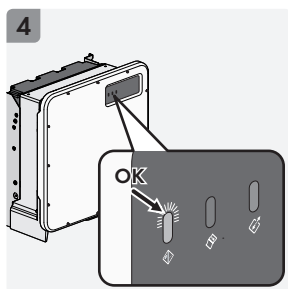
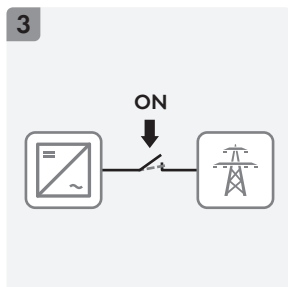
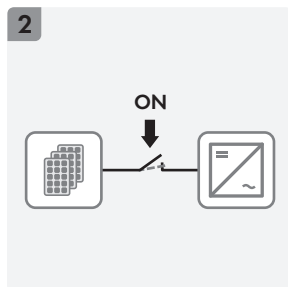
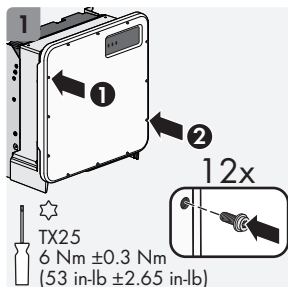
V<sub>DC, max</sub>

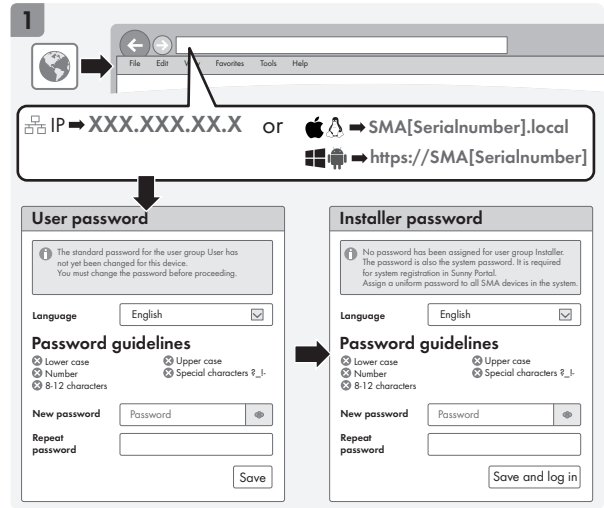
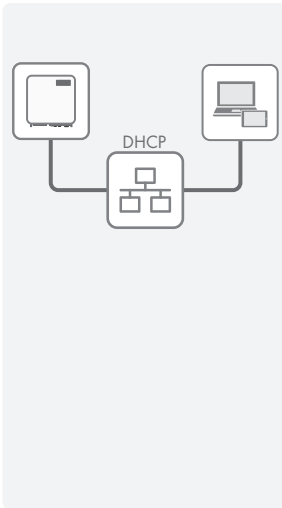
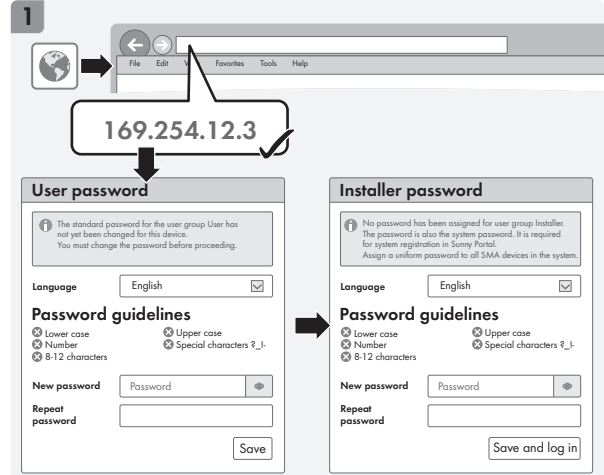
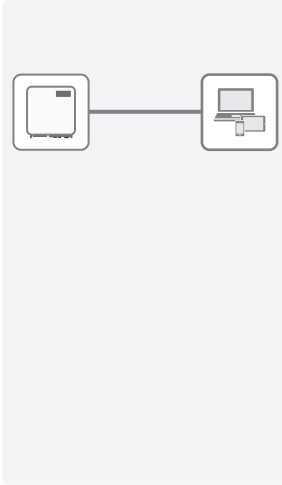
1500 V



| DC            | SHP 125-US-20   | SHP 150-US-20   |
|---------------|-----------------|-----------------|
| $V_{DC, MPP}$ | 705 V to 1450 V | 880 V to 1450 V |
| $I_{DC, max}$ | 180 A           |                 |
| $I_{SC PV}$   | 325 A           |                 |

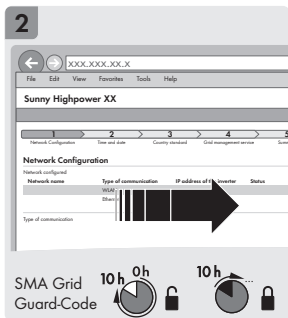
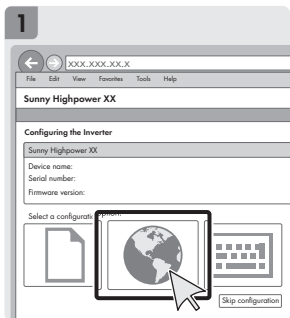
**en** Commissioning **es** Puesta en marcha **fr** Mise en service



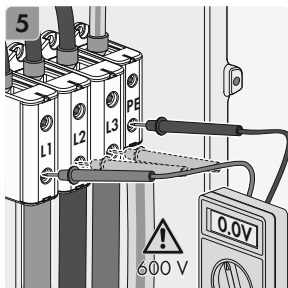
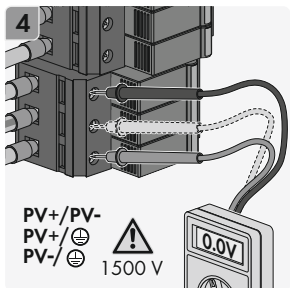
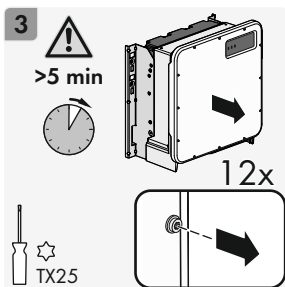
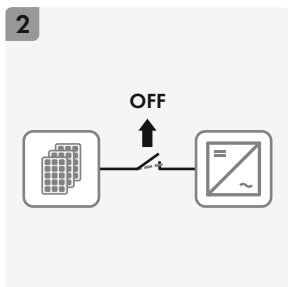
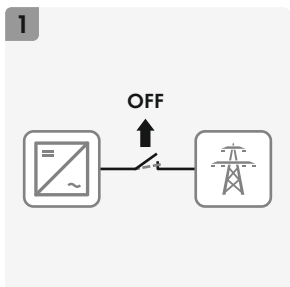




## en Configuration es Configuración fr Configuration



## en Disconnect from voltage sources es Desconexión de la tensión fr Mettez hors tension



## en System data es Datos del sistema fr Données du système

Topology

transformerless

Overvoltage category in accordance with IEC 60664-1

II (DC), III (AC)

Protection class in accordance with IEC 61140

I

All-pole sensitive residual-current monitoring unit

integrated

Maximum permissible value for relative humidity, condensing

100 %

Extended humidity range according to IEC 60721-3-4

0 % to 100 %

|                                        |   |
|----------------------------------------|---|
| Pollution degree inside the enclosure  | 2 |
| Pollution degree outside the enclosure | 3 |

**en** Compliance Information **es** Información de cumplimiento **fr** Informations sur le respect des spécifications

## FCC Compliance

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications made to this equipment not expressly approved by SMA Solar Technology AG may void the FCC authorization to operate this equipment.

**en** Contact **es** Contacto **fr** Contact

|               |                                                 |                                                                                                               |
|---------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| United States | SMA Solar Technology America LLC<br>Rocklin, CA | Toll free for USA and US Territories<br>+1 877-MY-SMATech (+1 877-697-6283)<br>International: +1 916 625-0870 |
| Canada        | SMA Solar Technology Canada Inc.<br>Mississauga | Toll free for Canada / Sans frais pour le Canada :<br>+1 877-MY-SMATech (+1 877-697-6283)                     |
| México        | SMA Solar Technology de México<br>Mexico City   | Internacional: +1 916 625-0870                                                                                |





Access data for the registration in Sunny Portal and WLAN password | Datos de acceso para registrarse en el Sunny Portal y contraseña WLAN | Données d'accès pour l'enregistrement sur le Sunny Portal et mot de passe WLAN

Serial number

Installer password | Contraseña de instalador | Mot de passe installateur

User password | Contraseña del usuario | Mot de passe utilisateur

ENERGY  
THAT  
CHANGES



# YUKON Series

Half-Cell  
Transparent Backsheet Module

**540-555W**

Module Power Output

**21.48%**

Max Efficiency



## Key Features



High module conversion efficiency



Better temperature coefficient



Super multi busbar technology



Low attenuation long warranty



Superior load capacity



Higher bifaciality

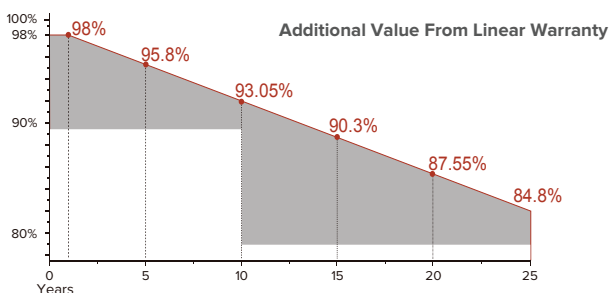


USA based liability insurance



Houston, Texas based company

## Warranty



**15** <Years>  
Guarantee on product material and workmanship

**25** <Years>  
Linear power output warranty

## Product Certification

IEC61215:2016; IEC 61730:2016; UL1703; UL61730/ETL/CEC

IEC62804 PID

IEC61701 Salt Mist

IEC62716 Ammonia Resistance

IEC60068 Dust and Sand

IEC61215 Hailstone

Fire Type (UL61730):Type1

ISO14001:2015; ISO9001:2015; ISO45001:2018



## About SEG Solar

SEG Solar is a leading manufacturer of high-performance solar panels for residential, commercial, and utility applications. The company, headquartered in Houston, Texas, is committed to providing cost-effective and reliable solar solutions that help customers reduce their energy costs and carbon footprint.



Download Datasheet

## Electrical Characteristics

| Module Type                   | SEG-540-BMA-TB |               |             | SEG-545-BMA-TB |               |             | SEG-550-BMA-TB |               |             | SEG-555-BMA-TB |               |             |
|-------------------------------|----------------|---------------|-------------|----------------|---------------|-------------|----------------|---------------|-------------|----------------|---------------|-------------|
|                               | Front<br>STC   | Front<br>NOCT | Back<br>STC | Front<br>STC   | Front<br>NOCT | Back<br>STC | Front<br>STC   | Front<br>NOCT | Back<br>STC | Front<br>STC   | Front<br>NOCT | Back<br>STC |
| Maximum Power -Pmp(W)         | 540            | 406           | 378         | 545            | 409           | 382         | 550            | 414           | 385         | 555            | 418           | 389         |
| Open Circuit Voltage -Voc(V)  | 49.50          | 46.18         | 49.48       | 49.60          | 46.32         | 49.58       | 49.70          | 46.40         | 49.68       | 49.80          | 46.47         | 49.78       |
| Short Circuit Current -Isc(A) | 13.81          | 11.16         | 9.74        | 13.90          | 11.23         | 9.80        | 14.00          | 11.32         | 9.87        | 14.10          | 11.40         | 9.94        |
| Maximum Power Voltage -Vmp(V) | 41.55          | 38.39         | 41.61       | 41.80          | 38.41         | 41.86       | 42.05          | 38.58         | 42.10       | 42.31          | 38.75         | 42.35       |
| Maximum Power Current -Imp(A) | 13.00          | 10.59         | 9.09        | 13.04          | 10.65         | 9.13        | 13.08          | 10.73         | 9.15        | 13.12          | 10.79         | 9.19        |
| Module Efficiency STC-ηm(%)   | 20.90          |               |             | 21.10          |               |             | 21.29          |               |             | 21.48          |               |             |
| Power Tolerance(W)            | (0, +3%)       |               |             |                |               |             |                |               |             |                |               |             |
| Maximum System Voltage        | 1500V DC       |               |             |                |               |             |                |               |             |                |               |             |
| Maximum Series Fuse Rating    | 25 A           |               |             |                |               |             |                |               |             |                |               |             |

STC: Irradiance 1000 W/m<sup>2</sup> module temperature 25°C AM=1.5

NOCT: Irradiance 800W/m<sup>2</sup> ambient temperature 20°C module temperature 45°C wind speed: 1m/s

Power measurement tolerance: +/-3%

## Mechanical Specifications

|                        |                                               |
|------------------------|-----------------------------------------------|
| External Dimension     | 2278 x 1134 x 35 mm                           |
| Weight                 | 27.0 kg                                       |
| Solar Cells            | PERC Mono 182 x 91mm(144 pcs)                 |
| Front Glass            | 3.2 / mm AR coating tempered glass / low iron |
| Frame                  | Anodized aluminium alloy                      |
| Junction Box           | IP68 / 3 diodes                               |
| Connector Type         | QC4.10                                        |
| Cable Type / Length    | 12 AWG PV Wire (UL) /1200 mm                  |
| Mechanical Load(Front) | 5400 Pa / 113 psf*                            |
| Mechanical Load(Rear)  | 3600 Pa / 75 psf*                             |

\*Refer to SEG installation Manual for details

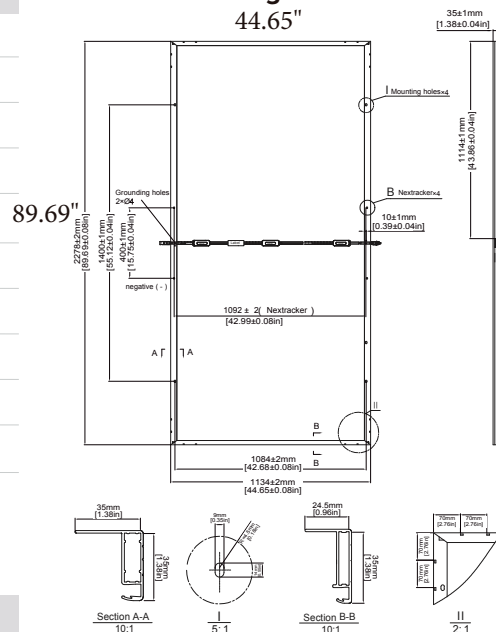
## Packing Configuration

|                       |       |       |
|-----------------------|-------|-------|
| Container             | 20'GP | 40'HQ |
| Pieces per Pallet     | 31    | 31    |
| Pallets per Container | 4     | 20    |
| Pieces per Container  | 124   | 620   |
| 341kw/container       |       |       |

## Temperature Characteristics

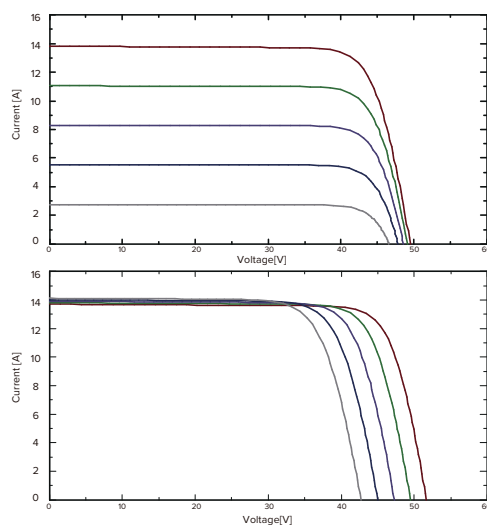
|                                           |            |
|-------------------------------------------|------------|
| Pmax Temperature Coefficient              | -0.35 %/°C |
| Voc Temperature Coefficient               | -0.27 %/°C |
| Isc Temperature Coefficient               | +0.05 %/°C |
| Operating Temperature                     | -40~+85 °C |
| Nominal Operating Cell Temperature (NOCT) | 45±2 °C    |

## Technical Drawing



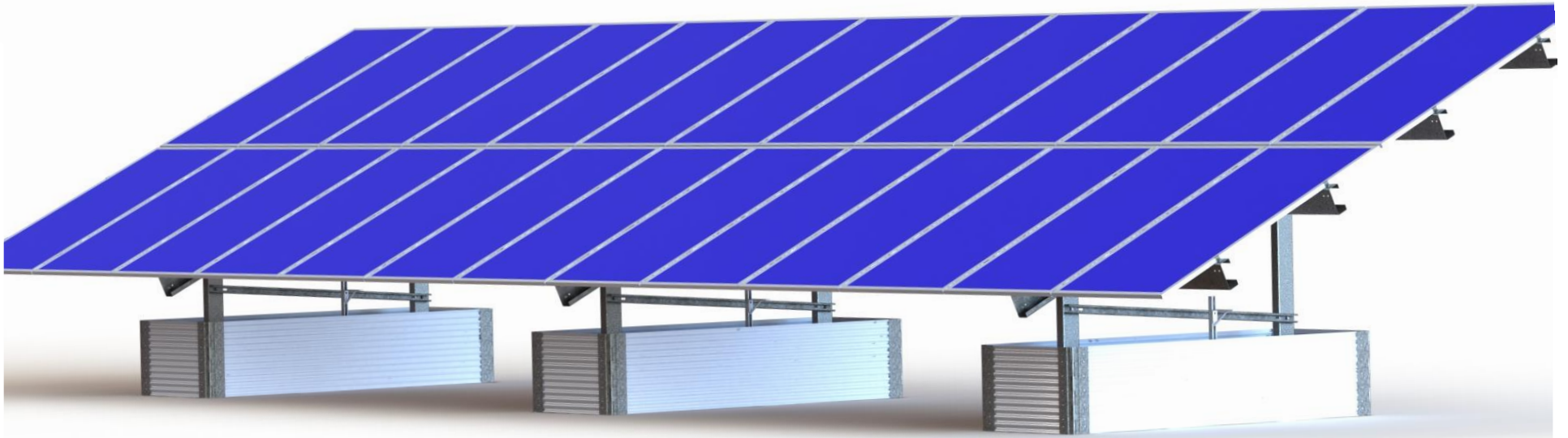
\*Refer to SEG installation Manual for details

## I-V Curve





## ***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

|                                                                                                     |                             |                                                                                                           |                                                                                                                          |                                                                                                       |
|-----------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|                    |                             | <br><b>Power Drill</b>  | <br><b>Laser Level or String Line</b> |                                                                                                       |
| 3/4" Socket                                                                                         | <b>1/2"</b> Hex Bolt / Nut  |                                                                                                           |                                                                                                                          |                                                                                                       |
| 9/16" Socket                                                                                        | <b>3/8"</b> Hex Bolt / Nut  |                                                                                                           |                                                                                                                          |                                                                                                       |
| 1/2" Socket                                                                                         | <b>5/16"</b> Hex Bolt / Nut | <br><b>Torque Wrench</b> | <br><b>Tape Measure</b>                |                                                                                                       |
| <br><b>Level</b> |                             |                                                                                                           |                                                                                                                          | <br><b>Square</b> |

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

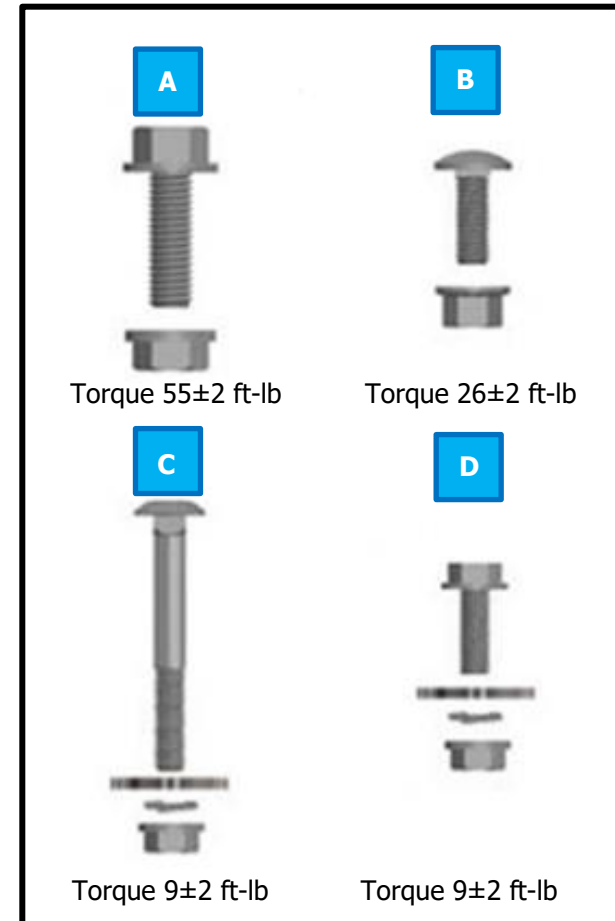
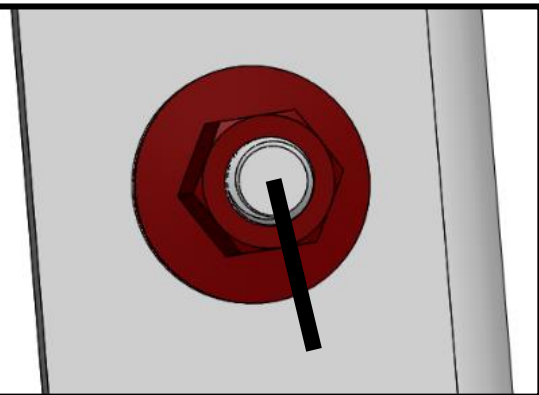


Figure 3: Hardware required for installation.

**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.

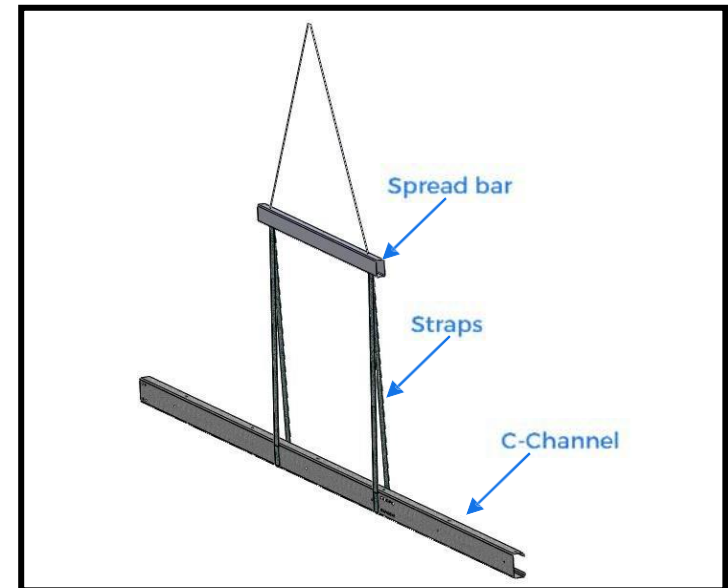


Figure 4: Proper way for lifting beams.

## 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)

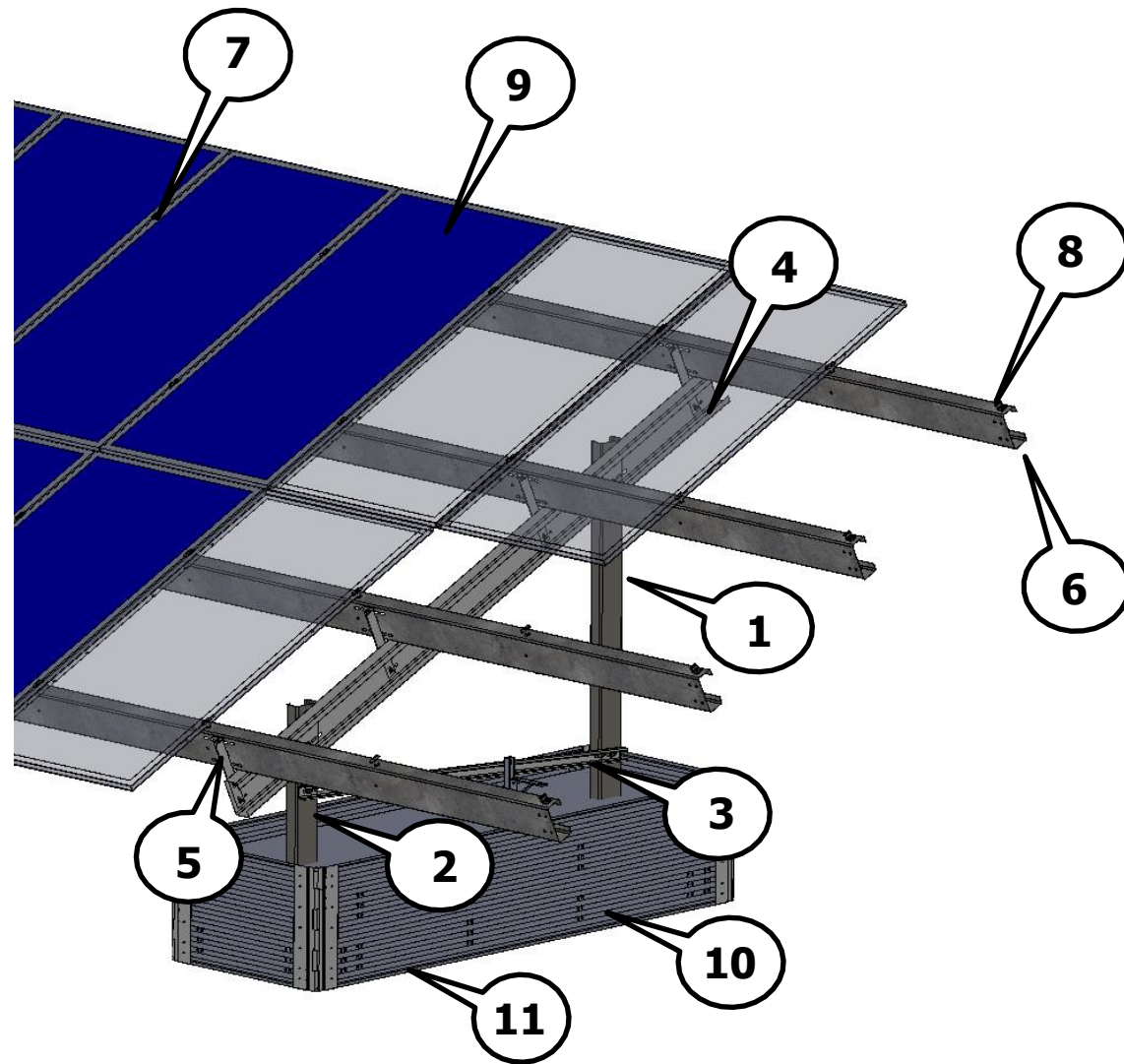


Figure 5: Ballasted Dual leg racking overview.

## 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.

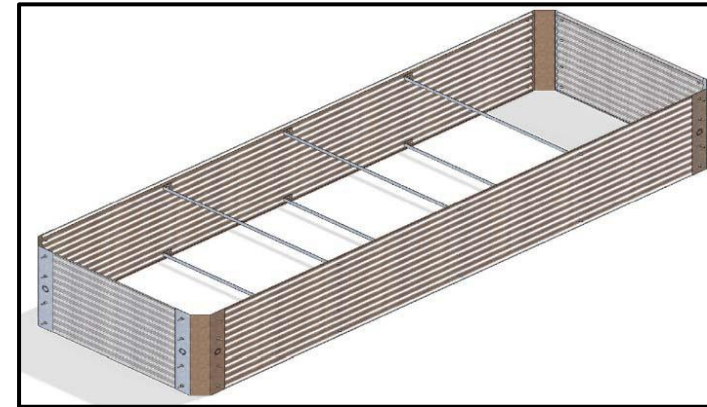


Figure 6: Assembled concrete tub ballast.

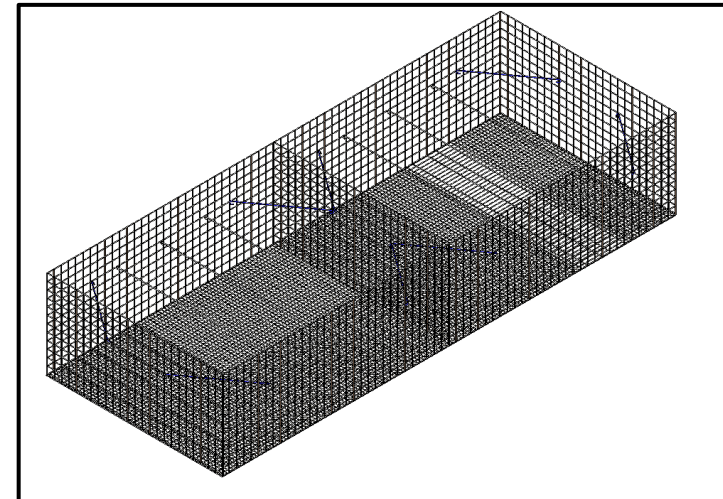


Figure 7: Assembled gabion basket tub.

#### 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:  $\pm 1$  inch (25 mm)
- East – West Spacing:  $\pm 2$  inches (51 mm)
- Height:  $\pm 2$  inches (51 mm)
- Plumbness:  $\pm 1^\circ$
- Rotation:  $\pm 2^\circ$

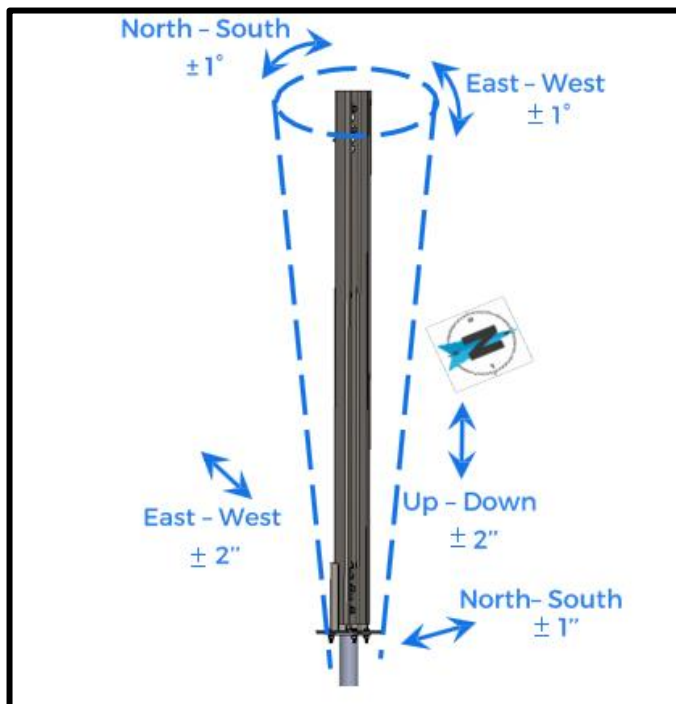


Figure 9: C-Channel Leg installation tolerances.

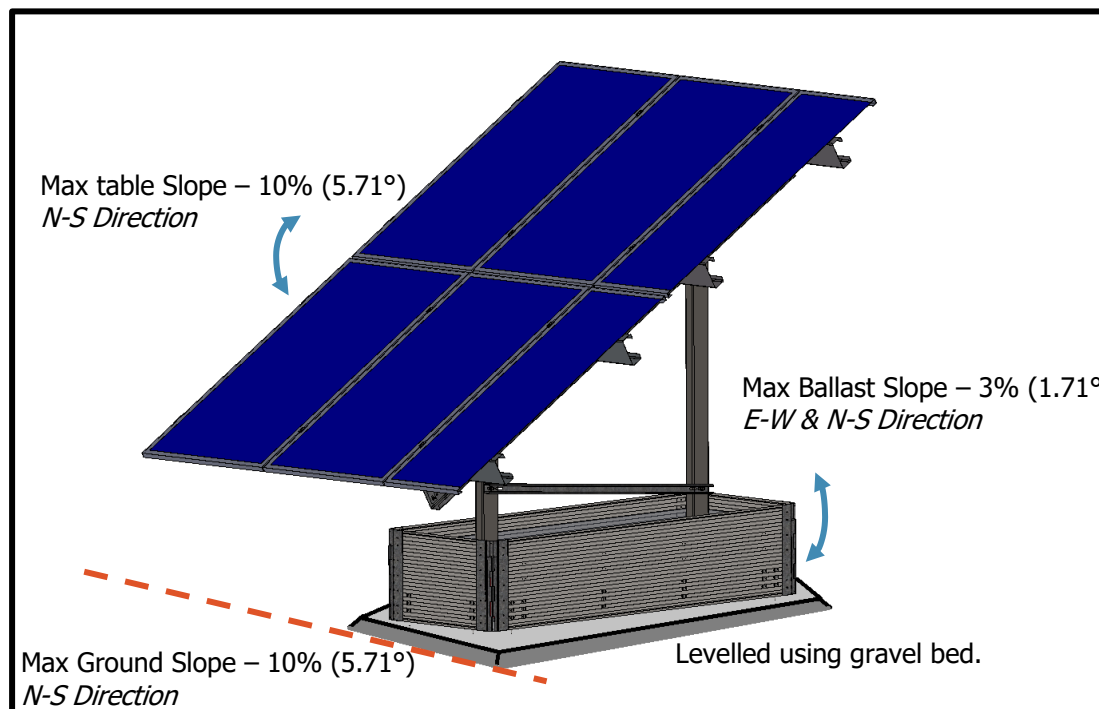


Figure 8: Ballast and table tolerances.

# e) Racking Tolerances and Adjustability

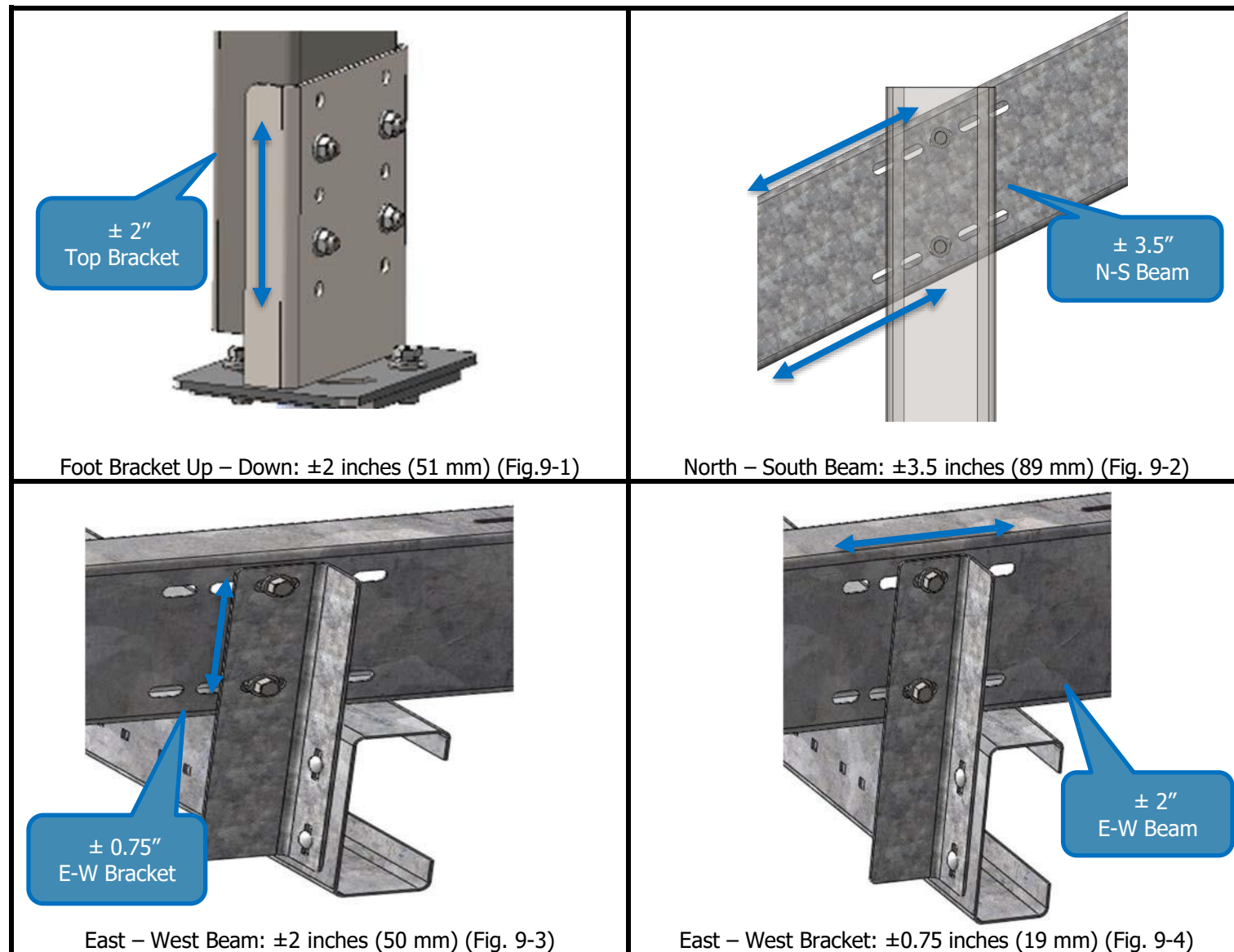


Figure 10: Rack Tolerance and Adjustability for Dual Legs.

## 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.

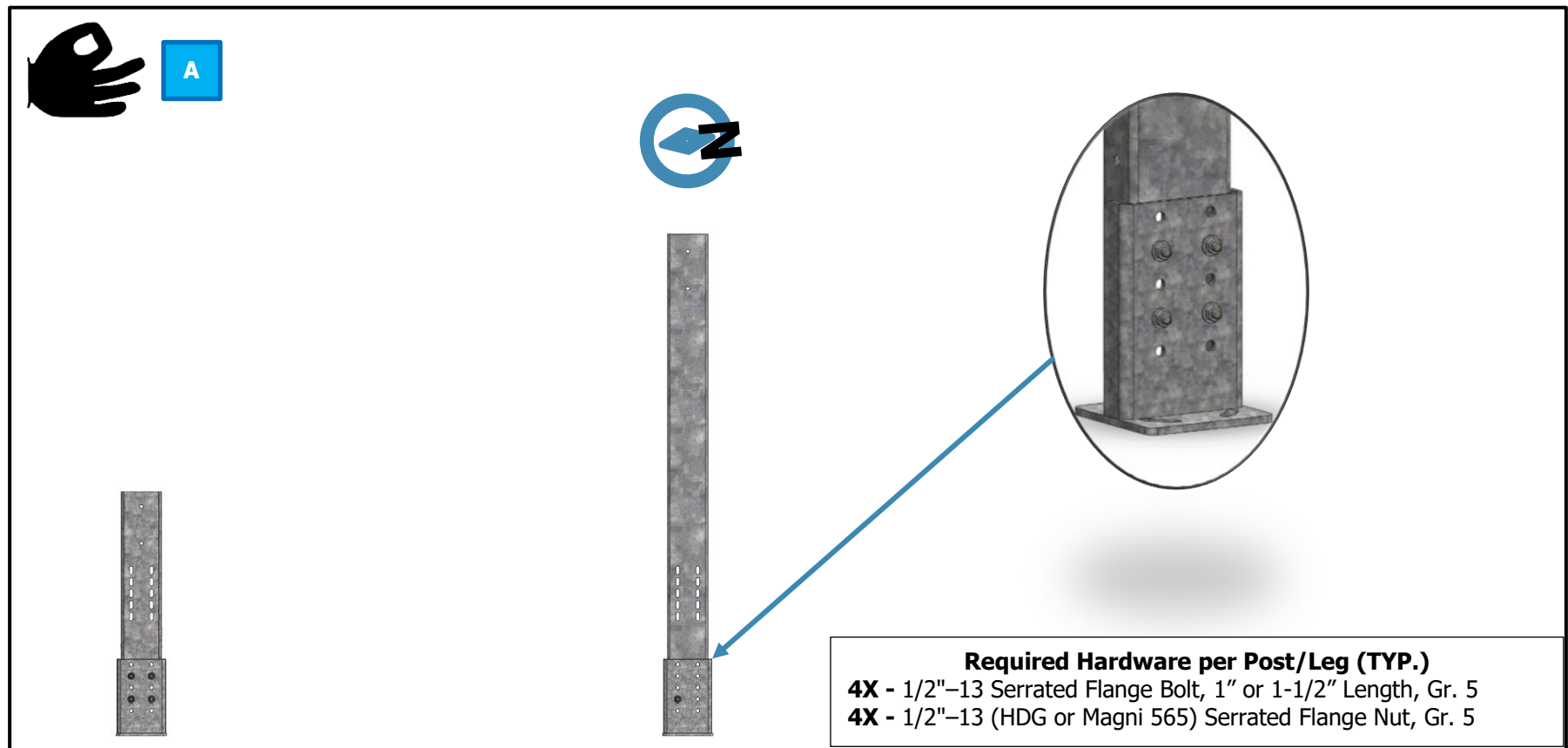


Figure 11: Foot bracket installation.

## 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.

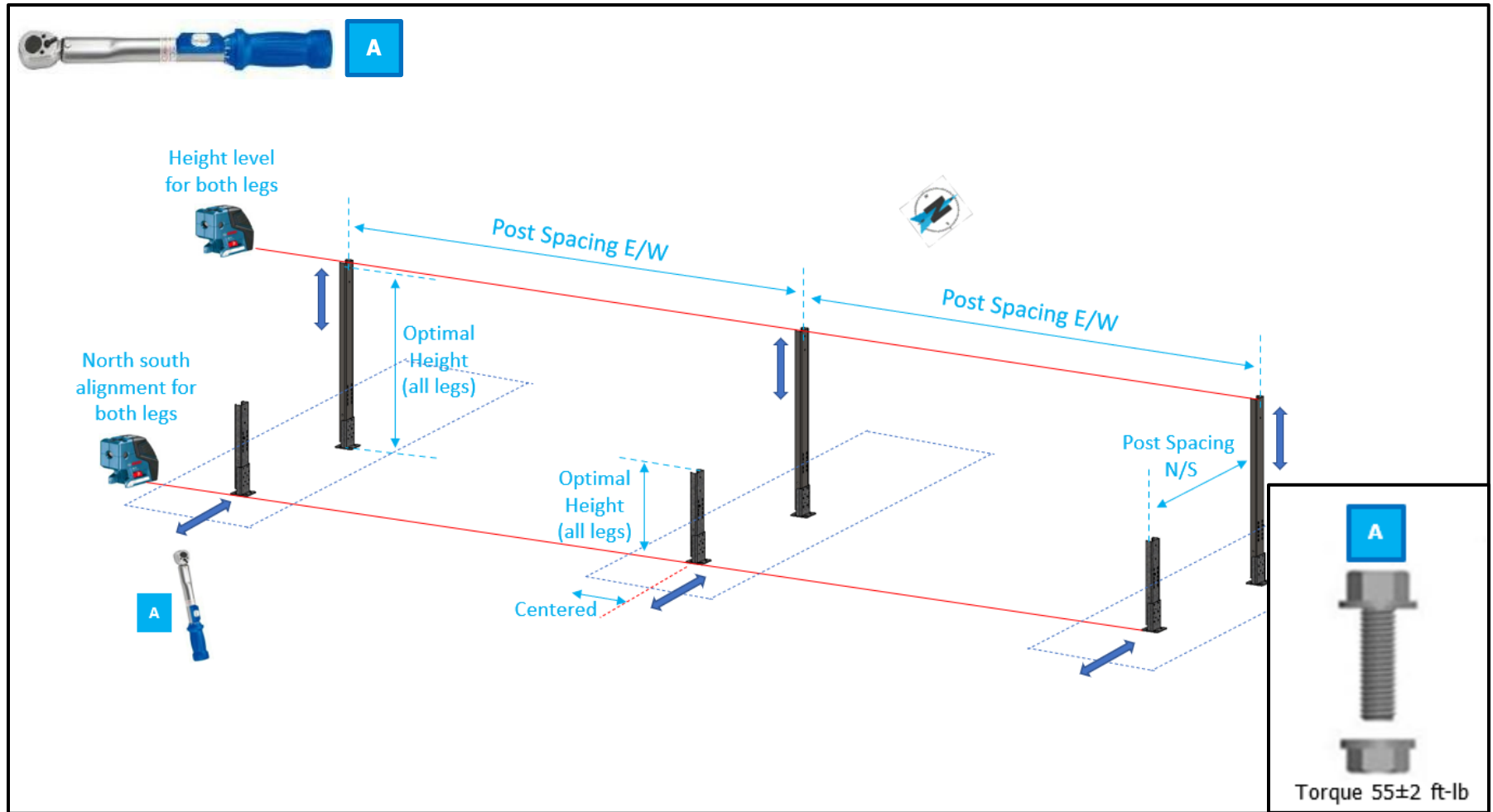


Figure 12: Post Layout & Installation.

### 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.

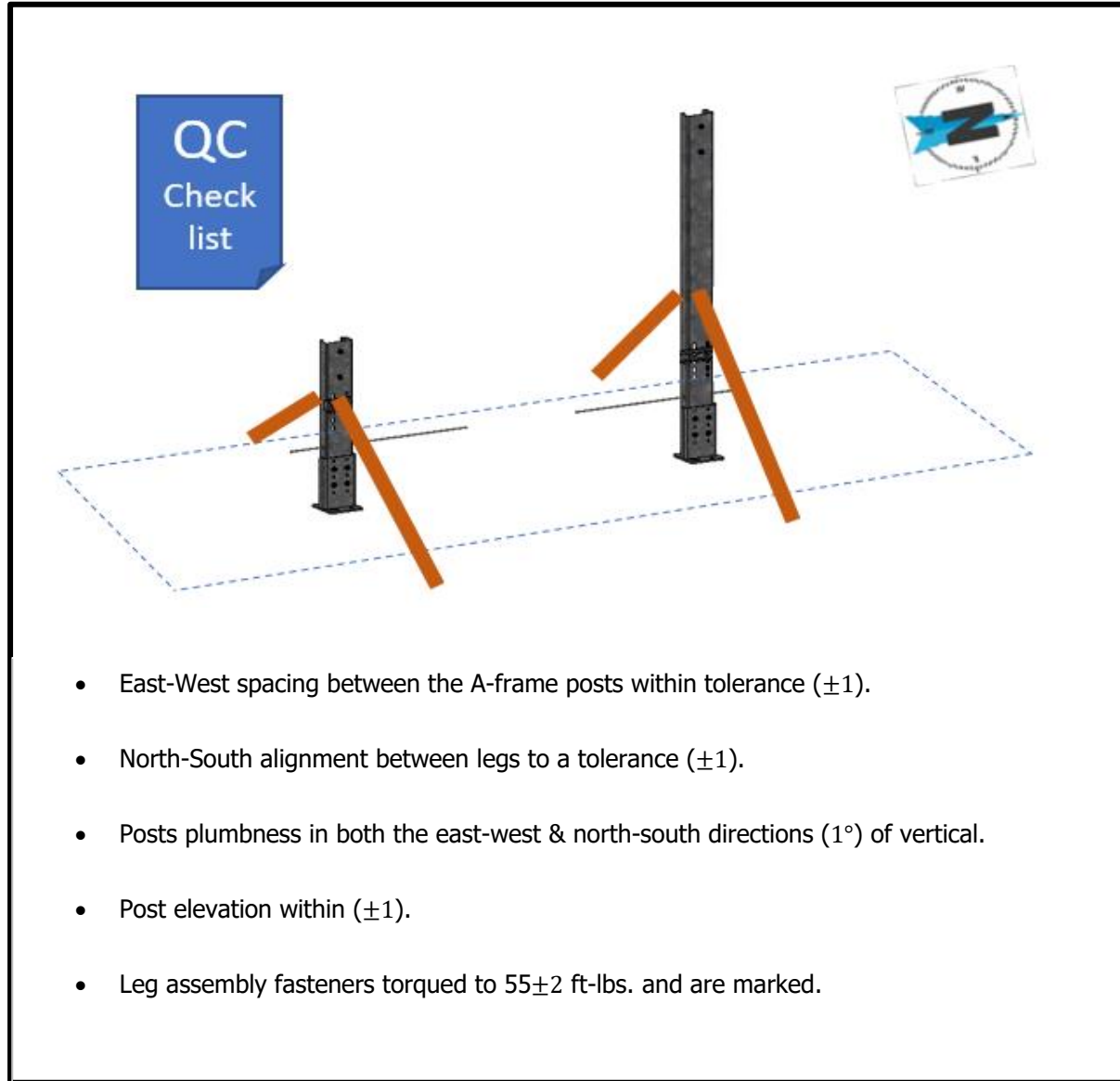


Figure 13: Post Installation (QC Checklist and Concrete Pour).

- 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).**

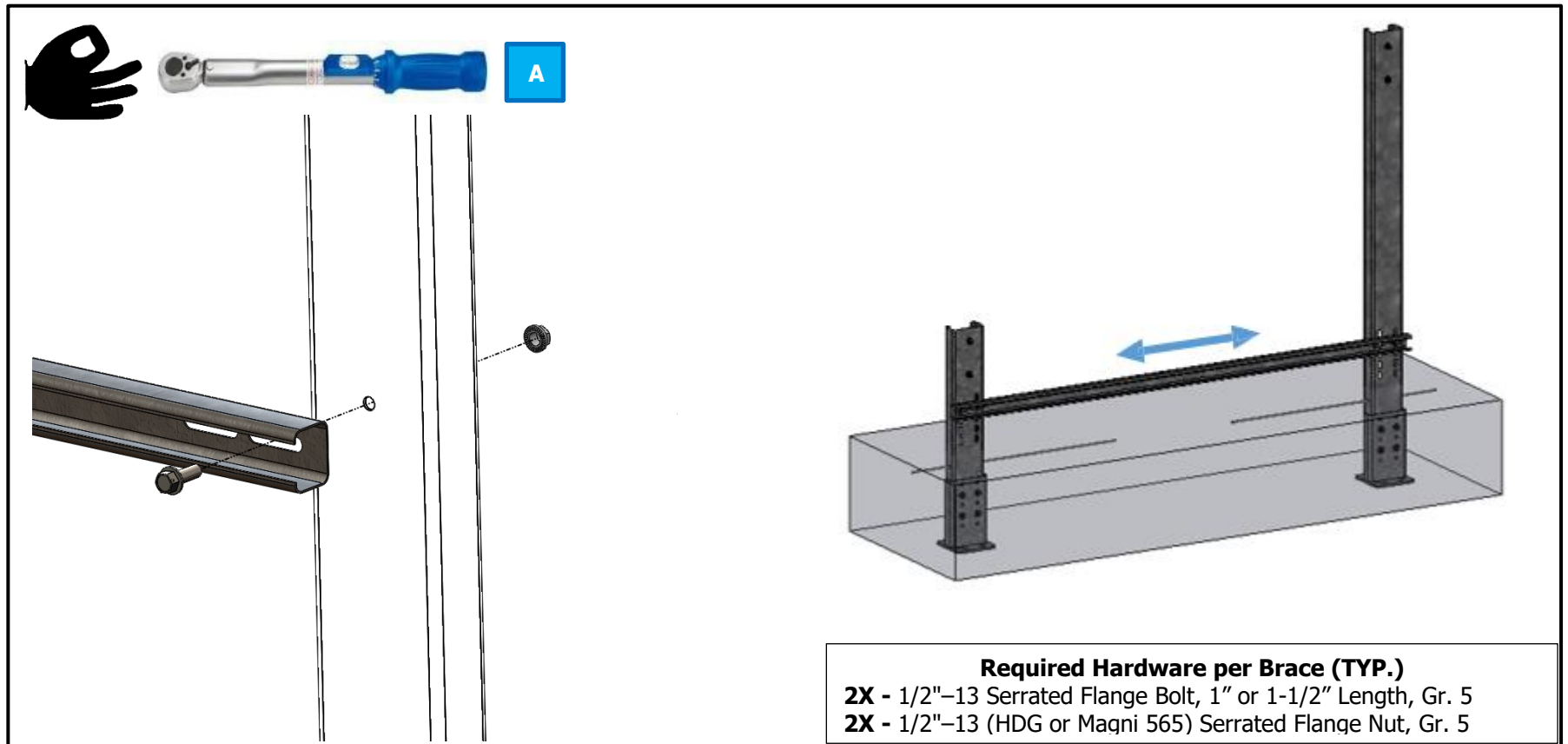


Figure 14: Brace installation.

**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.

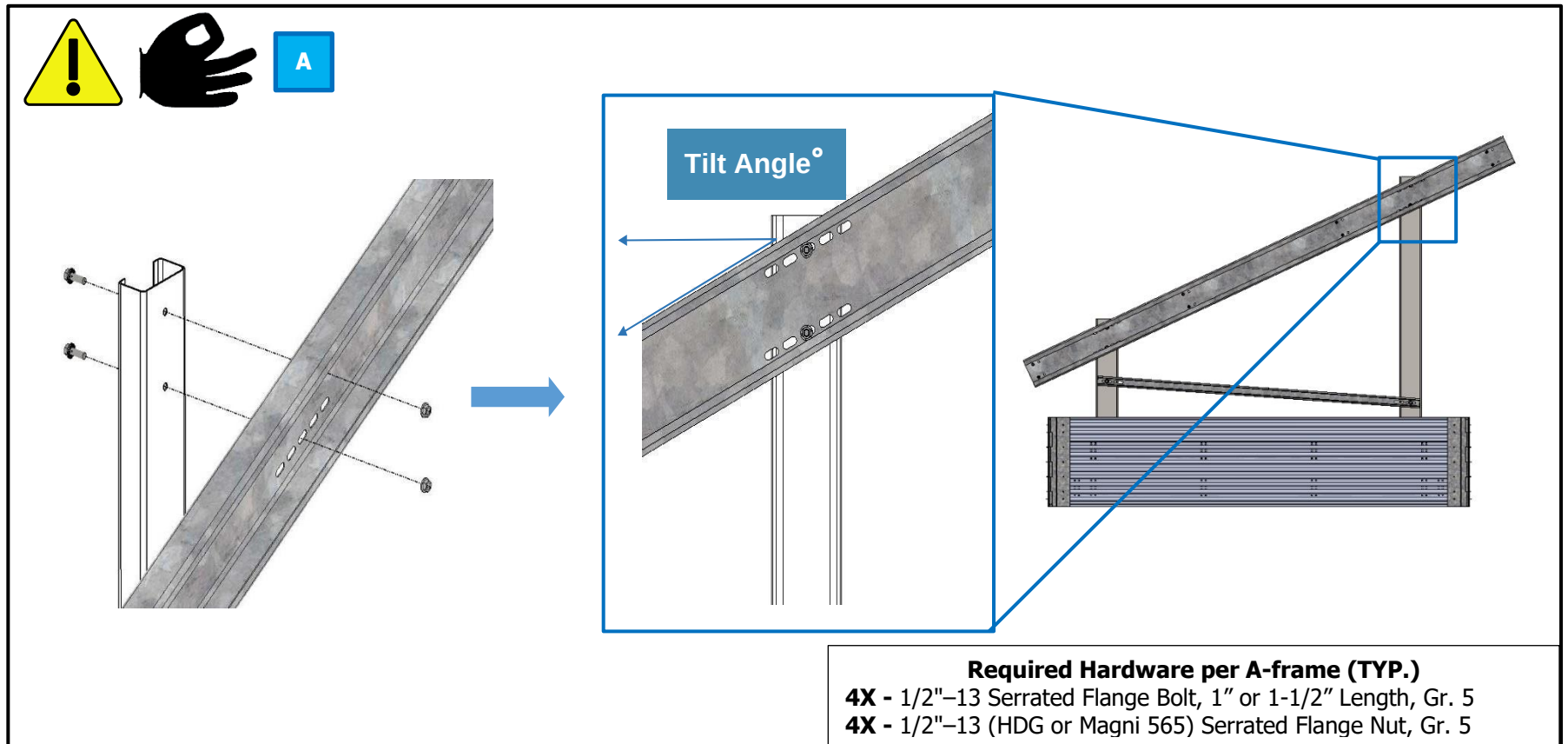


Figure 15: North-South beam installation.

**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.

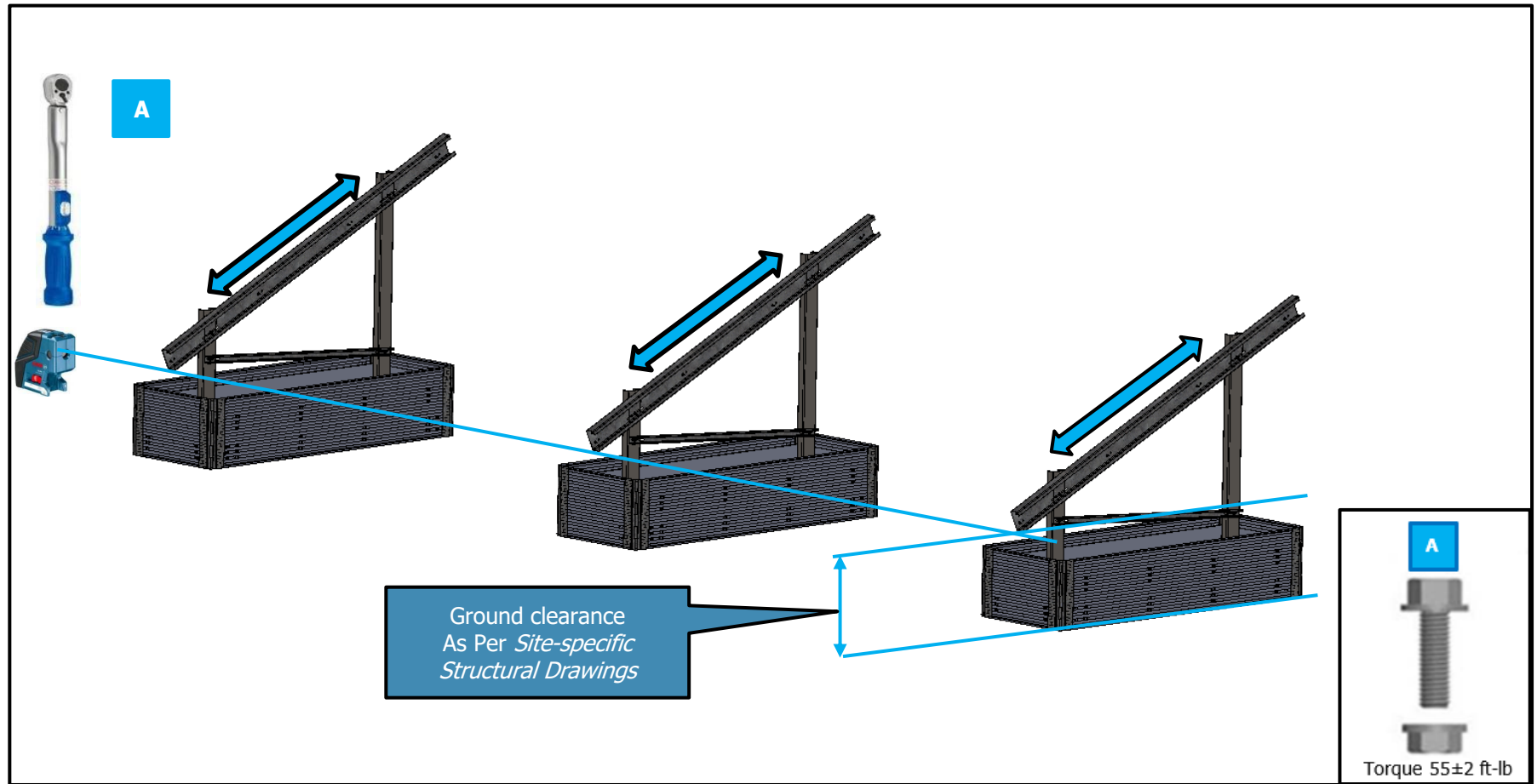


Figure 16: A-Frame alignment.

## 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.

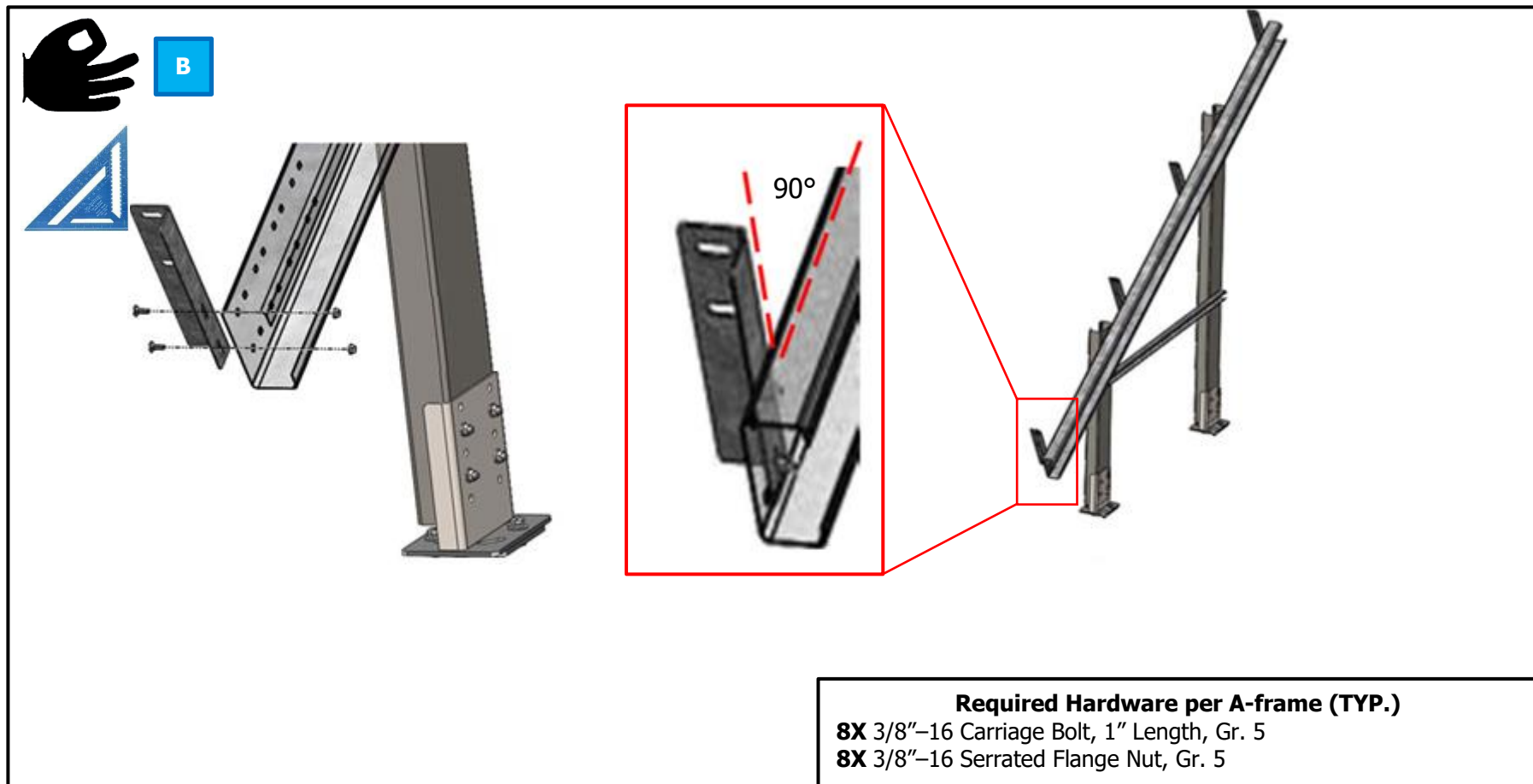


Figure 17: East-West bracket installation.

## 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.

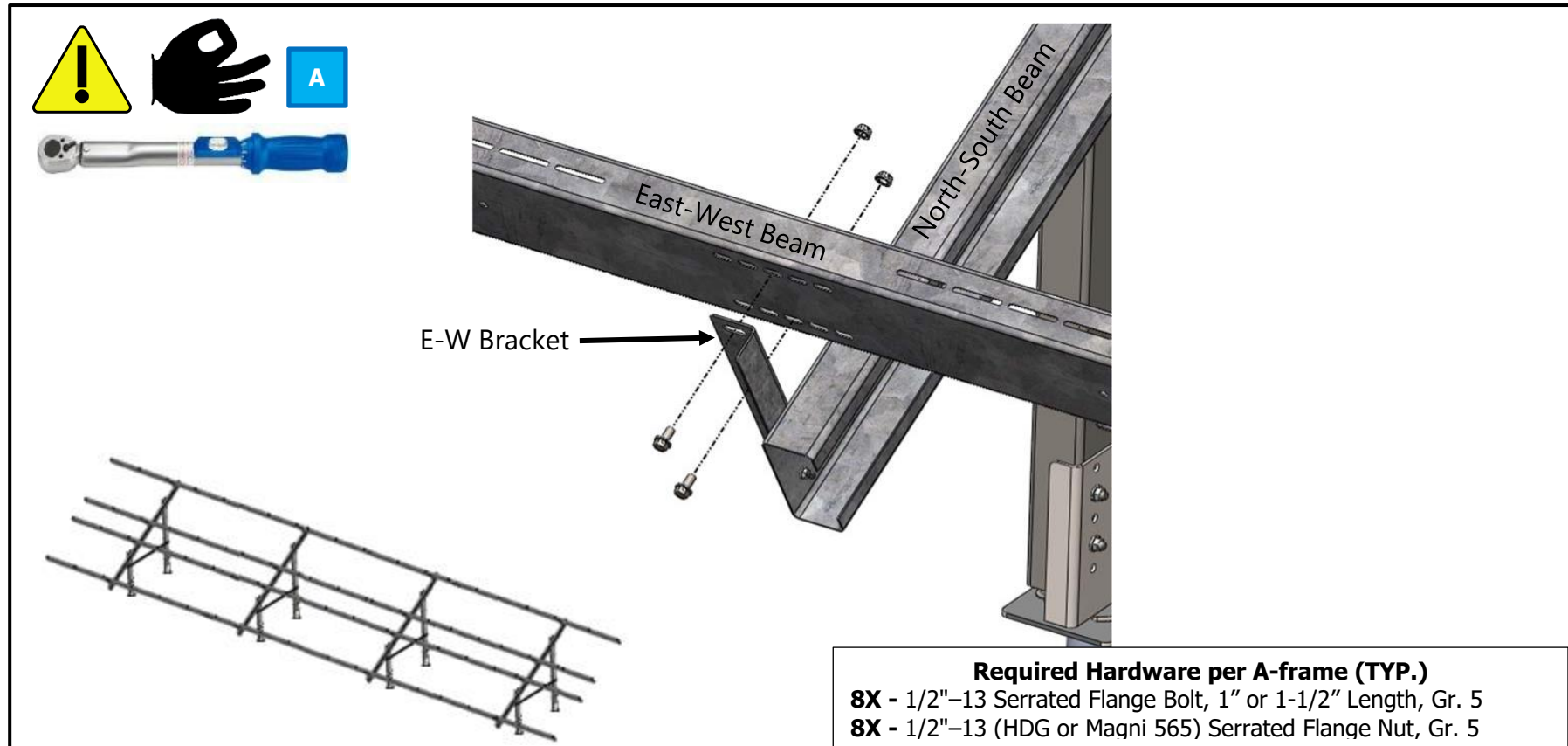


Figure 18: East-West Beam installation

**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.

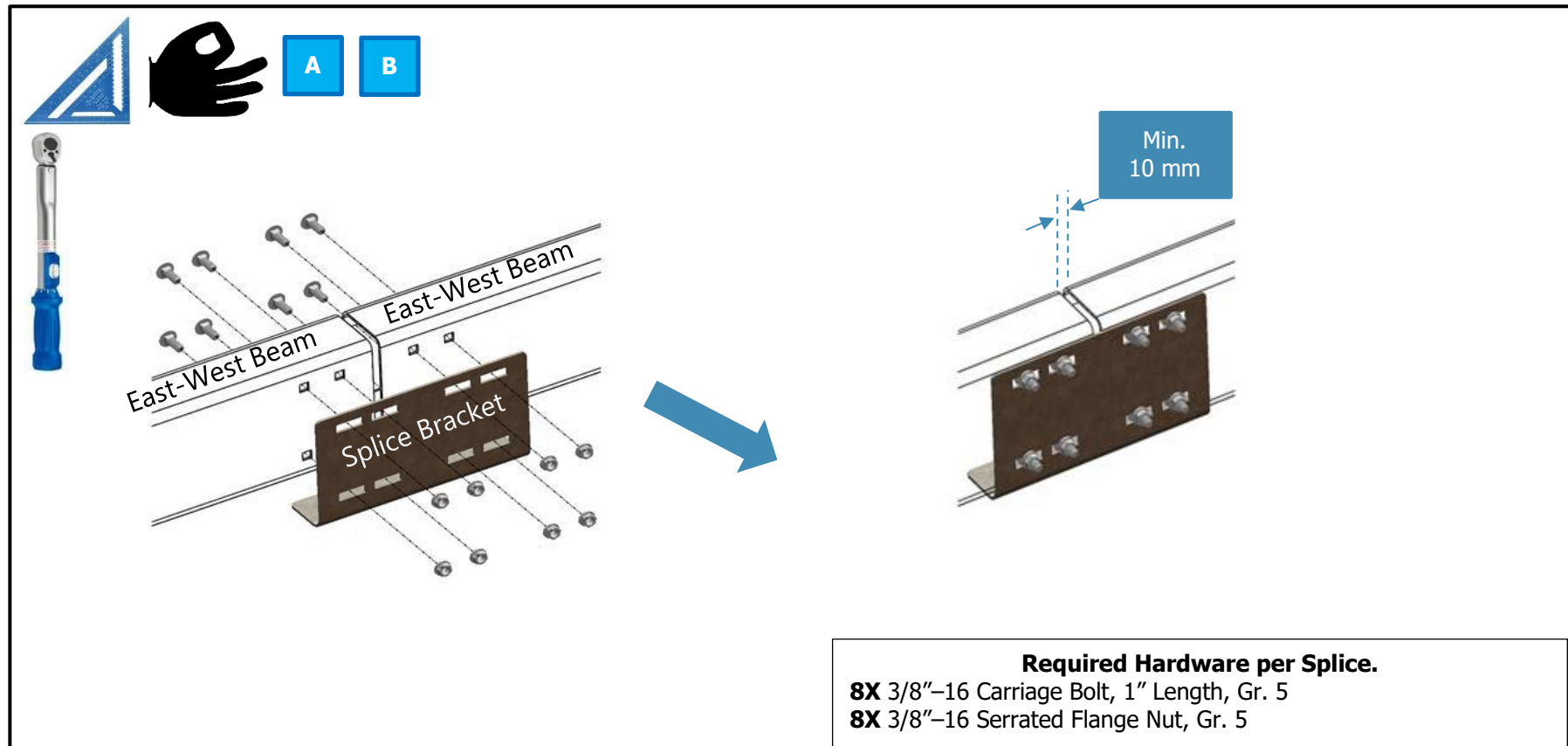


Figure 19: Splice beam installation.

### 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.**

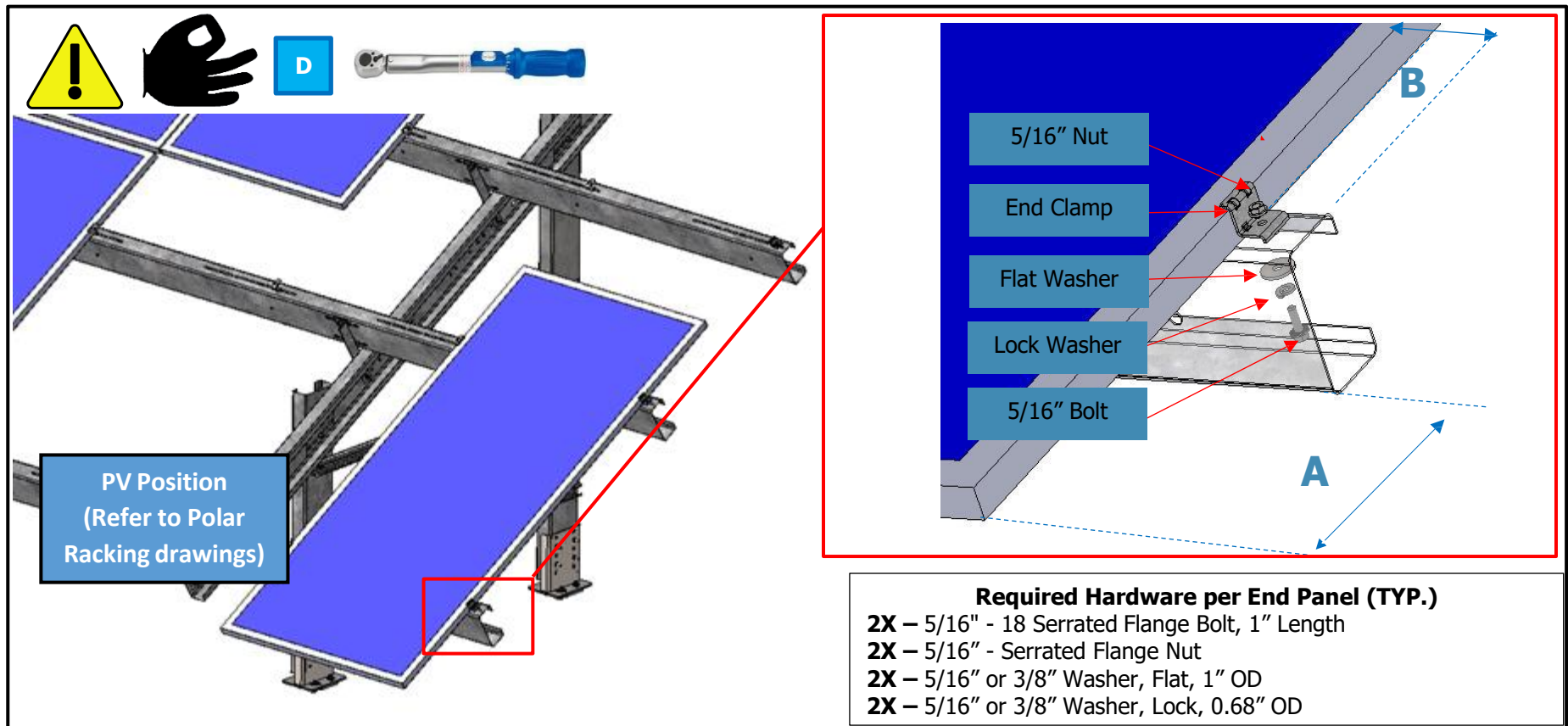


Figure 20: Module to End clamp connection.

## 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.**

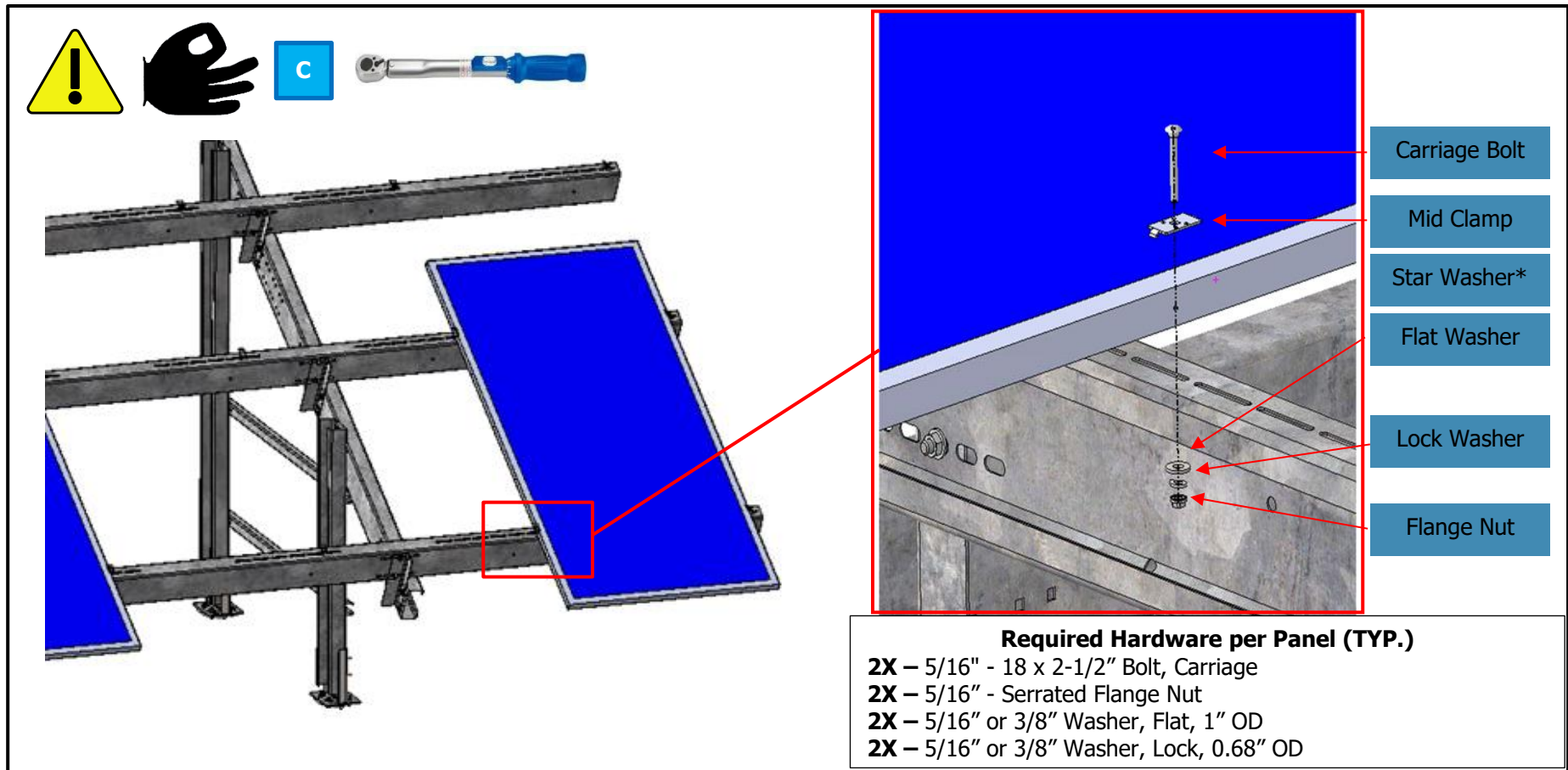


Figure 21: Intermodule connection details.

**\*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.**

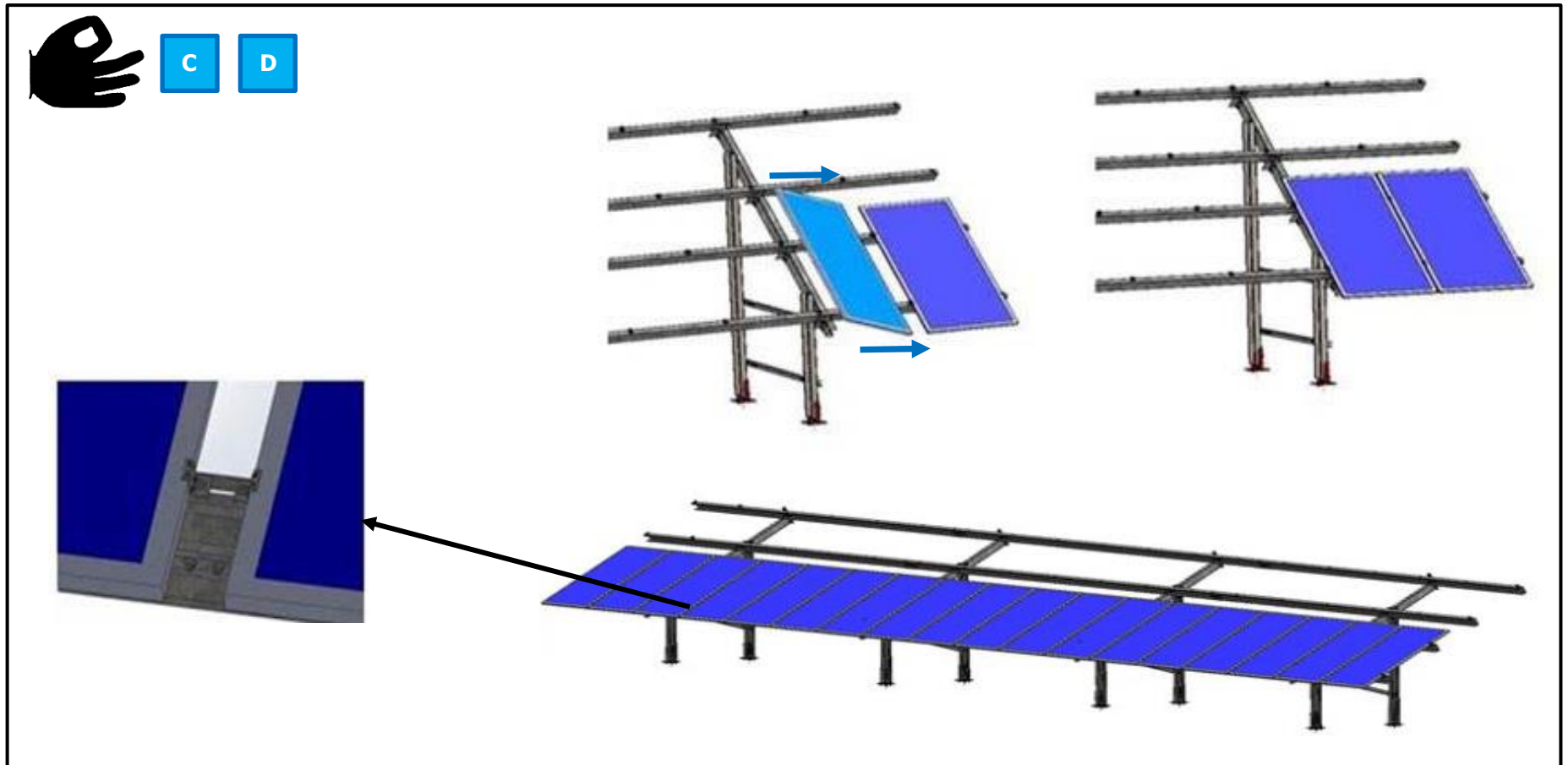


Figure 22: Modules Installation (first row).

#### 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.

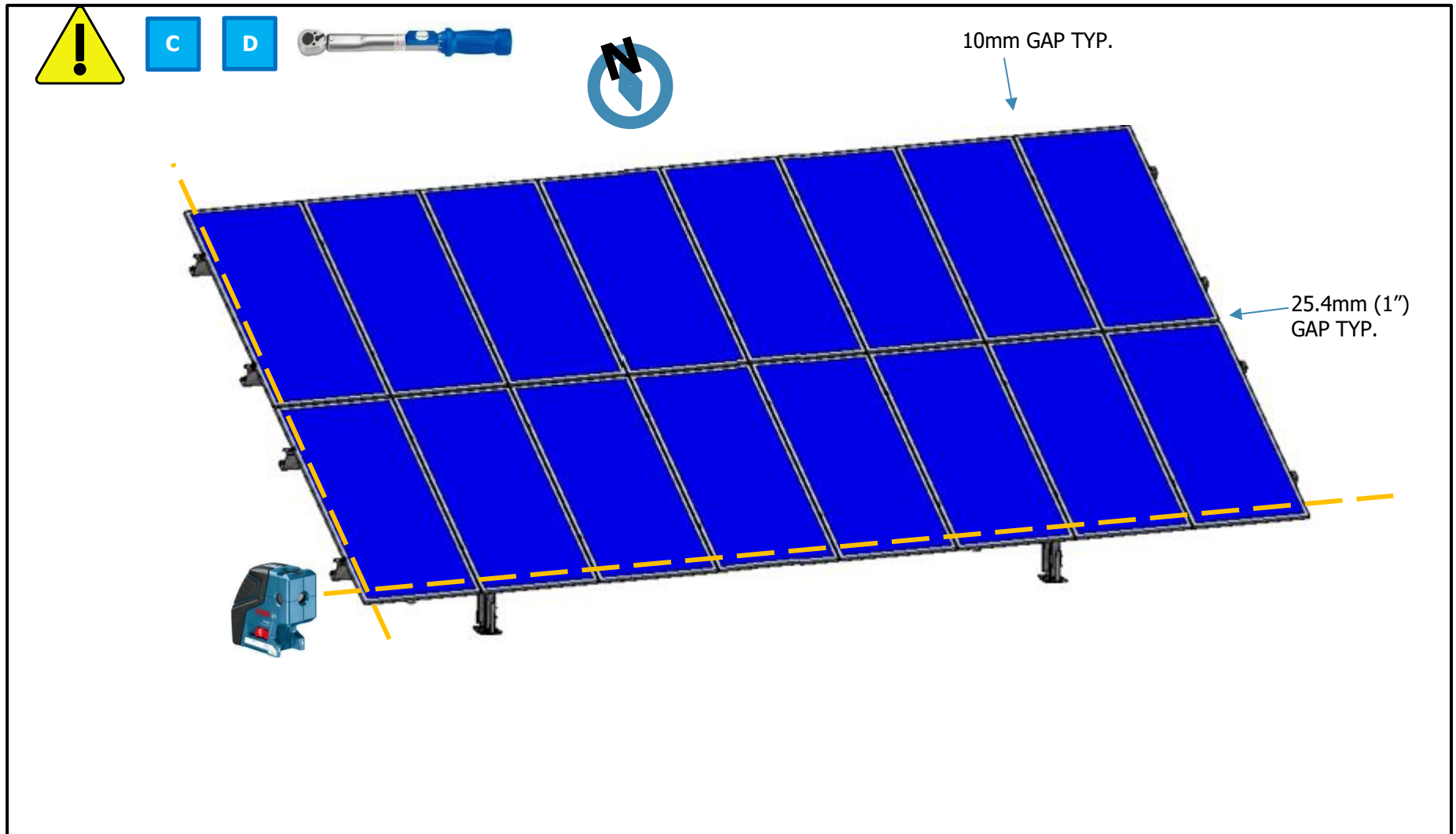


Figure 23: Full Table Installation.

## 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).

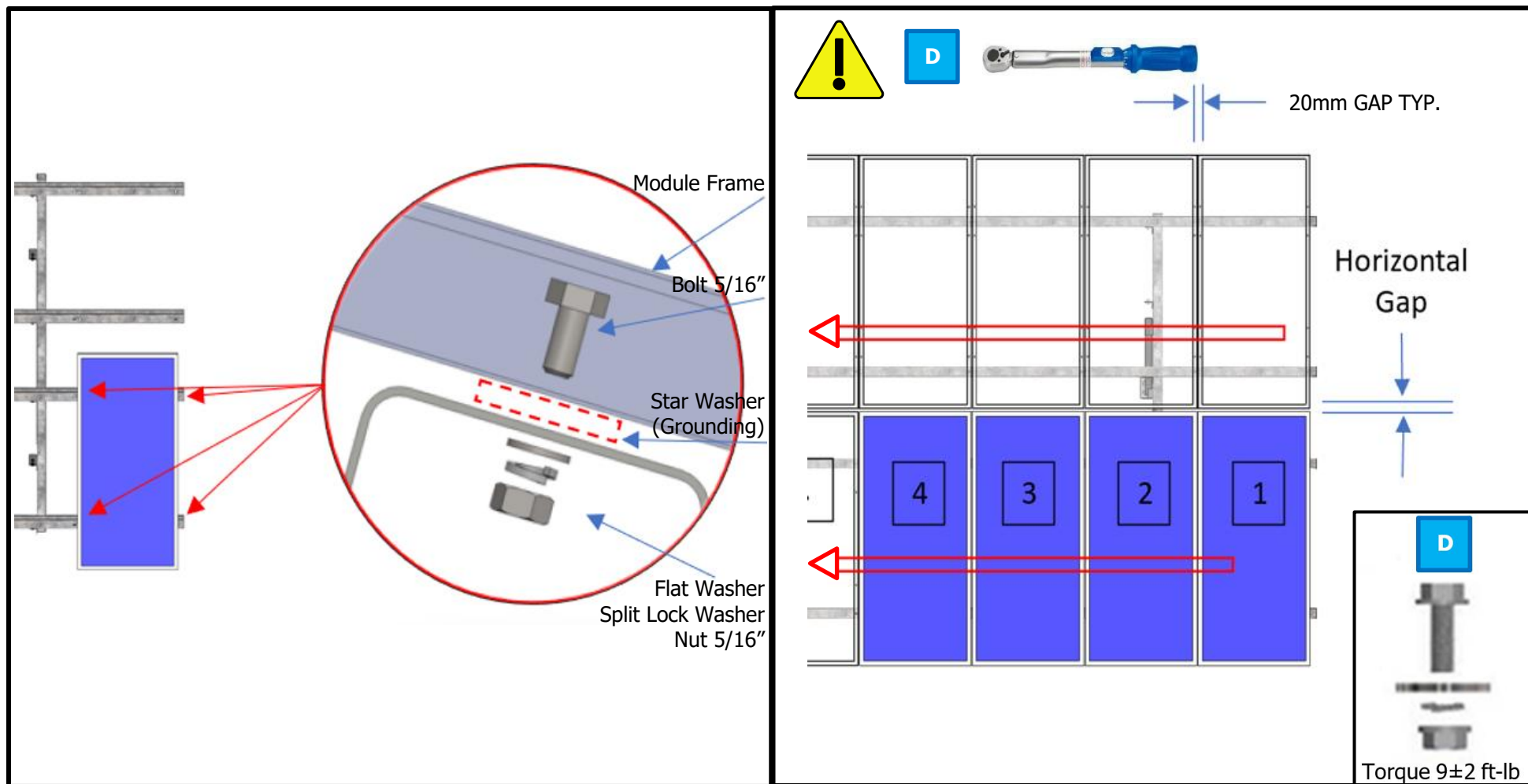


Figure 24: Direct Fastening Connection & Sequence.

## 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.

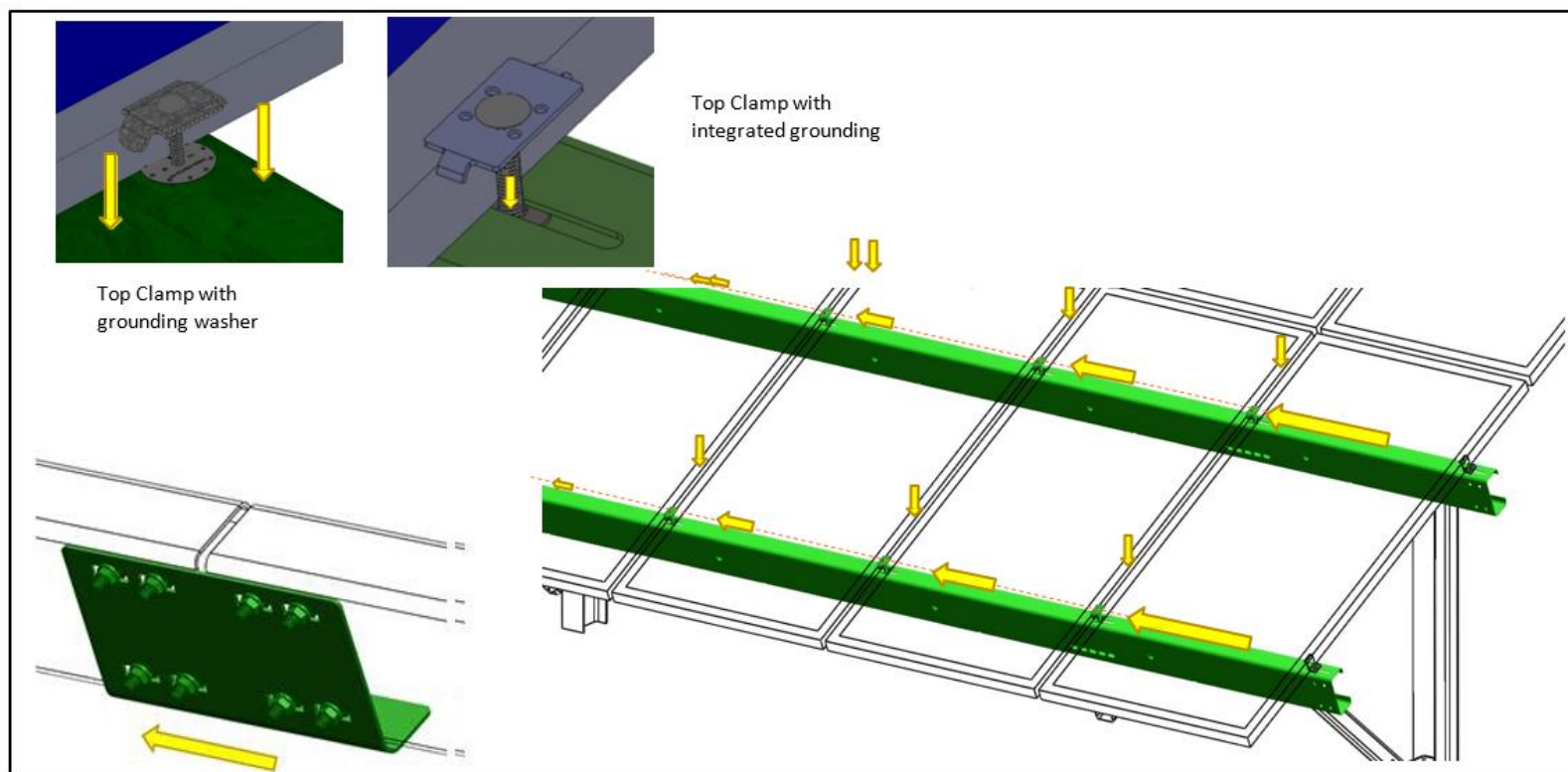


Figure 25: Typical table bonding path.

### 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.

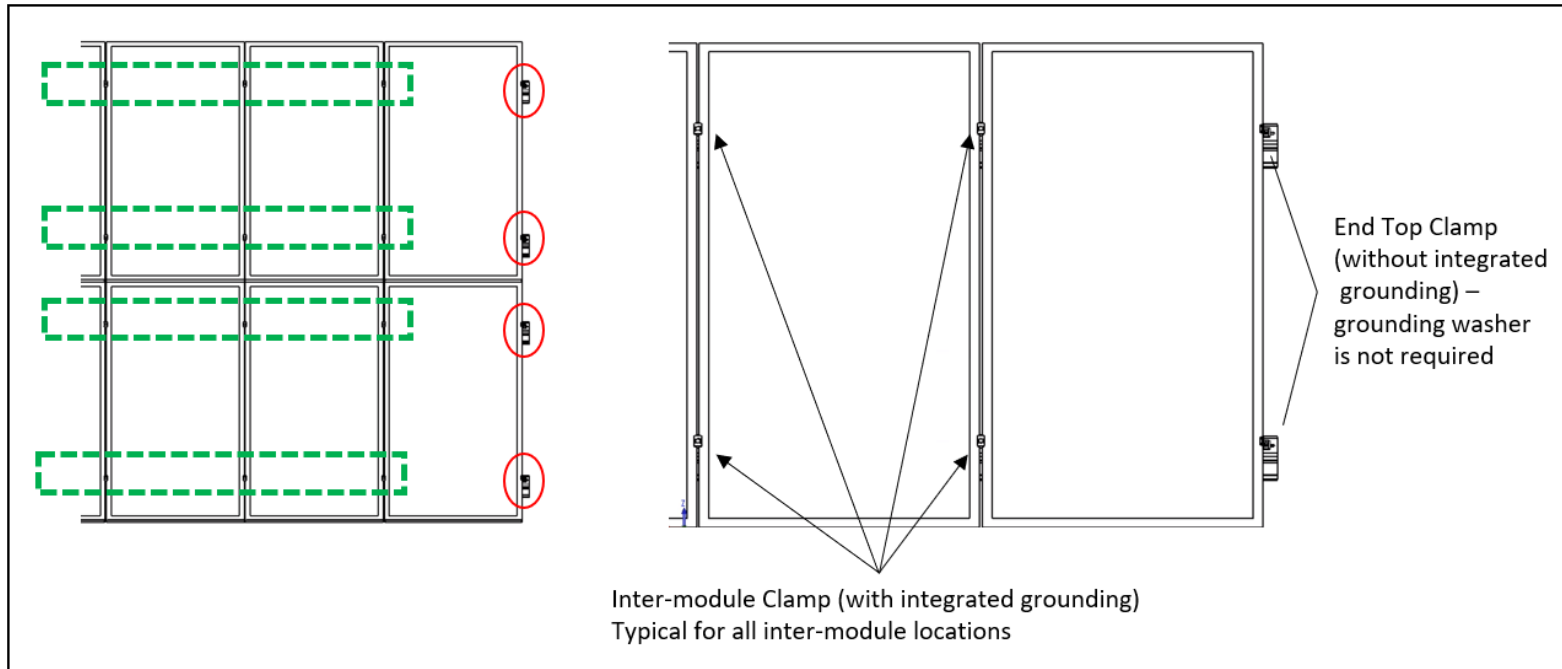


Figure 26: Inter-module clamp with integrated grounding – TYP. layout.

### 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.

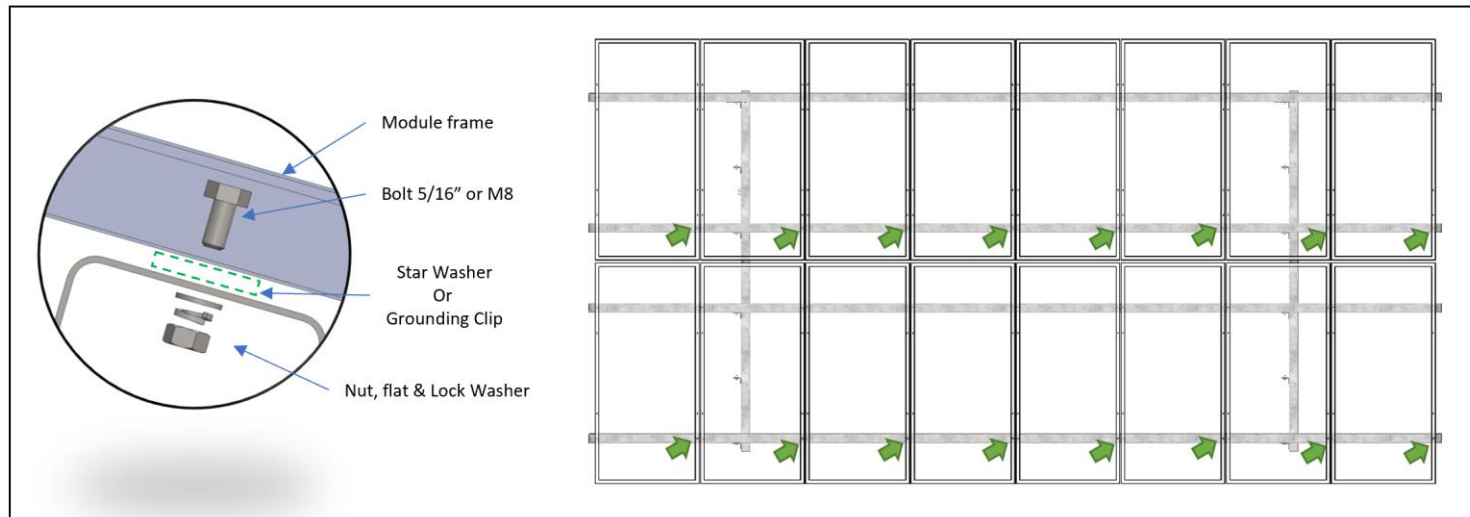


Figure 27: Direct fastener to module using star washer or grounding clips (IlSCO SBC-516)

#### d) Wire Management

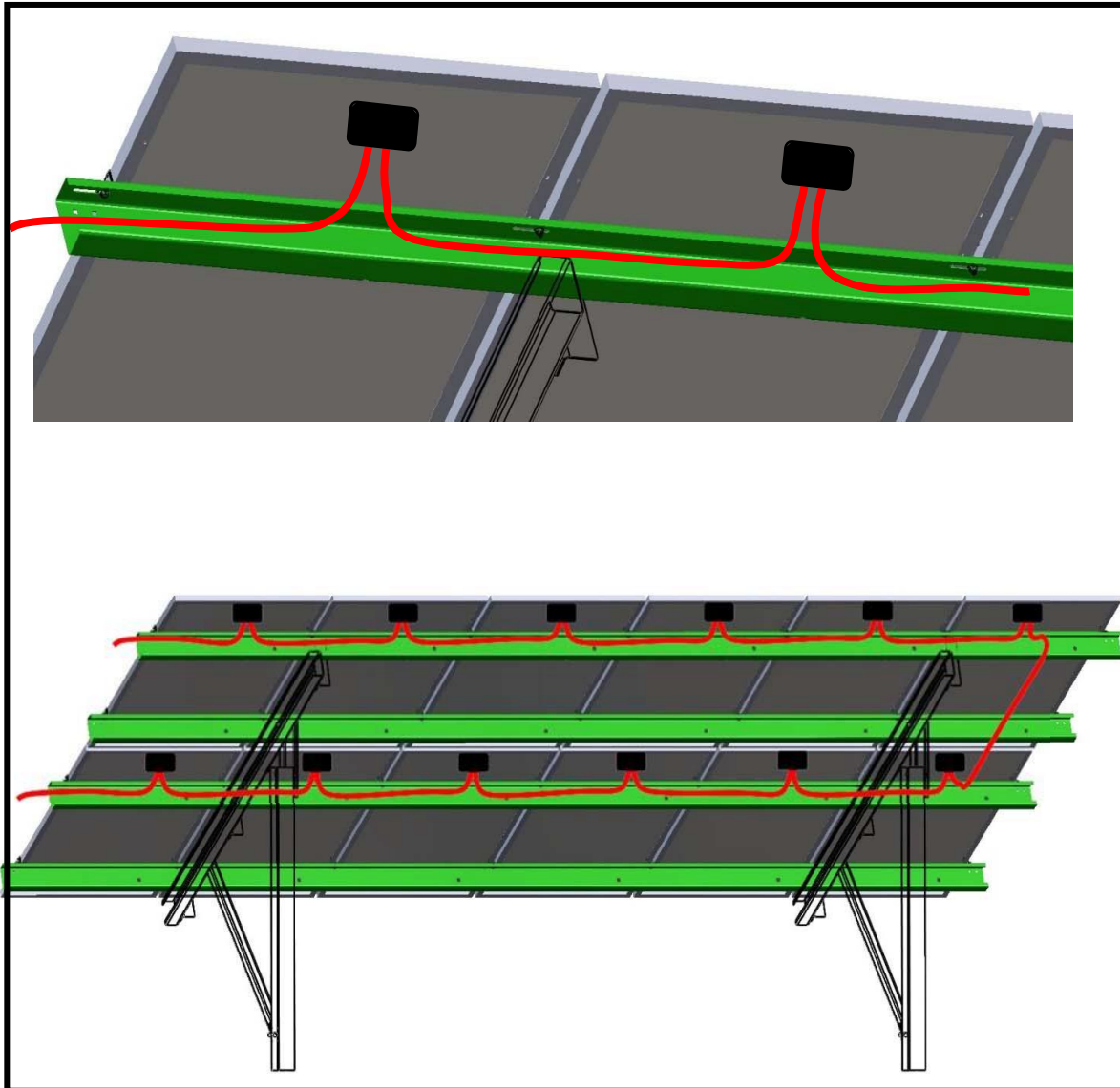


Figure 28: Wire Management.

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                                                                                                                        |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adani</b>            | Asa-b-c(XXX)-d<br>Where "a" can be M, P; "b" can be 7, 14; "c" can be PERC, or blank; "d" can be 72, 144;                                                                                         | <b>JA Solar</b>     | JAMabc(XXX)d<br>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.                                               |
| <b>Astronergy Solar</b> | aaSMbbyyC/zz-xxx<br>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 | <b>Jinko Solar</b>  | JKM (XXX) a-b<br>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.                                                   |
|                         |                                                                                                                                                                                                   | <b>LG</b>           | LG(XXX)a-A5 - Where "a" can be N2W, N2T, or S2W                                                                                                                |
| <b>Boviet Solar</b>     | BVM66aMb (XXX) c-d<br>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.                                                             | <b>Longi</b>        | LRn-bc(XXX)d<br>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.                 |
| <b>Canadian Solar</b>   | CSbY-XXXZ<br>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                                   | <b>Panasonic</b>    | SC(XXX) B2                                                                                                                                                     |
|                         |                                                                                                                                                                                                   | <b>Seraphim</b>     | SRP-(XXX)BMA-BG                                                                                                                                                |
|                         |                                                                                                                                                                                                   | <b>SEG</b>          | SEG-(XXX)BMA-BG                                                                                                                                                |
| <b>CSUn</b>             | CSUN XXX a-b<br>Where "a" can be 60 or 72; "b" can be P or M.                                                                                                                                     | <b>S-Energy</b>     | SD20/25-72BDE (XXX)                                                                                                                                            |
| <b>ET Solar</b>         | ET-YZZZZXXXAA<br>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        | <b>Silfab</b>       | SYy-Z-XXXAb<br>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 |
|                         |                                                                                                                                                                                                   | <b>Suniva</b>       | OPTXXX-AA-B-YYY-Z<br>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                    |
| <b>GCL</b>              | GCL-a-(XXX)-b<br>Where "a" can be M3, M6, P3, or P6; "b" can be 72, or 72H                                                                                                                        | <b>Sunpower</b>     | E20-(320-327)-COM                                                                                                                                              |
| <b>Hansol</b>           | ND-AN3 (300, 305, 310, 315, 320, 325, 330)<br>HS (290, 295, 300, 305, 310, 315, 320, 325, 330) ME-V001                                                                                            | <b>Talesun</b>      | TP572 - (320-330)<br>TPH6H72M-360, 365, 370, 375, 380                                                                                                          |
|                         |                                                                                                                                                                                                   | <b>Trina Solar</b>  | TSM-PD14(XXX), TSM-PE14A(XXX), TSM-PE15H, TSM-ab(II)(XXX), TSM-DEGAb.20(II)(XXX)                                                                               |
|                         |                                                                                                                                                                                                   | <b>Vsun</b>         | VSUN(XXX)-ab-c<br>Where "a" can be 60, 72, or 144; "b" can be M, or BMH; "c" can be BB, DG, or blank                                                           |
|                         |                                                                                                                                                                                                   | <b>Vikram Solar</b> | VSMa.72(XXX).05 - Where "a" can be DT, or DHT                                                                                                                  |
| <b>Heliene</b>          | 72-a (XXX)<br>Where "a" can be M, P, BLK                                                                                                                                                          | <b>Znshine</b>      | 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.

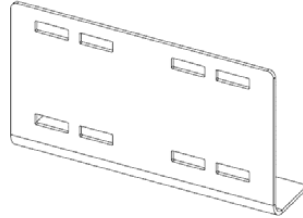
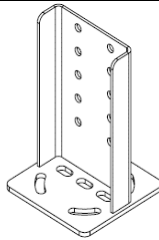
### How Do You Get Service?

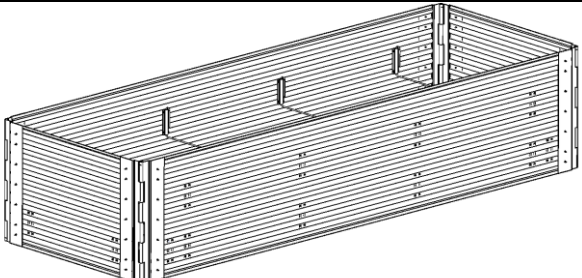
To be eligible for service under this warranty you must immediately notify Polar, in writing, upon learning of any defects of its Products by either calling the phone number listed above or writing to the address listed above and explaining the nature of defect. If appropriate, arrangement for service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

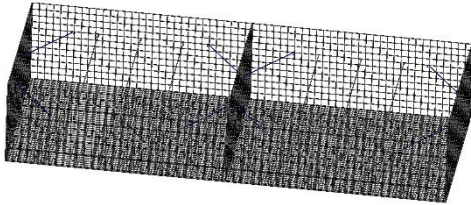
Polar will not be held responsible for any modification or alterations made to any approved design layout and/ or specification provided by Polar. Any and all proposed changes must first be reviewed and approved in writing by Polar's Engineering team. By acceptance of this document, the Purchaser acknowledges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

## APPENDIX 1. CORE RACK COMPONENTS

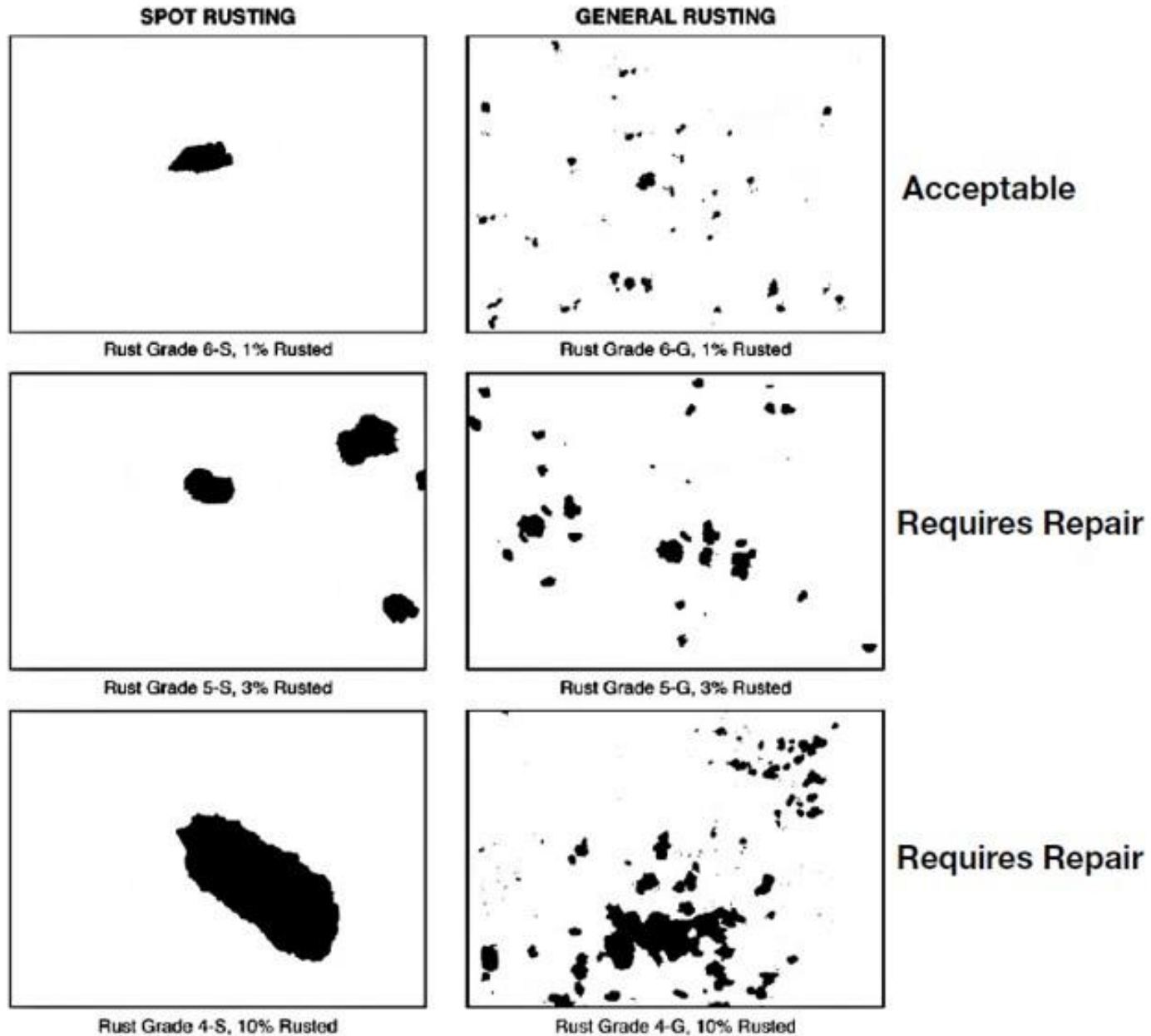
**Table 2: CORE - Portrait Rack Components**

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

|    |                      |                                                                                                                                                                                                                                                           |                       |                                                                                       |
|----|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|
| 7  | Legs                 | <b>Material:</b> 50 KSI min. Prime Steel.<br><b>Finish:</b> G90 Pre-galvanized   ASTM 653<br><b>Details:</b> 3"x6" Standard C Shape<br><b>Thickness:</b> Ga16 – Ga12                                                                                      | All                   |    |
| 11 | End-Clamps           | <b>Material:</b> 50 KSI min. Prime Steel.<br><b>Finish:</b> G90 Pre-galvanized   ASTM 653<br><b>Details:</b> Height: 30-50mm<br><b>Thickness:</b> Ga10.                                                                                                   | Top Clamp             |    |
| 12 | Mid-Clamps           | <b>Material:</b> 50 KSI min. Prime Steel.<br><b>Finish:</b> G90 Hot Dipped Galvanized   ASTM 653<br><b>Details:</b> Length: 50mm.<br><b>Thickness:</b> Ga10.                                                                                              | Top Clamp             |    |
| 13 | Grounding Lug        | <b>Manufacturer:</b> ILSCO - SGB-4<br><b>Description:</b> 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.<br><b>NOT POLAR SUPPLIED</b> | See Grounding Details |    |
| 14 | IlSCO Grounding Clip | <b>Manufacturer:</b> ILSCO - SBC-16<br><b>Material:</b> S304 Stainless Steel.<br><b>Details:</b> M8 or 5/16" Hardware.                                                                                                                                    | See Grounding Details |    |
| 15 | Star Washer          | <b>Material:</b> S304 Stainless steel.<br><b>Details:</b> M6                                                                                                                                                                                              | All                   |   |
| 17 | Pre-Assembled Tub    | <b>Material:</b> Mild Carbon Steel – Pre-galvanized G90 (Z275)<br>Reinforcement Deformed Bars – Min Fy = 260 MPa<br><b>Description:</b> Hinged concrete tub with reinforcement bars.<br>See <i>Structural Package</i> for dimensions.                     | Concrete Ballasted    |  |

|    |                              |                                                                                                                                                                                                                     |                       |                                                                                     |
|----|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------|
| 18 | Rebar                        | <b>NOT POLAR SUPPLIED</b><br>Diameter: M10                                                                                                                                                                          | Concrete<br>Ballasted |  |
| 19 | Gabion<br>Basket<br>Assembly | <b>Materials:</b> Steel Wire – 525-700 N/mm <sup>2</sup> – G90 Galvanized.<br><b>Details:</b> DIA. 4.5mm±0.03. Mesh Size 50x50mm. 17.5%<br>Weld Depth & <2mm Edge. ASTM 974 – 97.<br><b>Spiral Wire:</b> 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<br>F=Fastener,<br>W=Weld, V=Visual | Details of Inspection/Maintenance Performed |                    |
|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |
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|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |
|                       |                        |                                                    |                                             |                    |

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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# **HIGH TO LOW V O L T A G E**

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## **TRANSFORMER TEST REPORT**

Type of Product  
Serial No:23100227  
Drawing No:1.710.3519

---



**HIGH TO LOW VOLTAGE**  
8075 Pontiac Street | Commerce City, Colorado 80022  
1-866-840-7634 | [info@hightolowvoltage.com](mailto:info@hightolowvoltage.com)

| 1 Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |                  |          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------|----------|
| Name of Product                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Three-phase Pad Mount Transformer |                  |          |
| Serial No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 23100227                          |                  |          |
| Drawing No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.710.3519                        |                  |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |                  |          |
| 2 Technical Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |                  |          |
| Power Rating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1500kVA                           | Cooling Type     | ONAN     |
| Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12.47/0.48kV                      | Number of Phases | 3 Phases |
| Rated Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 69.45/1804.2A                     | Rated Frequency  | 60 Hz    |
| Vector Group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Dyn1                              |                  |          |
| Basic Insulation Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | HV                                | LI/AC 95/34 kV   |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | LV                                | LI/AC 30/10 kV   |          |
| 3 Applicable standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |                  |          |
| <p><b>ANSI/IEEE C57.12.00</b> General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers</p> <p><b>ANSI/IEEE C57.12.90</b> Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers</p> <p><b>ANSI/IEEE C57.12.80</b> Standard Terminology for Power and Distribution Transformers</p> <p><b>ANSI/IEEE C57.100</b> IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution and Power Transformers</p> <p><b>ANSI/IEEE C57.136</b> IEEE Guide For Sound Level Abatement &amp; Determination For Liquid-Immersed Power Transformers &amp; Shunt Reactors Rated Over 500 KVA</p> <p><b>ASTM D 6871</b> Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus</p> <p><b>AWS</b> American Welding Society</p> <p><b>NEMA</b> National Electrical Manufacturers Association</p> <p><b>NFPA TO</b> National Fire Protection Association National Electrical Code</p> <p><b>SSPC</b> The Society for Protective Coatings Paint Application Specification NO. 2</p> |                                   |                  |          |

## 4 Items and results of tests

### 4.1 Measurement of voltage ratio and check of vector group

| H.V.            |                | L.V.            |                | Calculated<br>Ratio | Deviation of Measured Voltage<br>Ratio（%） |      |           |      |           |      | Tolerance | Vector<br>Group |
|-----------------|----------------|-----------------|----------------|---------------------|-------------------------------------------|------|-----------|------|-----------|------|-----------|-----------------|
| Tap<br>Position | Voltage<br>(V) | Tap<br>Position | Voltage<br>(V) |                     | H1H2/X1X2                                 |      | H2H3/X2X3 |      | H3H1/X3X1 |      |           |                 |
| 1               | 13094          | /               | 480            | 27.279              | 0.13                                      | 0.13 | 0.13      | 0.13 | 0.13      | 0.13 | ≤±0.5%    | Dyn1            |
| 2               | 12782          |                 |                | 26.629              | 0.13                                      | 0.14 | 0.14      | 0.14 | 0.13      | 0.14 |           |                 |
| 3               | 12470          |                 |                | 25.979              | 0.13                                      | 0.14 | 0.13      | 0.14 | 0.13      | 0.14 |           |                 |
| 4               | 12158          |                 |                | 25.329              | 0.13                                      | 0.14 | 0.13      | 0.13 | 0.13      | 0.14 |           |                 |
| 5               | 11847          |                 |                | 24.681              | 0.13                                      | 0.14 | 0.14      | 0.14 | 0.13      | 0.14 |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |
|                 |                |                 |                |                     |                                           |      |           |      |           |      |           |                 |

Measuring instrument: Type: JYT(A)

| 4.2 Measurement of winding resistance |                            |           |           |                |
|---------------------------------------|----------------------------|-----------|-----------|----------------|
| Average Oil Temperature:23℃           |                            |           |           |                |
| Tap Position                          | H.V. Windings ( $\Omega$ ) |           |           | Unbalance Rate |
|                                       | H1H2                       | H2H3      | H3H1      | Measured       |
| 1                                     | 0.7804                     | 0.7781    | 0.7800    | 0.42%          |
| 2                                     | 0.7593                     | 0.7576    | 0.7593    | 0.30%          |
| 3                                     | 0.7392                     | 0.7373    | 0.7391    | 0.26%          |
| 4                                     | 0.7191                     | 0.7173    | 0.7191    | 0.25%          |
| 5                                     | 0.6980                     | 0.6945    | 0.6962    | 0.50%          |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
|                                       |                            |           |           |                |
| Tap Position                          | L.V. Windings ( $\Omega$ ) |           |           | Unbalance Rate |
|                                       | X1X2                       | X2X3      | X3X1      | Measured       |
| /                                     | 0.0010340                  | 0.0010296 | 0.0010429 | 1.28%          |
|                                       | X1X0                       | X2X0      | X3X0      | Measured       |
| /                                     | 0.0005520                  | 0.0005384 | 0.0005381 | 2.56%          |
| Measuring instrument: Type JYR(10C)   |                            |           |           |                |

| 4.3 Measurement of Insulation Resistance      |                                 |                     |                       |                      |                  |                     |              |        |
|-----------------------------------------------|---------------------------------|---------------------|-----------------------|----------------------|------------------|---------------------|--------------|--------|
| Relative Humidity:49%,Top Oil Temperature:23℃ |                                 |                     |                       |                      |                  |                     |              |        |
| Measured Between                              | 1min Insulation Resistance (MΩ) |                     | Voltage (V)           |                      |                  |                     |              |        |
| H.V.~L.V. &Earth                              | > 2500                          |                     | 2500                  |                      |                  |                     |              |        |
| L.V.~H.V.& Earth                              | > 5000                          |                     |                       |                      |                  |                     |              |        |
| H.V. & L.V.~Earth                             | > 2500                          |                     |                       |                      |                  |                     |              |        |
| Measuring Instrument: 3125A.                  |                                 |                     |                       |                      |                  |                     |              |        |
| 4.4 Applied Voltage Test (AV)                 |                                 |                     |                       |                      |                  |                     |              |        |
| Measured Between                              | Test Voltage (kV)               | Test Frequency (Hz) | Duration (s)          | Result               |                  |                     |              |        |
| H.V.                                          | 34                              | 50                  | 60                    | pass                 |                  |                     |              |        |
| L.V.                                          | 10                              | 50                  | 60                    | pass                 |                  |                     |              |        |
| 4.5 Induced Voltage Withstand Test(IVW)       |                                 |                     |                       |                      |                  |                     |              |        |
| Tap Position                                  | Tested Winding                  | Supplied Terminal   | Supplied Voltage (kV) | Induced Voltage (kV) | Induced Multiple | Test Frequency (Hz) | Duration (S) | Result |
| 3                                             | H.V.                            | L.V.                | 0.96                  | 24.94                | 2                | 200                 | 36           | Pass   |
|                                               |                                 |                     |                       |                      |                  |                     |              |        |

#### 4.6 Measurement of No-load Current and No-load Loss

Average Oil Temperature: 23 °C

| Test Voltage (kV) |       | Test Current |          |          | No-load Loss (kW) |                     |          |
|-------------------|-------|--------------|----------|----------|-------------------|---------------------|----------|
| Mean              | R.M.S | I0(A)        | I0(%)    |          | Test Loss (Pm)    | Corrected Loss (P0) | Required |
|                   |       |              | Required | Measured |                   |                     |          |
| 0.48              | 0.49  | 4.84         | /        | 0.22     | 1.268             | 1.686               | <1.7+15% |

Measuring Instrument: Norma 4000CN precision power analyzer.

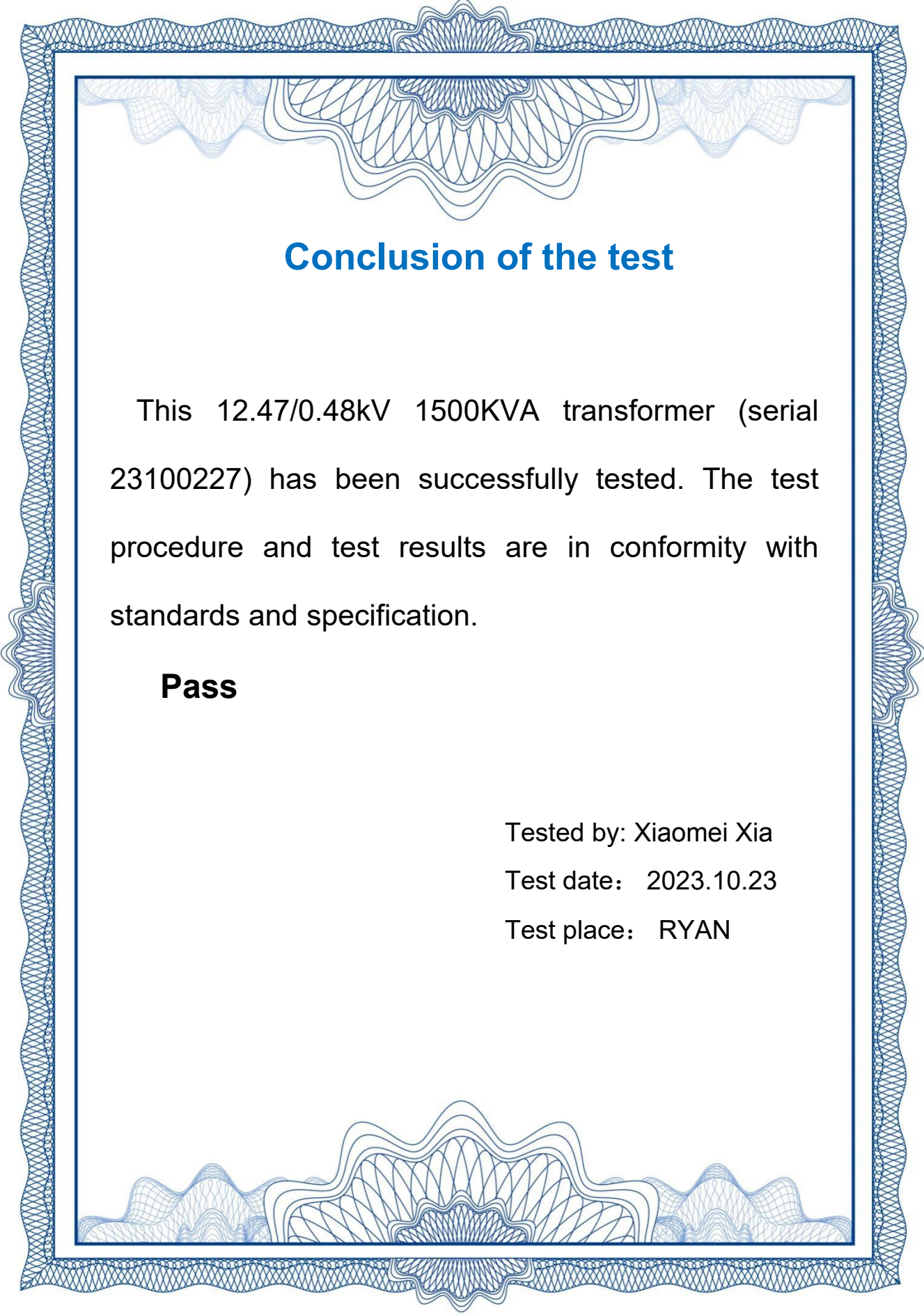
#### 4.7 Measurement of Short-circuit Impedance and Load Loss

【H.V.~L.V.】

| Tap Position |      | Test Current I(A) | Test Voltage U(kV) | Impedance Base:1500kVA |           |       |       | Temp.:75°C(kW)<br>Base:1500kVA | Temp.:85°C(kW)<br>Base:1500kVA |           |
|--------------|------|-------------------|--------------------|------------------------|-----------|-------|-------|--------------------------------|--------------------------------|-----------|
| H.V.         | L.V. |                   |                    | Required               | Tolerance | Uk(%) | Zk(Ω) | Load Loss                      | Required                       | Load Loss |
|              |      |                   |                    |                        |           |       |       |                                |                                |           |
| 3            | /    | 41.77             | 0.348              | /                      | /         | 5.62  | /     | 14.378                         | <14.5+10%                      | 14.852    |
|              |      |                   |                    |                        |           |       |       |                                |                                |           |

Measuring Instrument: Norma 4000CN precision power analyzer.

| 4.8 Tank Pressure (Leakage) Test |                           |                         |                           |          |
|----------------------------------|---------------------------|-------------------------|---------------------------|----------|
| Test Method                      | Applied Pressure<br>(MPa) | Duration of Test<br>(h) | Release Pressure<br>(Mpa) | Result   |
| Tank Pressure                    | 0.03                      | 24                      | 0.03                      | No leaks |
|                                  |                           |                         |                           |          |



## Conclusion of the test

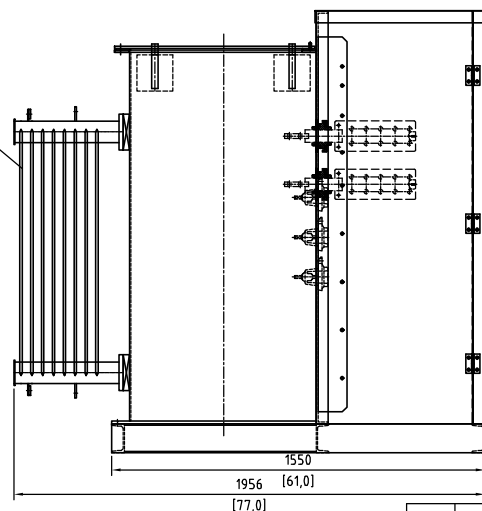
This 12.47/0.48kV 1500KVA transformer (serial 23100227) has been successfully tested. The test procedure and test results are in conformity with standards and specification.

**Pass**

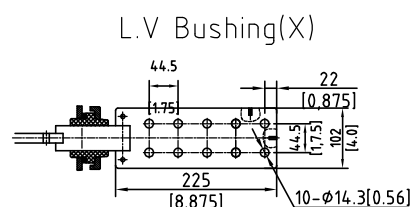
Tested by: Xiaomei Xia

Test date: 2023.10.23

Test place: RYAN



The overall dimensions for reference only,  
Actual dimensions based on finished product



| PHYSICAL DATA          |      |     |
|------------------------|------|-----|
| TOTAL OIL VOLUME       | 335  | GAL |
| TOTAL OIL WEIGHT       | 2550 | LB  |
| CORE & COIL WEIGHT     | 3616 | LB  |
| TANK & FITTINGS WEIGHT | 2207 | LB  |
| TOTAL WEIGHT           | 8532 | LB  |

| Item | Description                    | Item | Description                     |
|------|--------------------------------|------|---------------------------------|
| 14   | Oil Fill Valve                 | 1    | Tank                            |
| 15   | Pressure Vacuum Gauge          | 2    | Core & Coil Assemble            |
| 16   | Pressure Switch                | 3    | Oil Mineral                     |
| 17   | OIL Thermometer                | 4    | HV Bushing 15/25kV 200A(BW150F) |
| 18   | Lifting Lug                    | 5    | Load Switch                     |
| 19   | LV Bushing (BFG-1250/1)10-hole | 6    | TAP Change                      |
| 20   | Radiators                      | 7    | Bayonet Fuse                    |
| 21   | Darin Plug                     | 8    | Drip Shield Assembly            |
| 22   | Tank Earth Pad                 | 9    | Fuse Holder                     |
| 23   |                                | 10   | ElsP                            |
| 24   |                                | 11   | Oil Level Gauge                 |
| 25   |                                | 12   | Pressure Relief Valve           |
| 26   |                                | 13   | Nameplate                       |

|                                                                                                           |         |         |  |                                                                                       |                               |                |       |                                                                                       |
|-----------------------------------------------------------------------------------------------------------|---------|---------|--|---------------------------------------------------------------------------------------|-------------------------------|----------------|-------|---------------------------------------------------------------------------------------|
| TYPE<br>ZGSL-H-1000/4160D-480Y/227                                                                        |         |         |  |                                                                                       | DWG. NAME<br>general assembly |                |       |                                                                                       |
| DRAWN                                                                                                     | CHECKED | CHECKED |  | APPROVED                                                                              | FIRST ANGLE<br>PROJECTION     | SCALE          | 1 / 1 | 2024/3/28                                                                             |
|                                                                                                           |         |         |  |  | REF.<br>DWG.<br>NO.           |                |       | REV.<br>NO.                                                                           |
|  HIGH TO LOW VOLTAGE |         |         |  |                                                                                       | DWG.<br>NO.                   | 1RE.710.3711.1 |       |  |