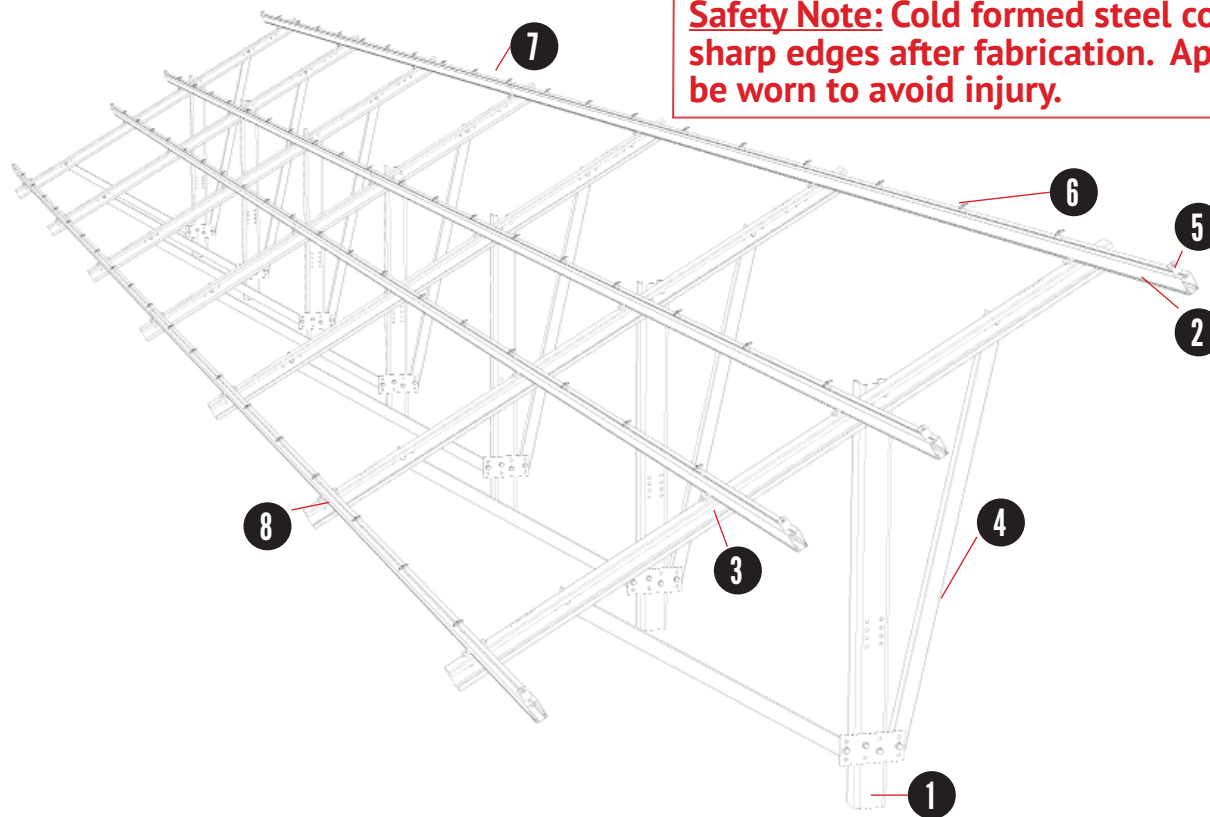




## TABLE OF CONTENTS

- A - PRIMARY COMPONENTS
- B - OVERALL VIEW OF COMPONENTS
- C - END AND MID CLAMPS ASSEMBLIES
- D - BEAM CLIP AND BEAM SPLICE
- E - TOP CHORD AND DIAGONAL BRACE PILE CONNECTIONS
- 1-22 - STEP BY STEP INSTALLATION INSTRUCTIONS
- 23 - ELECTRICAL CONSIDERATIONS
- 24 - BONDING GROUND PATHS
- 25 - MODULE COMPATABILITY

**NOTE:**  
GFT construction  
drawings have  
precedence over these  
installation guidelines.



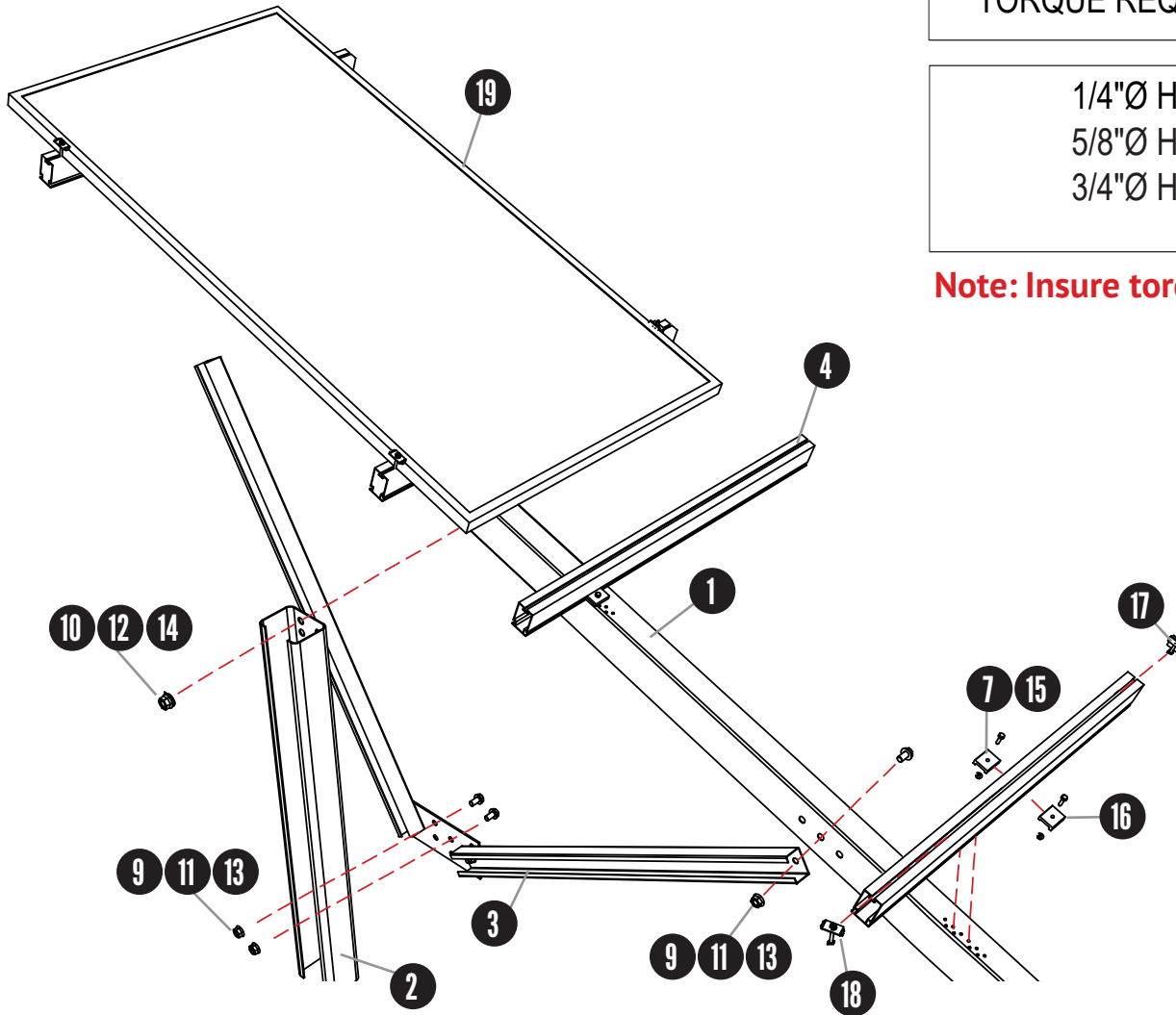
**Safety Note:** Cold formed steel components may have sharp edges after fabrication. Appropriate PPE should be worn to avoid injury.

| ITEM | COMPONENT                   | MATERIAL   |
|------|-----------------------------|--|
| 1    | Roll- Formed Steel Pile     | 4.5 " x 6" C Shape (Length Varies)                         |
| 2    | Aluminum East-West Beam     | Aluminum Beam with Continuous Slots for Adjustability      |
| 3    | Roll-Formed Steel Top Chord | C Shape with Hole Pattern for Adjustability                |
| 4    | Diagonal Brace Assembly     | Roll-formed Front and Rear Diagonal Brace with Steel Plate |
| 5    | End Clamp                   | End Clamp Assembly with T-Bolt                             |
| 6    | Mid Clamp                   | Mid Clamp Assembly with T-Bolt                             |
| 7    | E-W Beam Splice             | Internal Aluminum Splice Retained with Self-Tapping Screws |
| 8    | East-West Beam Clip         | Aluminum Extruded Clamp with Stainless Steel Hardware      |

TORQUE REQUIREMENTS FOR THE GFT PRODUCT:

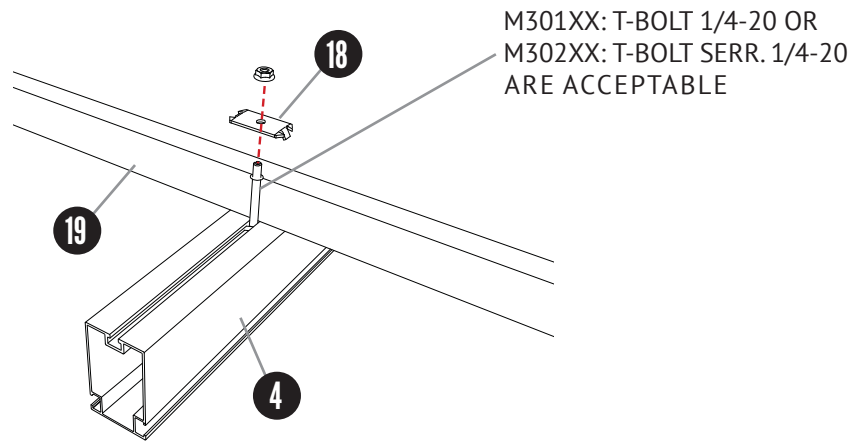
1/4"Ø HARDWARE = 9 - 11 FT-LBS  
 5/8"Ø HARDWARE = 54 - 66 FT-LBS  
 3/4"Ø HARDWARE = 99 - 121 FT-LBS

**Note: Insure torque wrenches have been calibrated.**

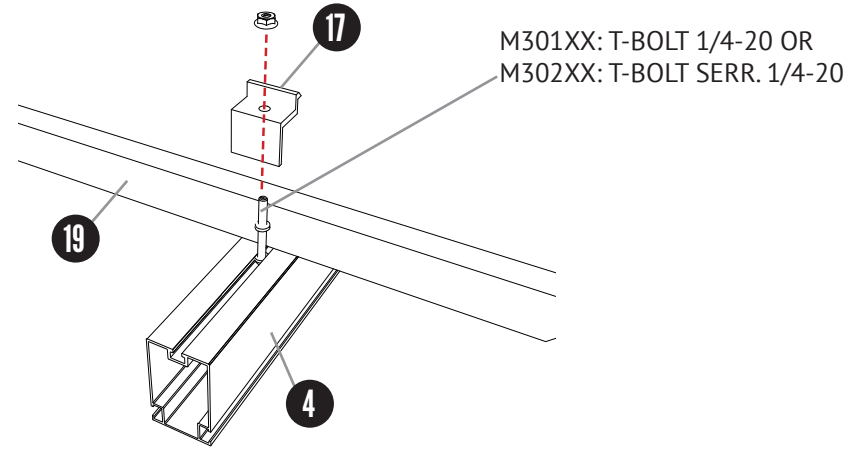


| ITEM | COMPONENT                          |
|------|------------------------------------|
| 1    | 4.1" Top Chord Channel             |
| 2    | 6" x 4.5" 11 Gauge Pile            |
| 3    | Diagonal Brace Assembly            |
| 4    | 3.25" x 2" East-West Aluminum Beam |
| 7    | Hex Flange Nut 1/4-20 Serrated     |
| 9    | Flat Washer 5/8"                   |
| 10   | Flat Washer 3/4"                   |
| 11   | Hex Bolt 5/8-11" x 1-1/2"          |
| 12   | Hex Bolt 3/4-10" x 1-1/2"          |
| 13   | Hex Flange Nut 5/8-11 Serrated     |
| 14   | Hex Flange Nut 3/4-10 Serrated     |
| 15   | Hex Bolt 1/4-20 x 1"               |
| 16   | East-West Beam Clip                |
| 17   | End Clamp Assembly                 |
| 18   | Mid Clamp Assembly                 |
| 19   | PV Module (By Others)              |

### Mid Clamp Assembly with T-Bolt



### End Clamp Assembly with T-Bolt



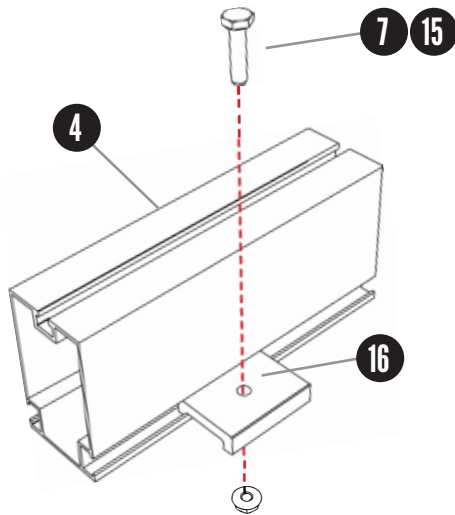
### Mid Clamp Assembly With T-Bolt

| ITEM    | COMPONENT                                | MATERIAL  |
|---------|--|---|
| 4       | 3.25" x 2" East-West Aluminum Beam       | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |
| 18      | Mid Clamp                                | Stainless Steel, 301,302, or 304, 1/4 Hard, Mill Finish                             |
| 19      | PV Module (By Others)                    | As per Manufacturer   |
| SEE DWG | 1/4-20 T-Bolt (Serrated or Non-Serrated) | 300 Stainless Steel (301 Preferred) with Min Ft <sub>u</sub> = 70 ksi               |
| SEE DWG | 1/4-20 Serrated Flange Nut               | Stainless Steel ASTM F594 with Min Ft <sub>u</sub> = 70 ksi                         |

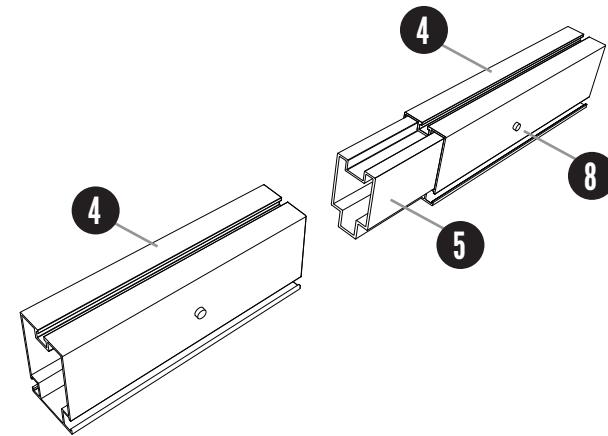
### End Clamp Assembly With T-Bolt

| ITEM    | COMPONENT                                | MATERIAL  |
|---------|--|---|
| 4       | 3.25" x 2" East-West Aluminum Beam       | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |
| 17      | End Clamp                                | Stainless Steel, 301,302, or 304, 1/4 Hard, Mill Finish                             |
| 19      | PV Module (By Others)                    | As per Manufacturer   |
| SEE DWG | 1/4-20 T-Bolt (Serrated or Non-Serrated) | 300 Stainless Steel (301 Preferred) with Min Ft <sub>u</sub> = 70 ksi               |
| SEE DWG | 1/4-20 Serrated Flange Nut               | Stainless Steel ASTM F594 with Min Ft <sub>u</sub> = 70 ksi                         |

### East-West Beam Clip



### East-West Beam Splice



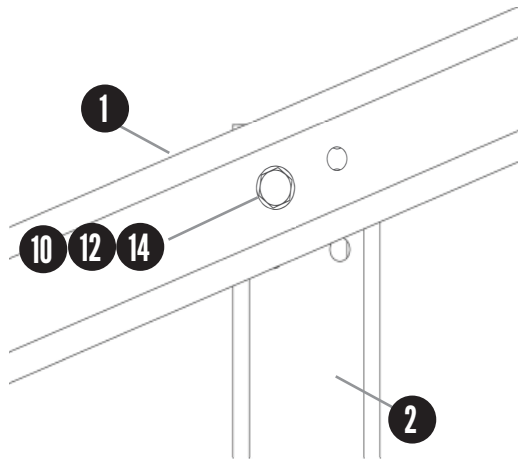
### East-West Rail Clip

| ITEM | COMPONENT                          | MATERIAL  |
|------|------------------------------------|---|
| 4    | 3.25" x 2" East-West Aluminum Beam | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |
| 7    | Hex Flange Nut 1/4-20 Serrated     | 302HQ 18/8 Stainless Steel Austenitic 300 Series, Min Ft <sub>u</sub> = 85 ksi      |
| 15   | Hex Bolt 1/4-20 x 1"               | 302HQ 18/8 Stainless Steel Austenitic 300 Series, Min Ft <sub>u</sub> = 85 ksi      |
| 16   | East-West Beam Clip                | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |

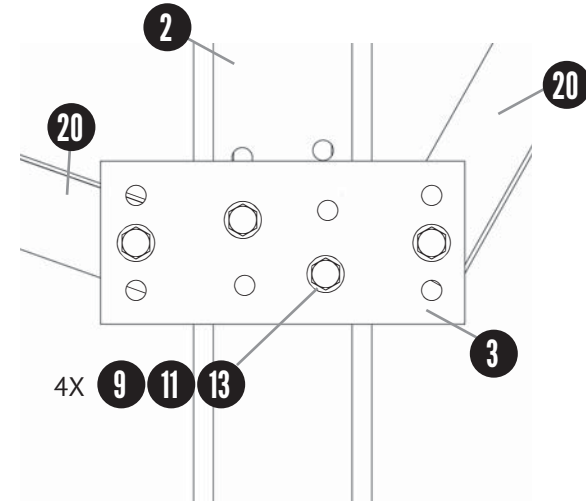
### East-West Beam Splice

| ITEM | COMPONENT                               | MATERIAL  |
|------|---|---|
| 4    | 3.25" x 2" East-West Aluminum Beam      | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |
| 5    | East-West Beam Splice Insert            | Aluminum Alloy 6005A-T61, 6351-T5 or 6061-T6, Fy = 35 ksi, Ft <sub>u</sub> = 38 ksi |
| 8    | 1/4" x 20 Self Drilling Screw (Buildex) | Grade 5, ASTM A449/ SAE J429 (Similar Properties Confirmed by testing)              |

### Top Chord to Pile Connection



### Diagonal Brace Plate to Pile Connection

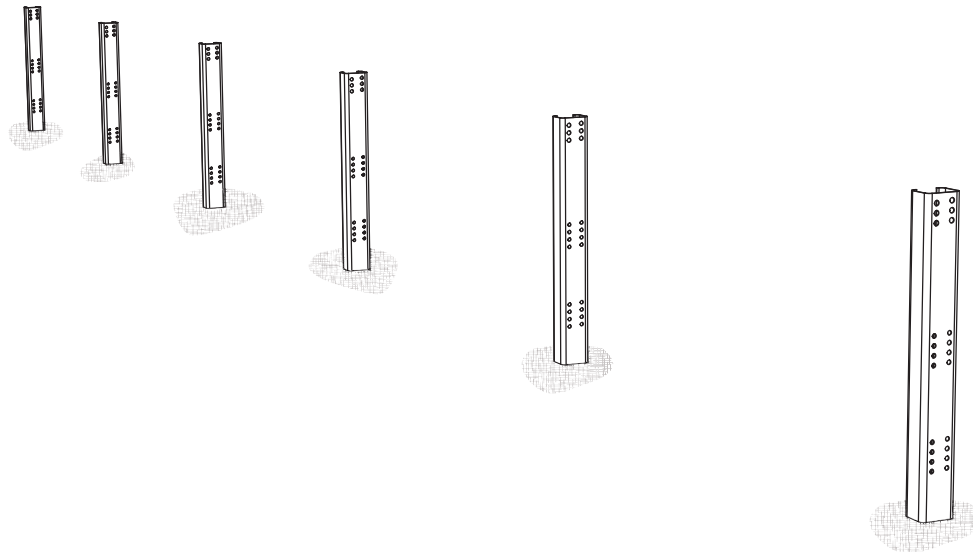


### Top Chord to Pile Connection

| ITEM | COMPONENT                      | MATERIAL                                   |
|------|--------------------------------|--|
| 1    | 4.1" Top Chord Channel         | Cold Rolled ASTM A653 HSLAS Grade 50 or 55 |
| 2    | 6" x 4.5" C-Shape Pile         | Cold Rolled ASTM A653 HSLAS Grade 50 or 55 |
| 10   | Flat Washer 3/4"               | SAE Type A Narrow                          |
| 12   | Hex Bolt 3/4-10 x 1-1/2"       | SAE J429-Grade Varies per Project          |
| 14   | Hex Flange Nut 3/4-10 Serrated | SAE J429-Grade Varies per Project          |

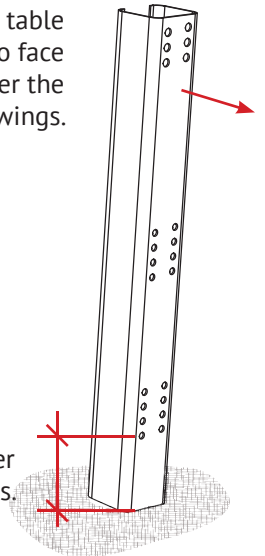
### Diagonal Brace Plate to Pile Connection

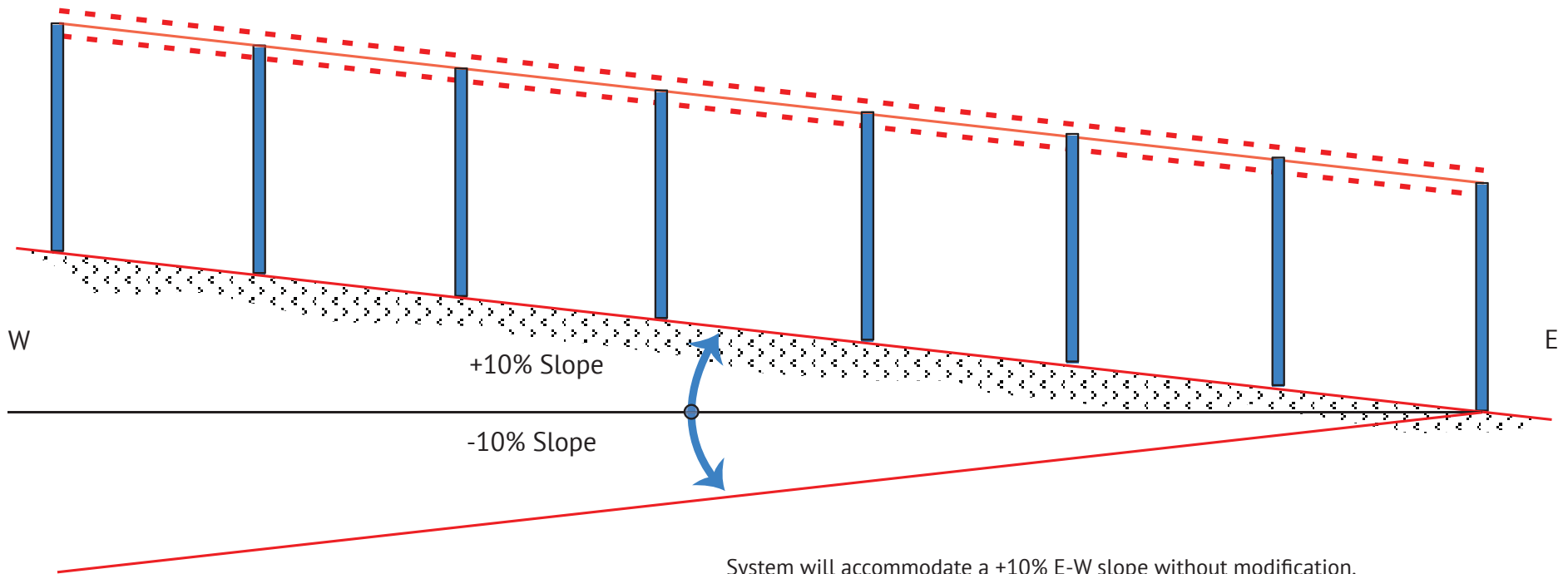
| ITEM | COMPONENT                      | MATERIAL                                   |
|------|--------------------------------|--|
| 2    | 6" x 4.5" C Shape Pile         | Cold Rolled ASTM A653 HSLAS Grade 50 or 55 |
| 3    | Diagonal Brace Plate           | ASTM A36 or ASTM A653 GR 50 Steel          |
| 9    | Flat Washer 5/8"               | SAE Type A Narrow                          |
| 11   | Hex Bolt 5/8-11 x 1-1/2"       | SAE J429-Grade Varies per Project          |
| 13   | Hex Flange Nut 5/8-11 Serrated | SAE J429-Grade Varies per Project          |
| 20   | Diagonal Brace                 | Cold Rolled ASTM A653 HSLAS Grade 50 or 55 |



All piles within single table must be oriented to face the same direction per the construction drawings.

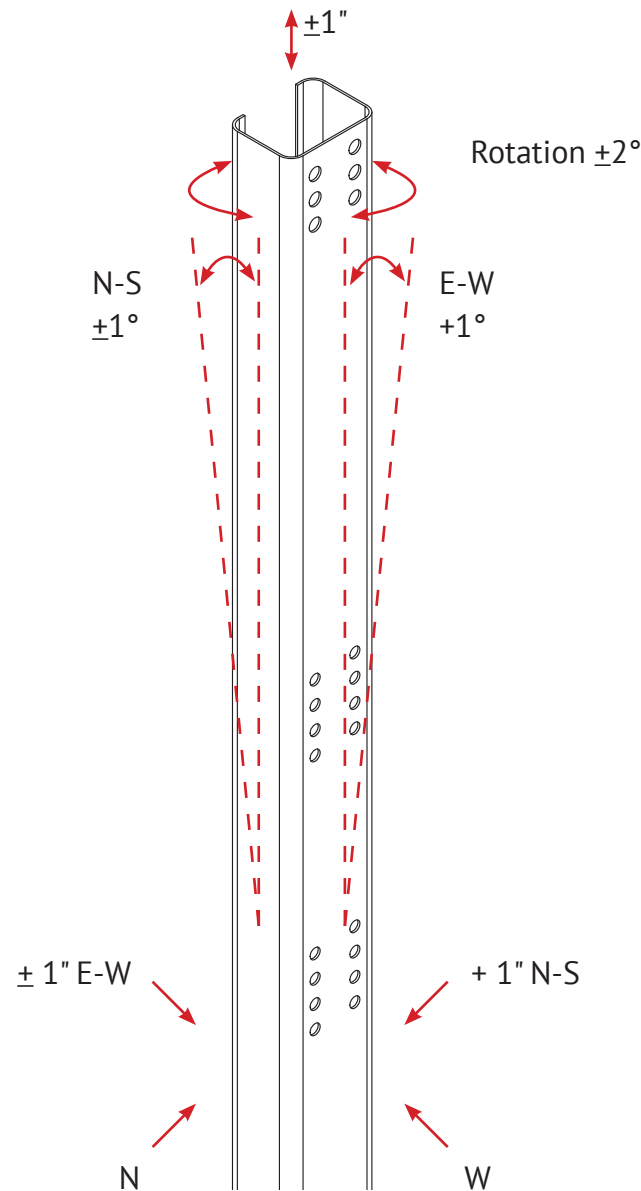
Hole height above grade per construction drawings.



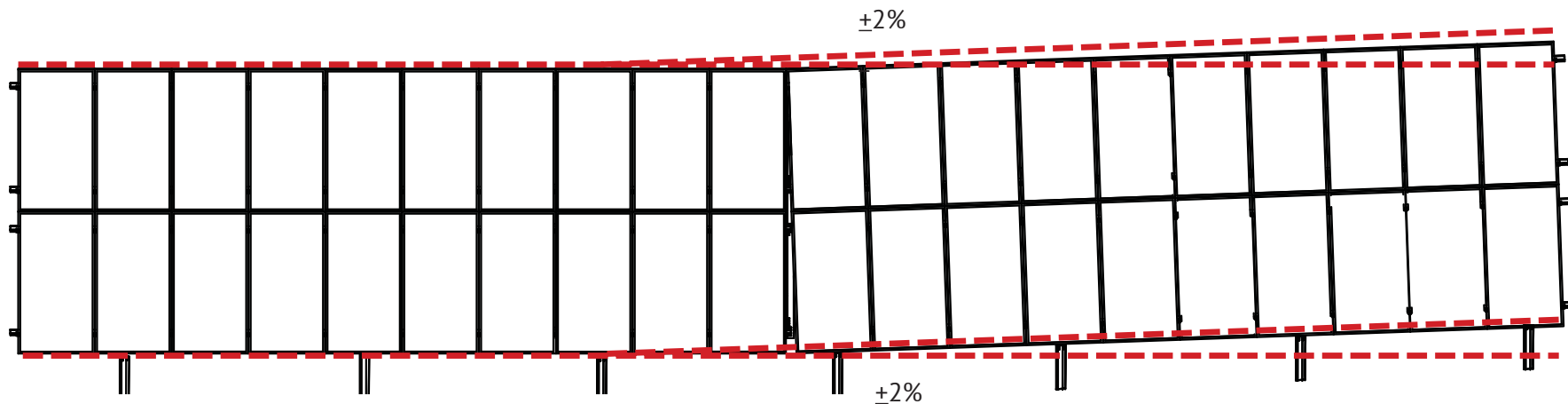
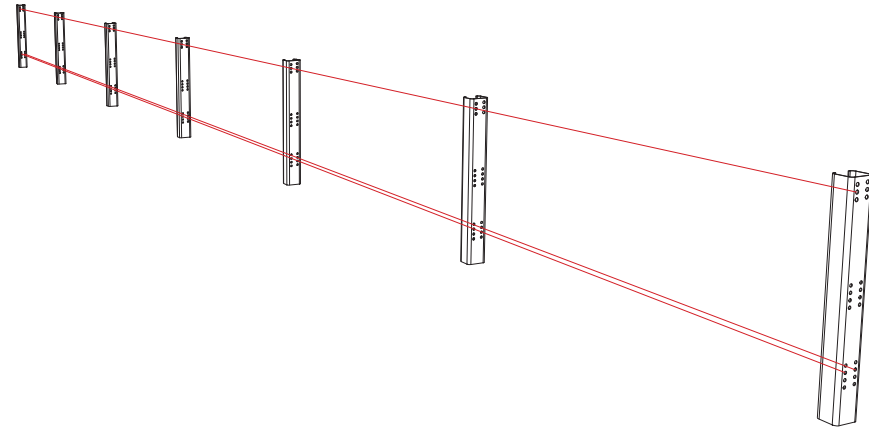


- System will accommodate a  $\pm 10\%$  E-W slope without modification.
- Plumb tolerances apply regardless of slope.
  - Pile position tolerances apply relative to nominal finish grade line.

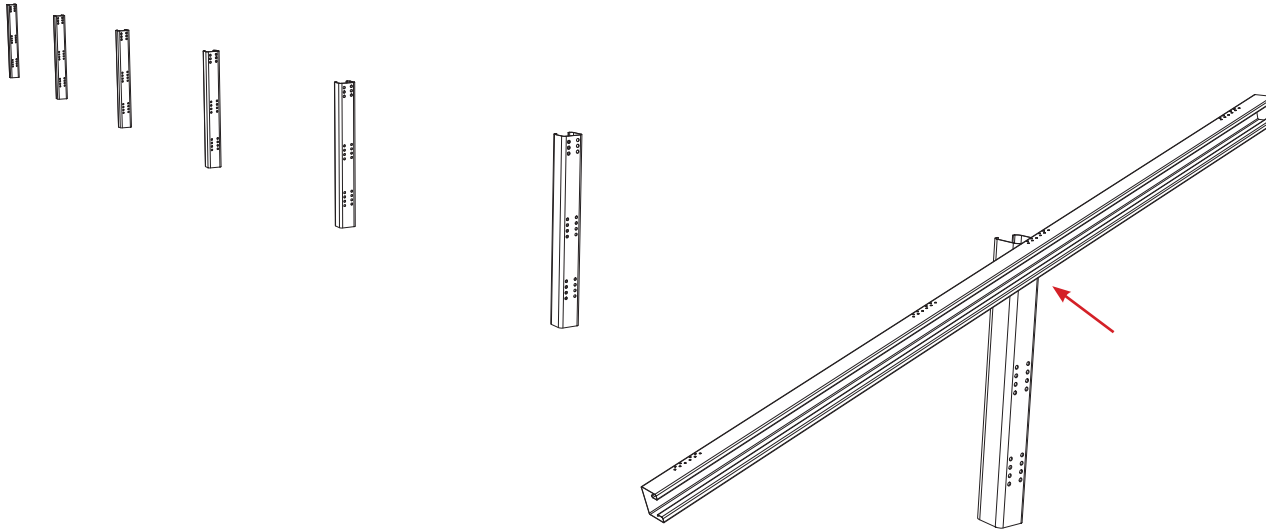




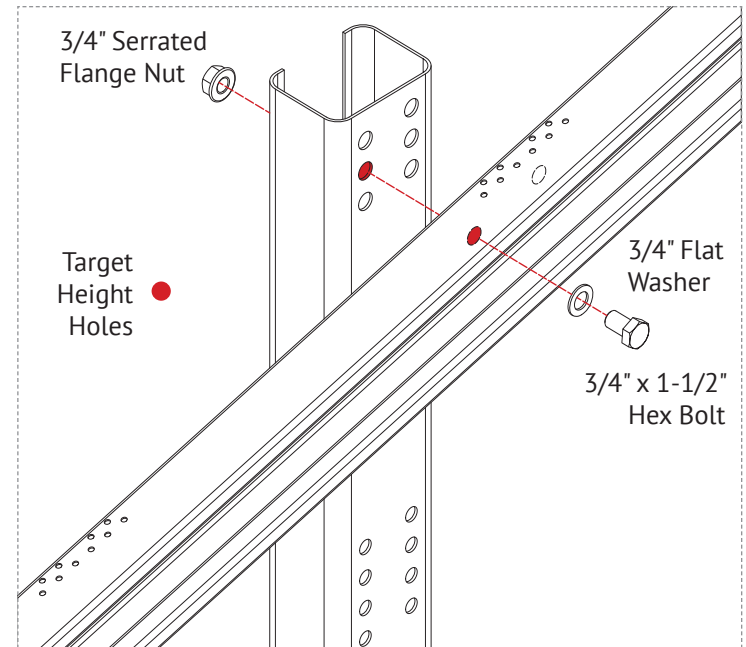
1. Align target hole locations in all piles (within tables and table to table) using laser or string line.
2. Determine if adjustments are needed up or down (hole patterns allow for + 1-1/2" adjustments in 3/4" increments per instruction on following pages).
3. Mark holes to be used for top chord and diagonal brace plate attachments prior to installing.



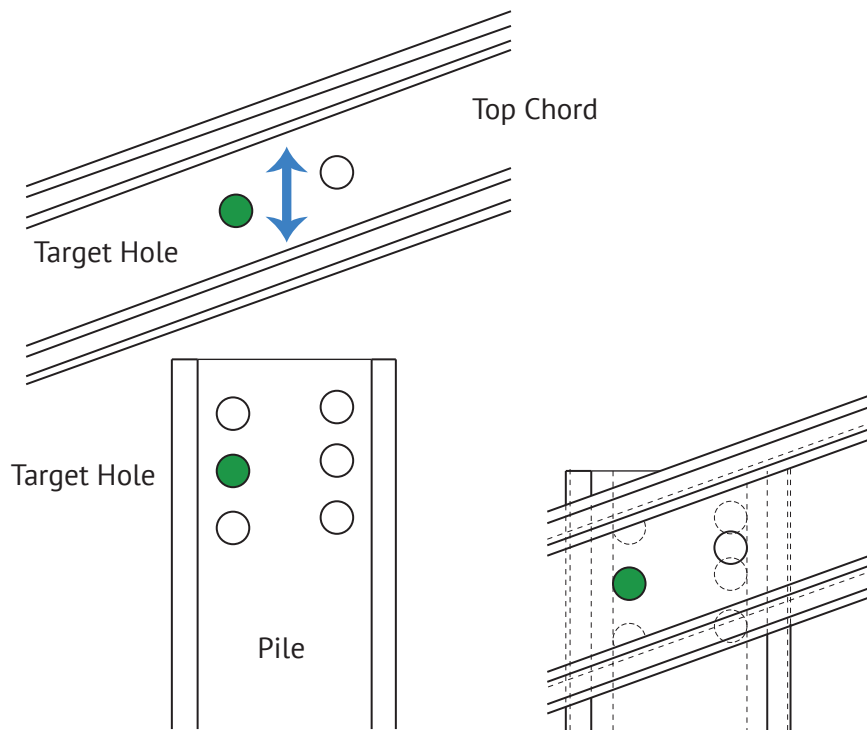
The system is capable of being aligned to the target string or laser line using the adjustment holes when piles are placed within allowable tolerances. Each table will however accommodate a 2% deviation from the target line as shown without impact to structural integrity.



Install hardware snug tight.  
*Torque per construction drawings after final adjustments.*



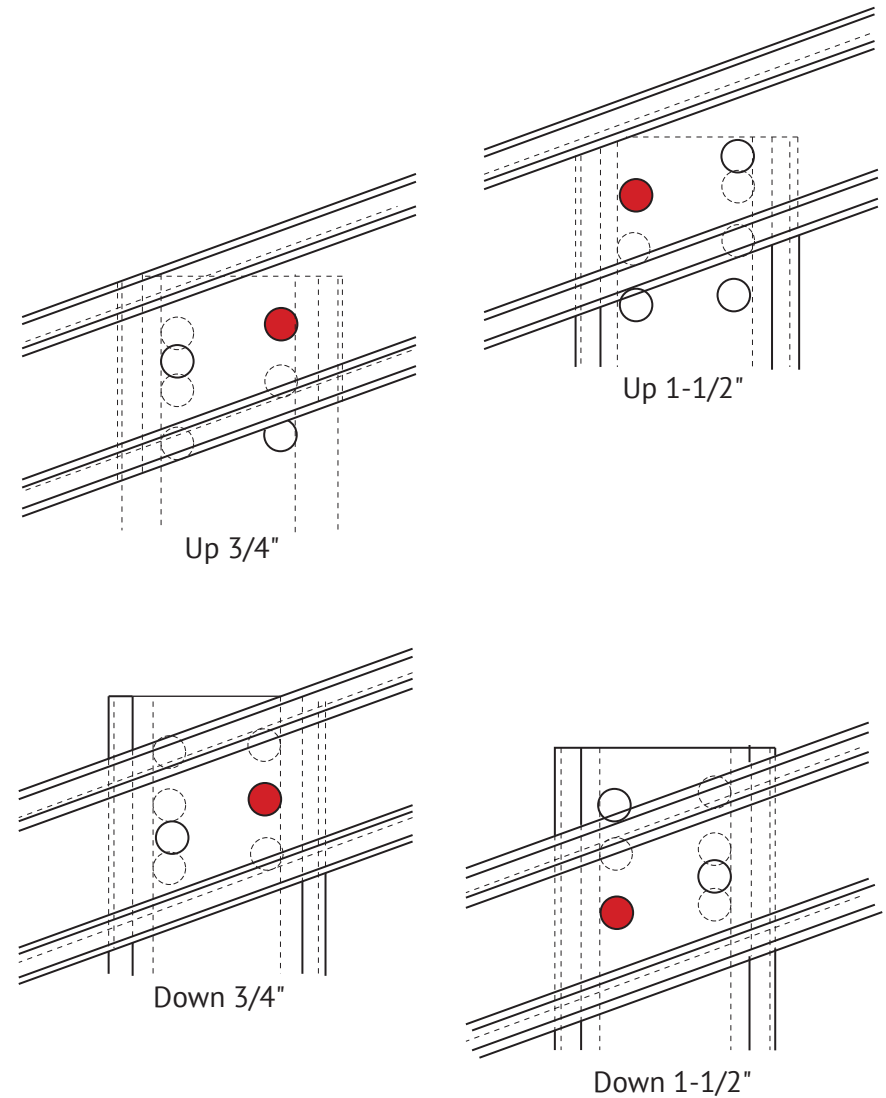
## Target Height

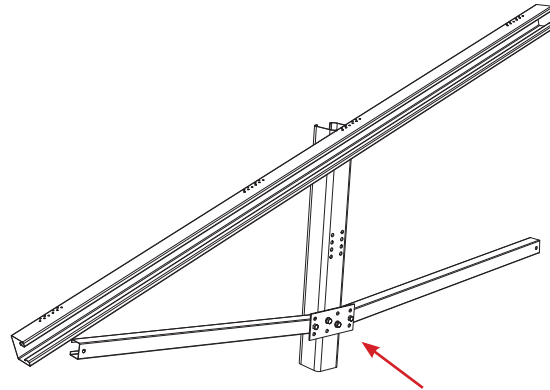
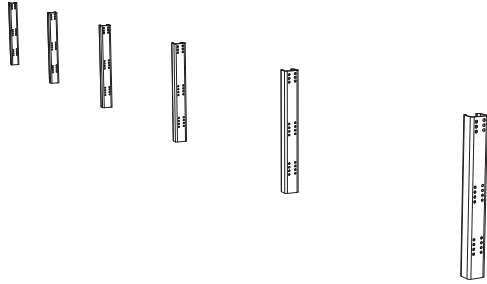


Move top chord up or down (not horizontally) as needed to adjust height in 3/4" increments.

Use single 3/4" bolt (nut and washer) at one of the locations shown.

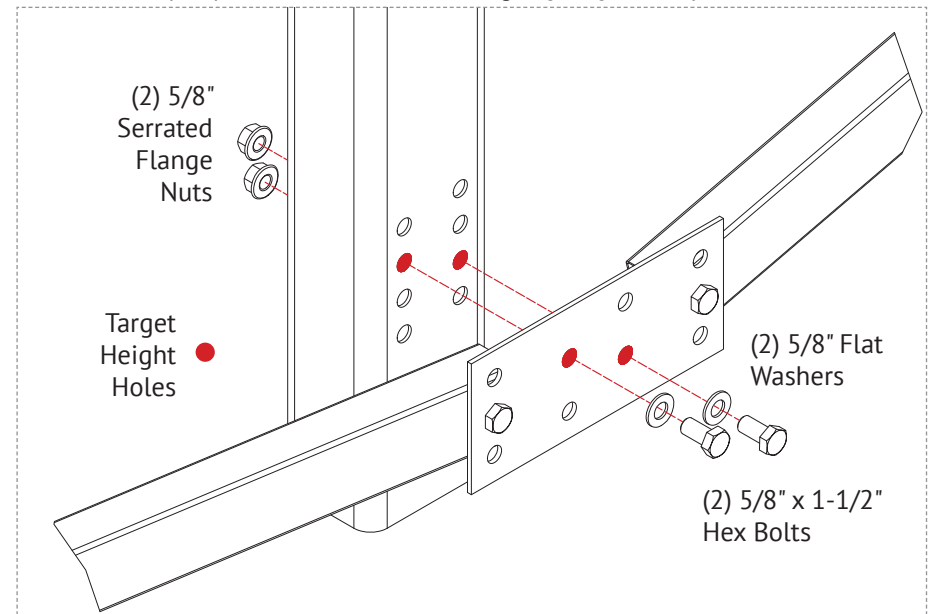
## Adjustment Locations (Single 3/4" Bolt)





Diagonal Brace Assembly

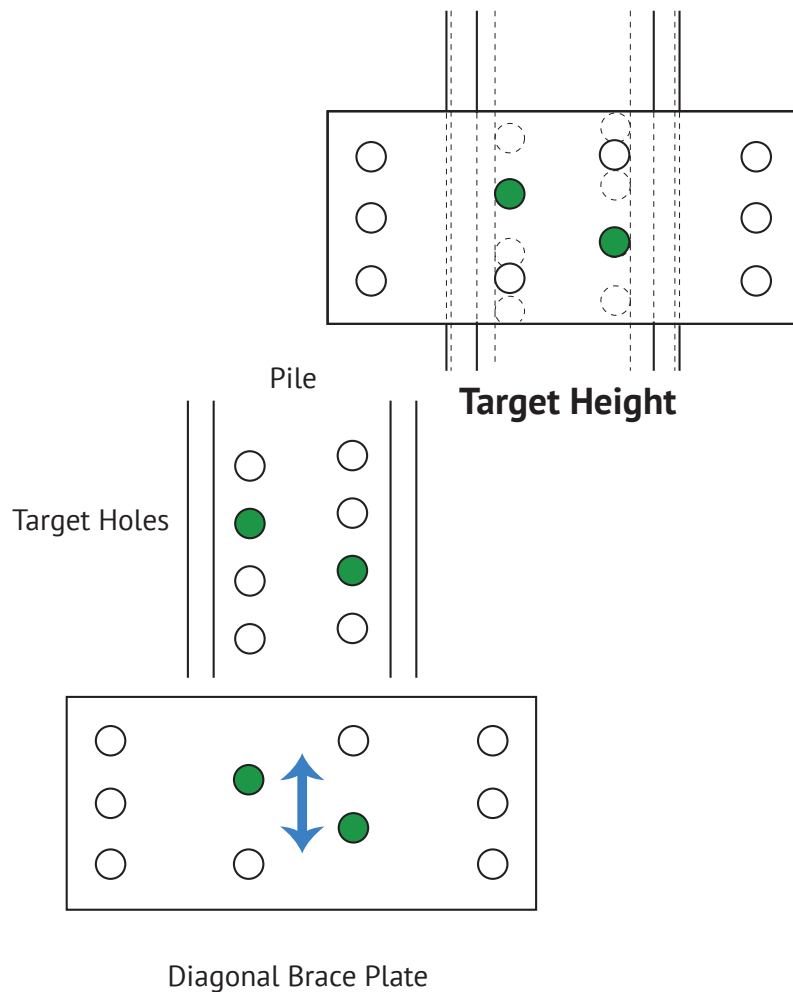
Install hardware snug tight.  
*Torque per construction drawings after final adjustments.*



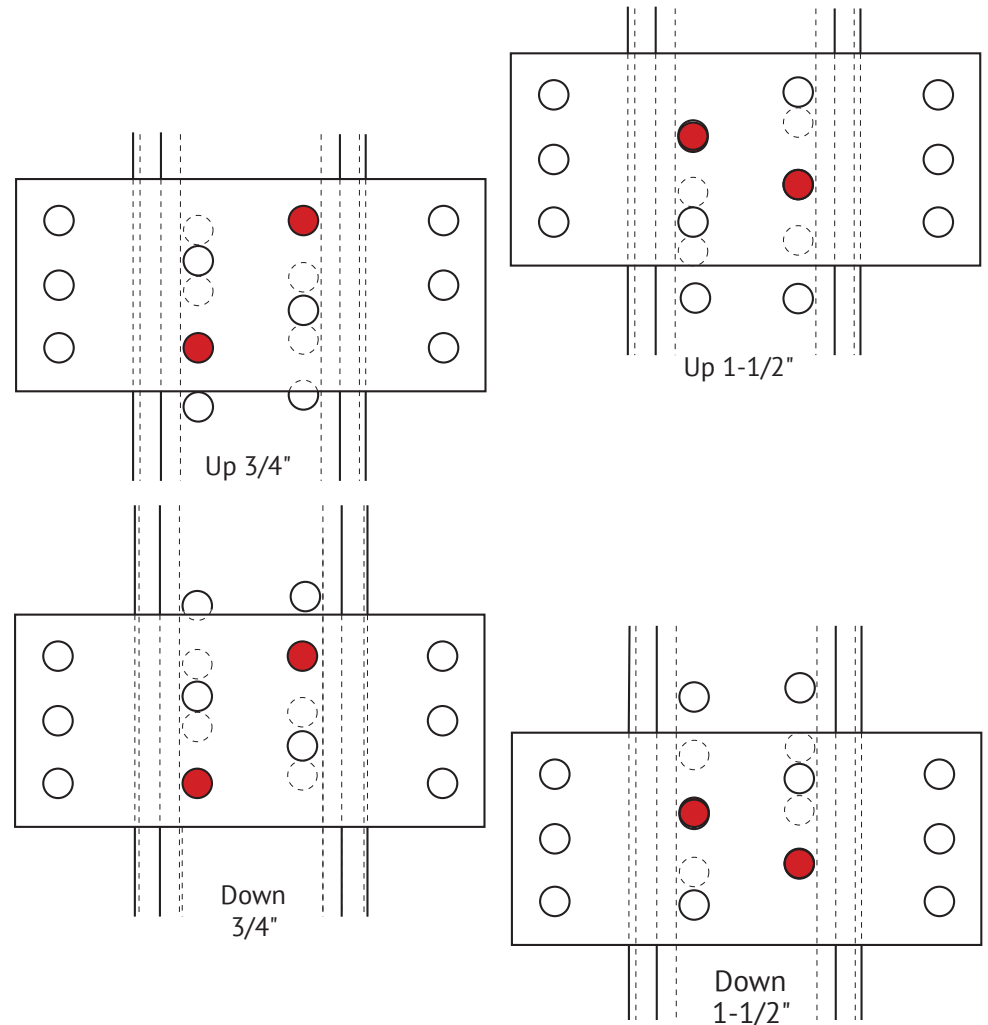
### Target Height

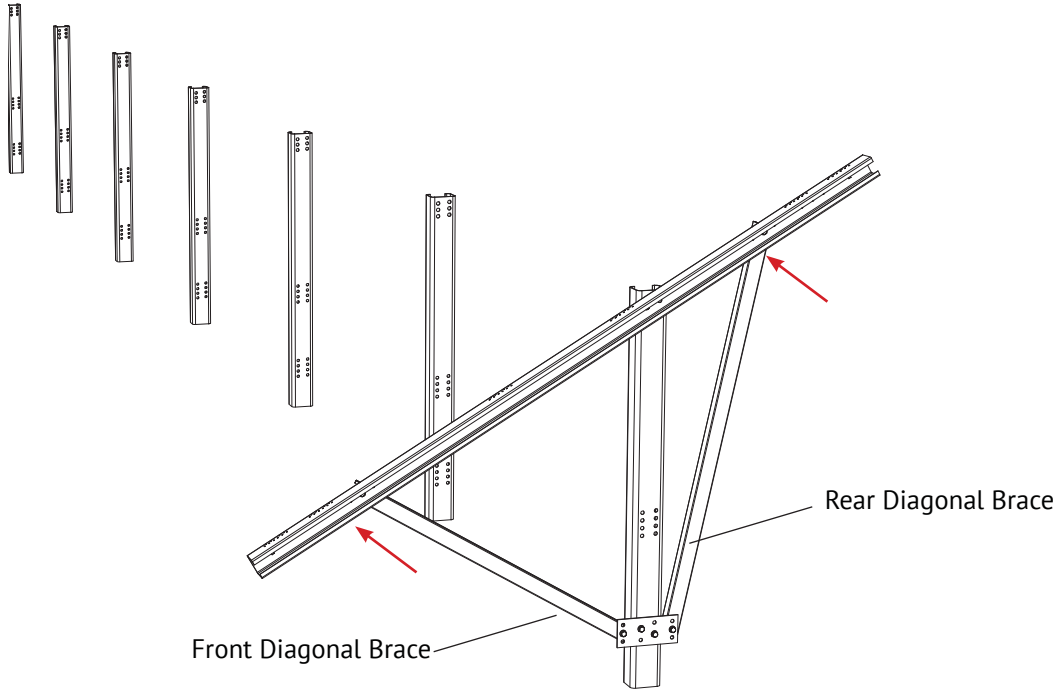
Move diagonal brace plate up or down (not horizontally) as needed to adjust height in 3/4" increments.

Use pair of 5/8" bolts (nuts and washers) at location shown.

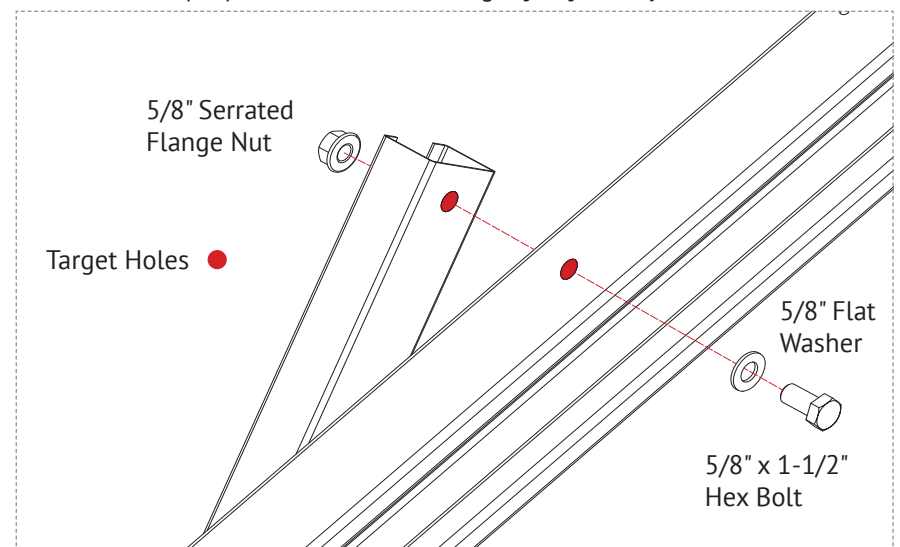


### Adjustment Locations (Pair of 5/8" Bolts)

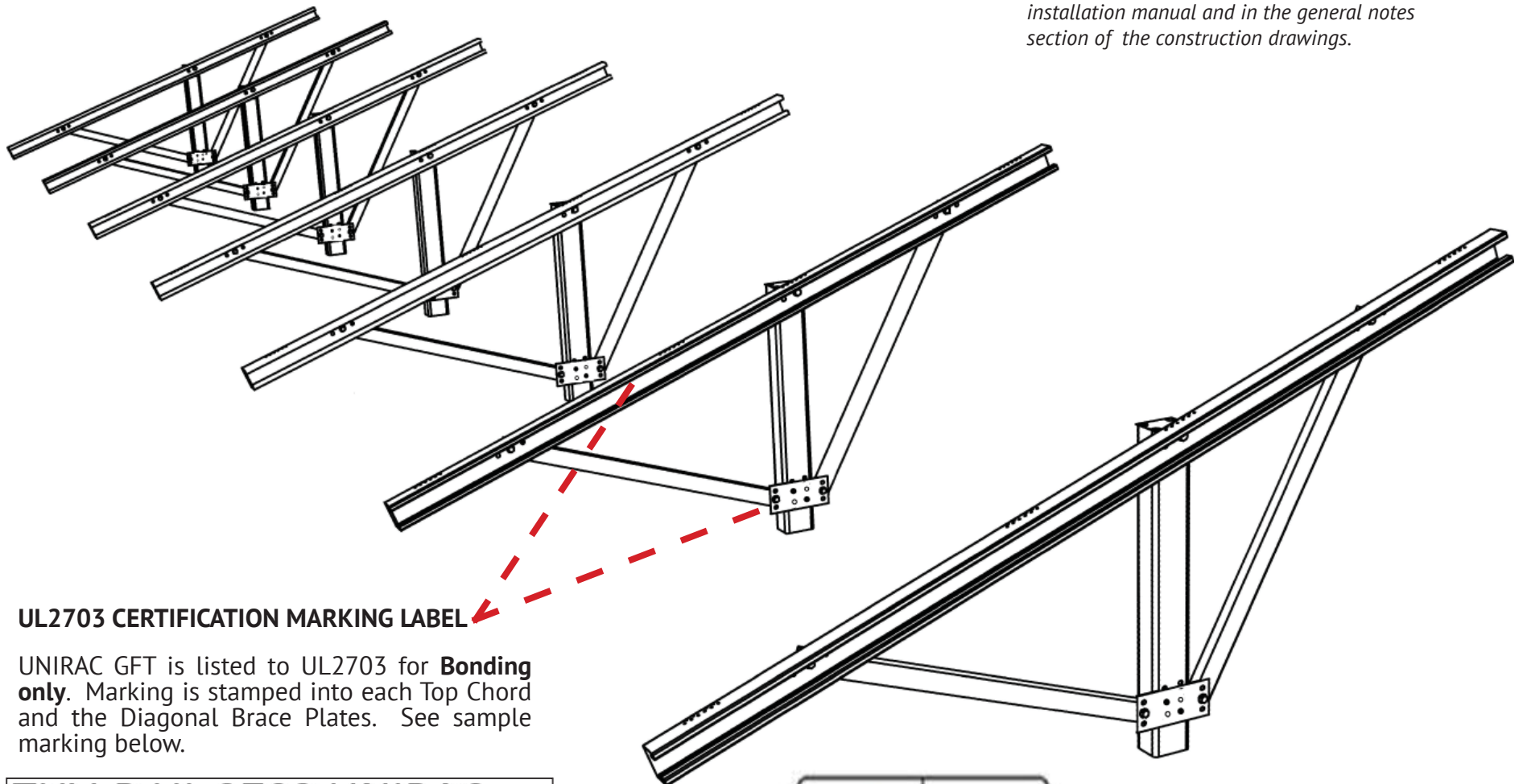




Install hardware snug tight.  
*Torque per construction drawings after final adjustments.*



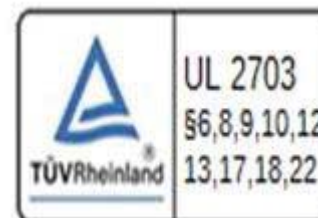
Torque all bolts after final adjustments.  
Refer to Torque values stated on page B of the installation manual and in the general notes section of the construction drawings.



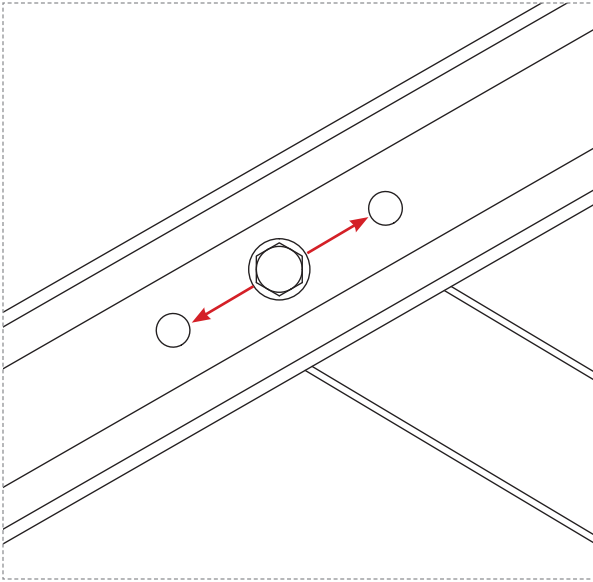
**UL2703 CERTIFICATION MARKING LABEL**

UNIRAC GFT is listed to UL2703 for **Bonding only**. Marking is stamped into each Top Chord and the Diagonal Brace Plates. See sample marking below.

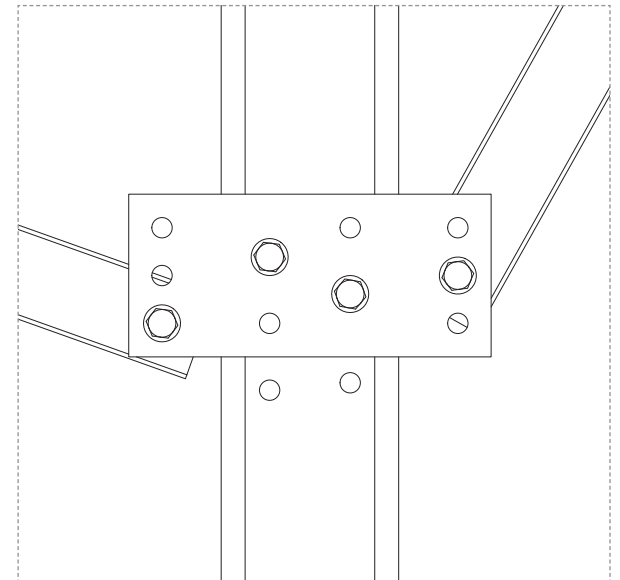
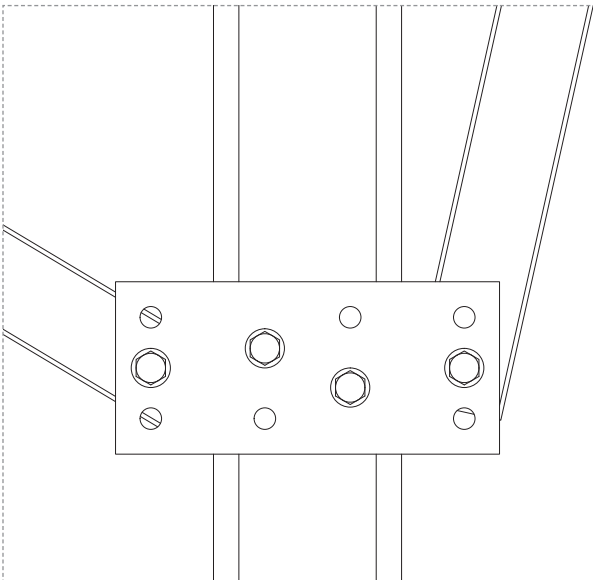
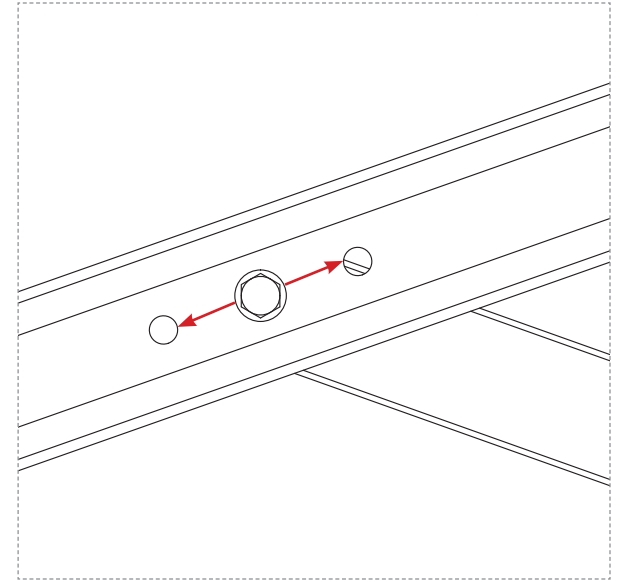
TUV-R UL 2703 UNIRAC  
GFT 002A-201610-285  
SEE MANUAL FOR DETAILS



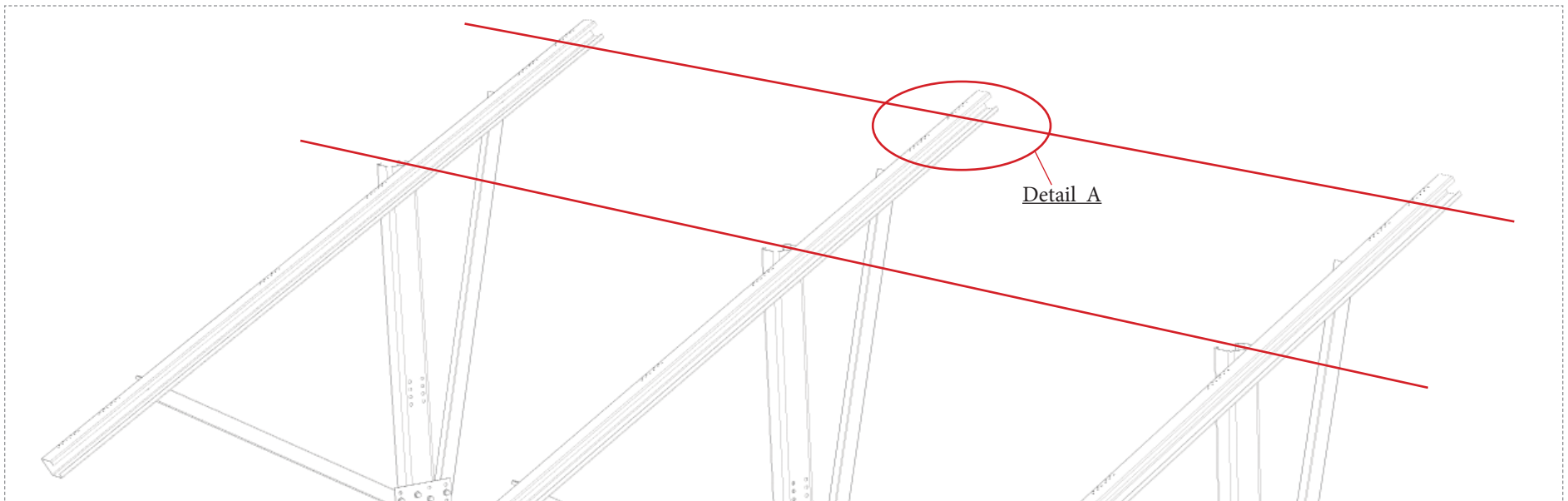
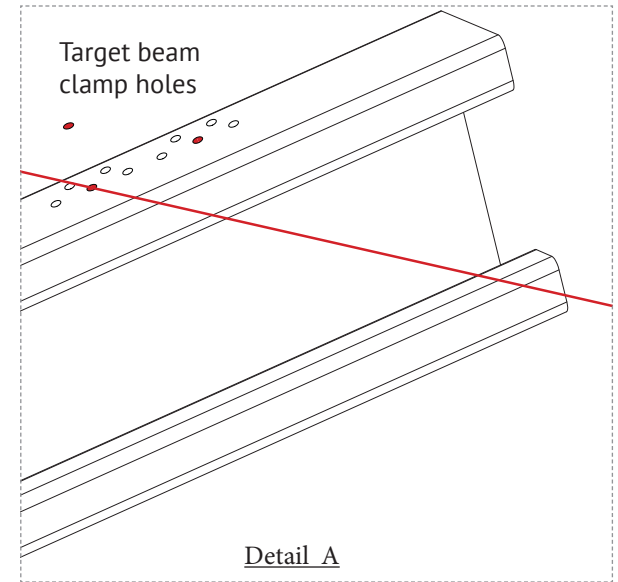


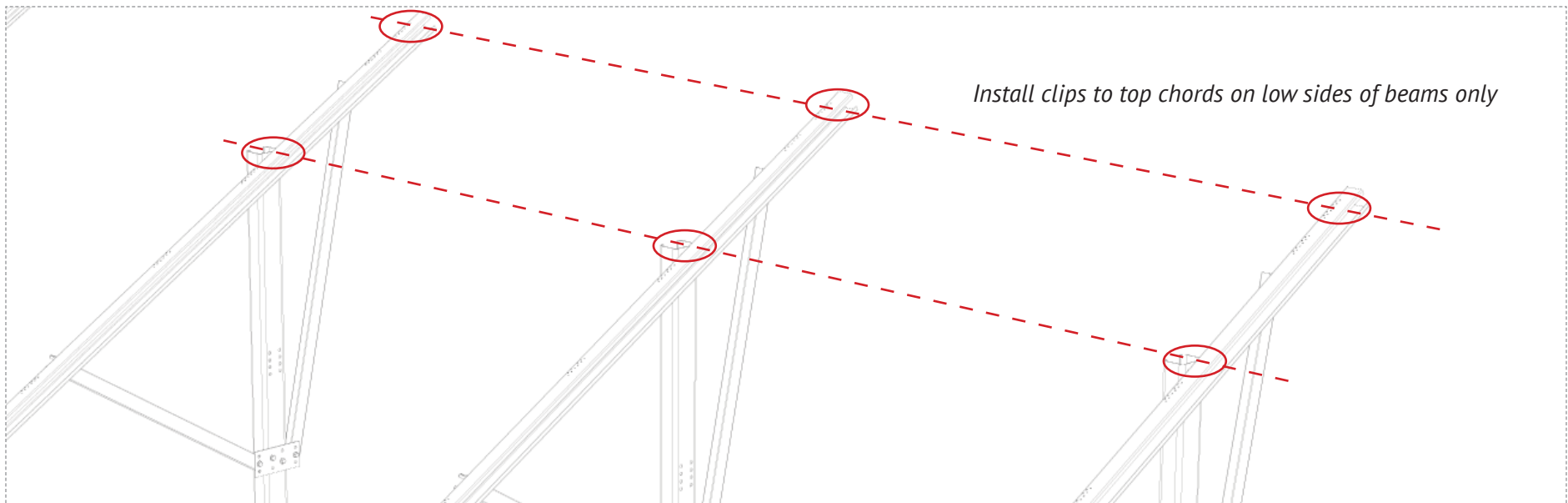
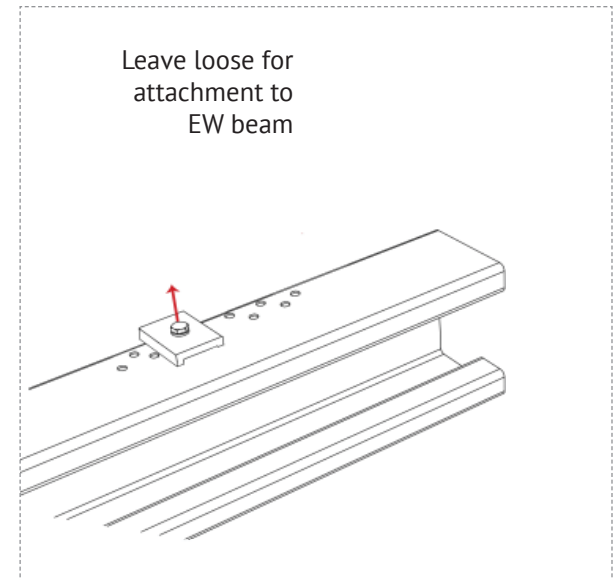
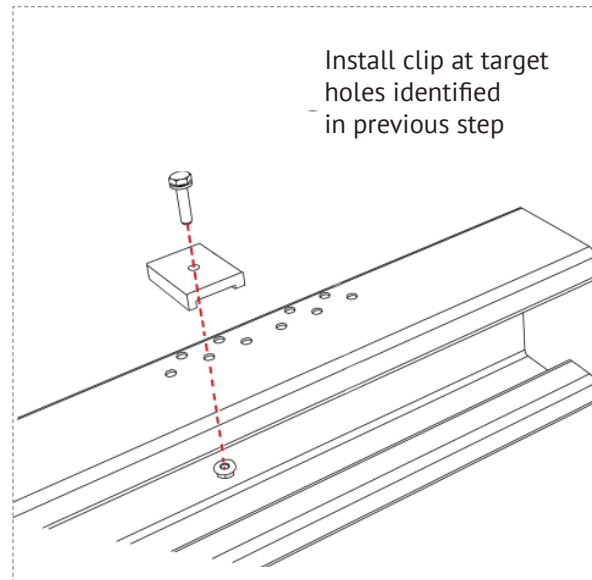


If required, additional minor adjustment of top chord angle may be achieved by a combined repositioning of diagonal braces to adjacent holes in top chord and diagonal brace plate.

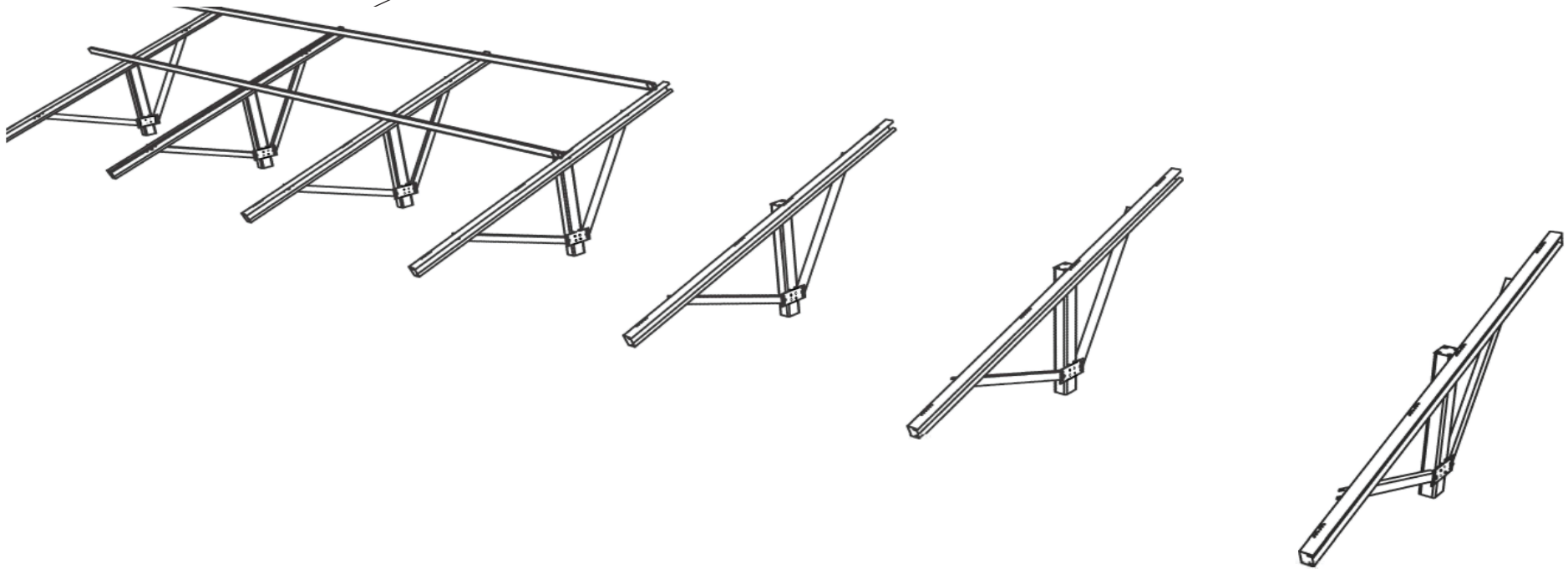


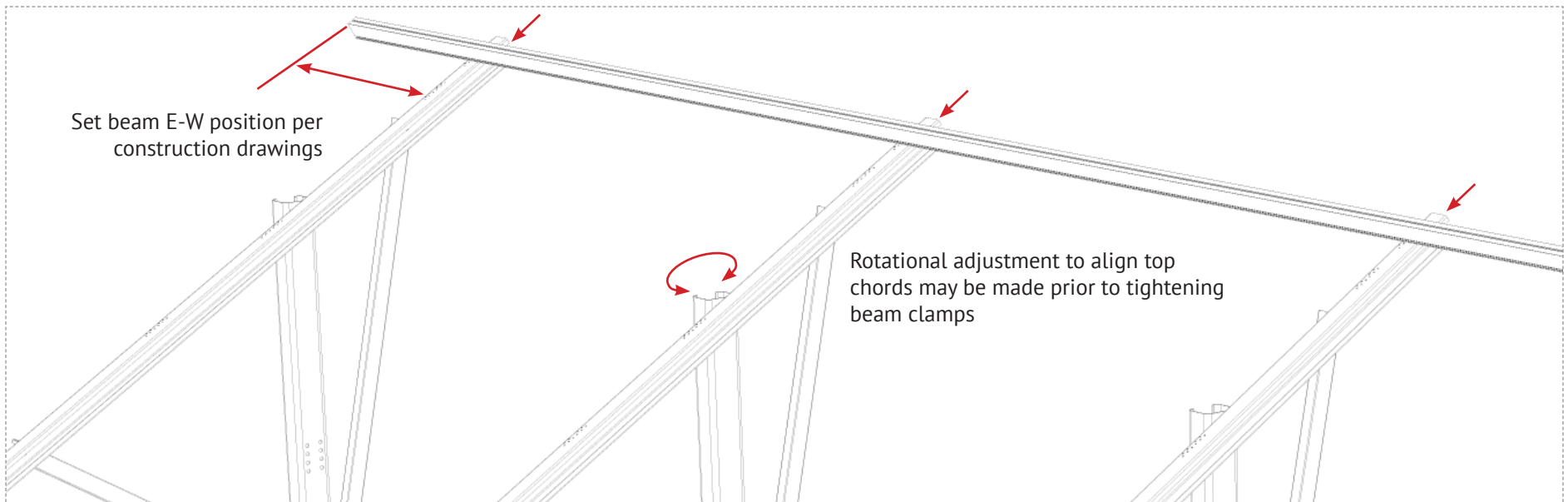
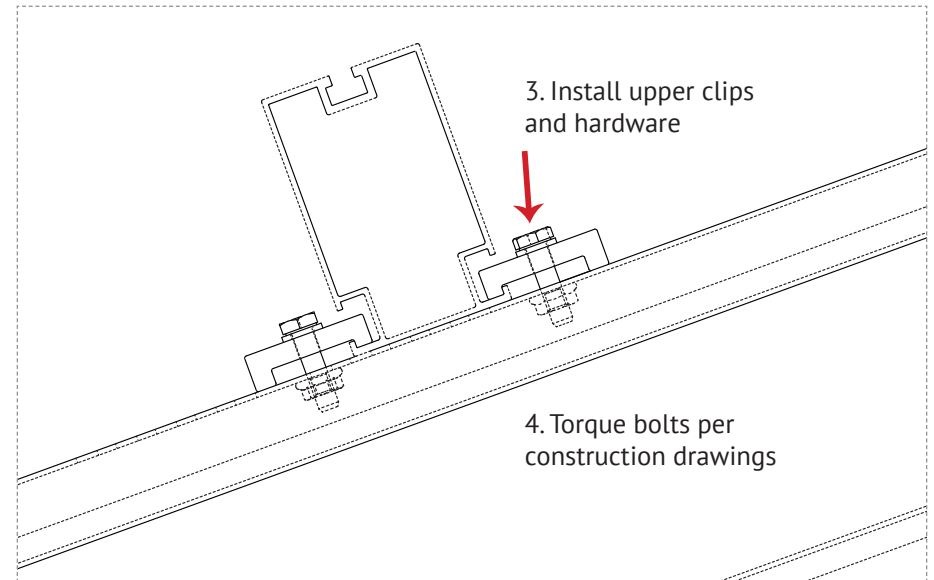
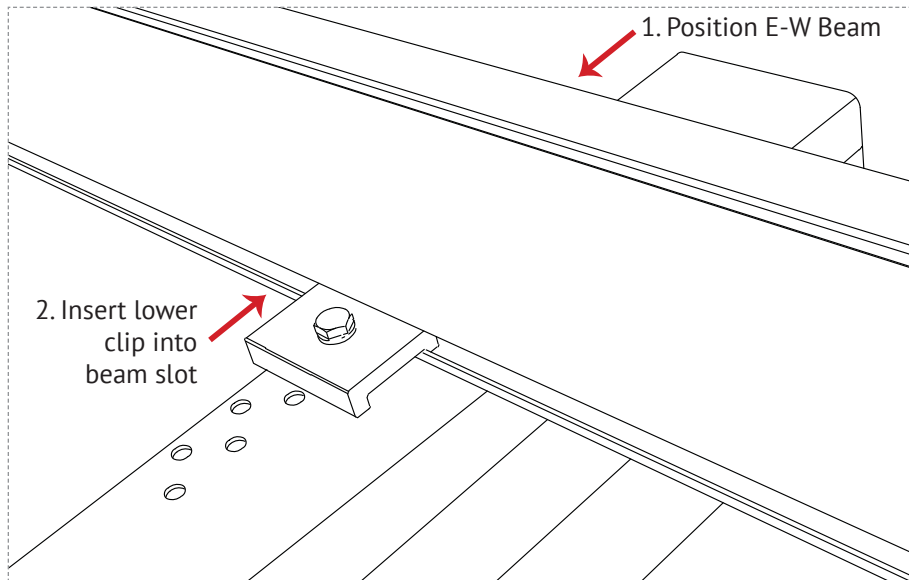
1. Align target hole locations using laser or string line.
2. Determine if adjustments are needed up or down. (hole patterns allow for +1" adjustment in 1/2" increments per instruction on following pages).
3. Mark holes to be used for attaching E-W beams prior to installing.

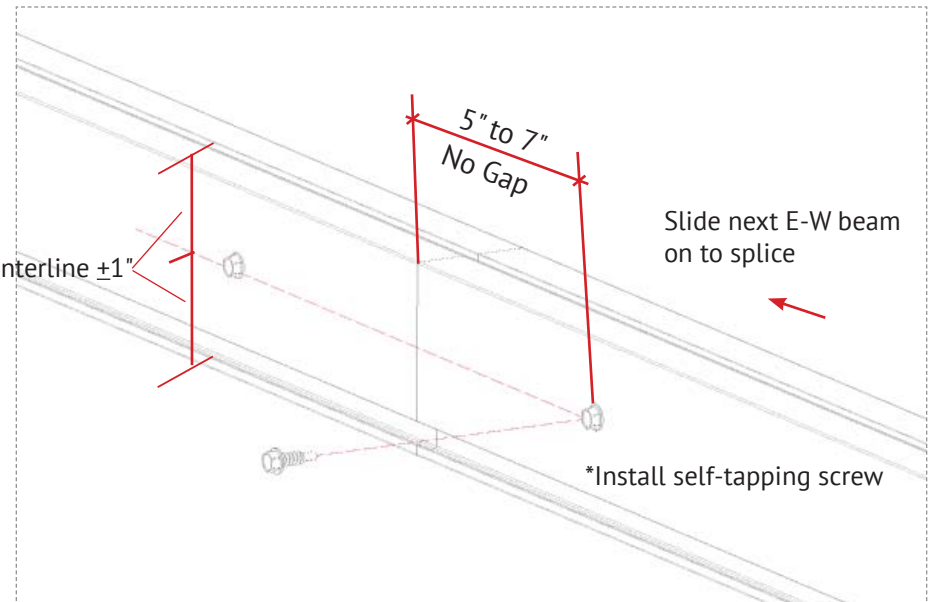
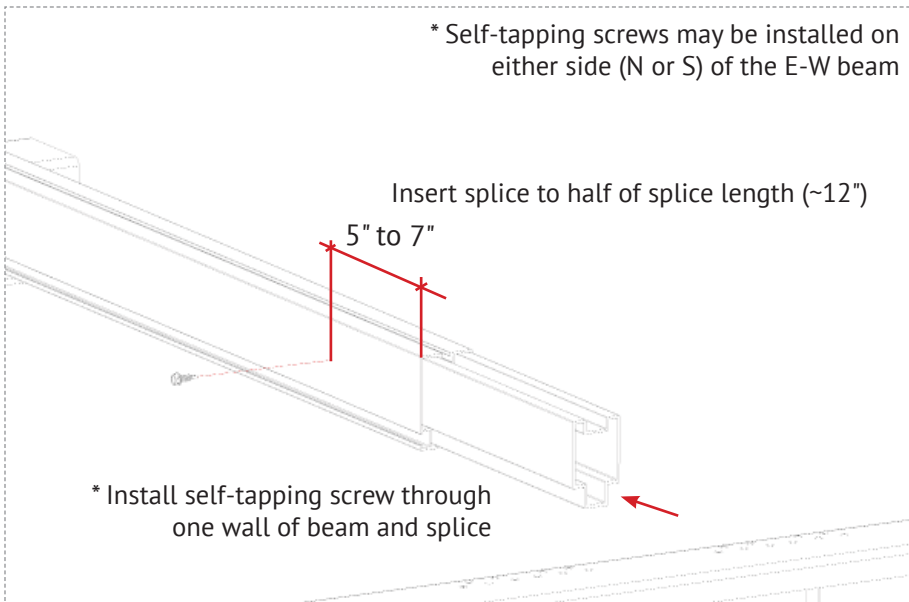
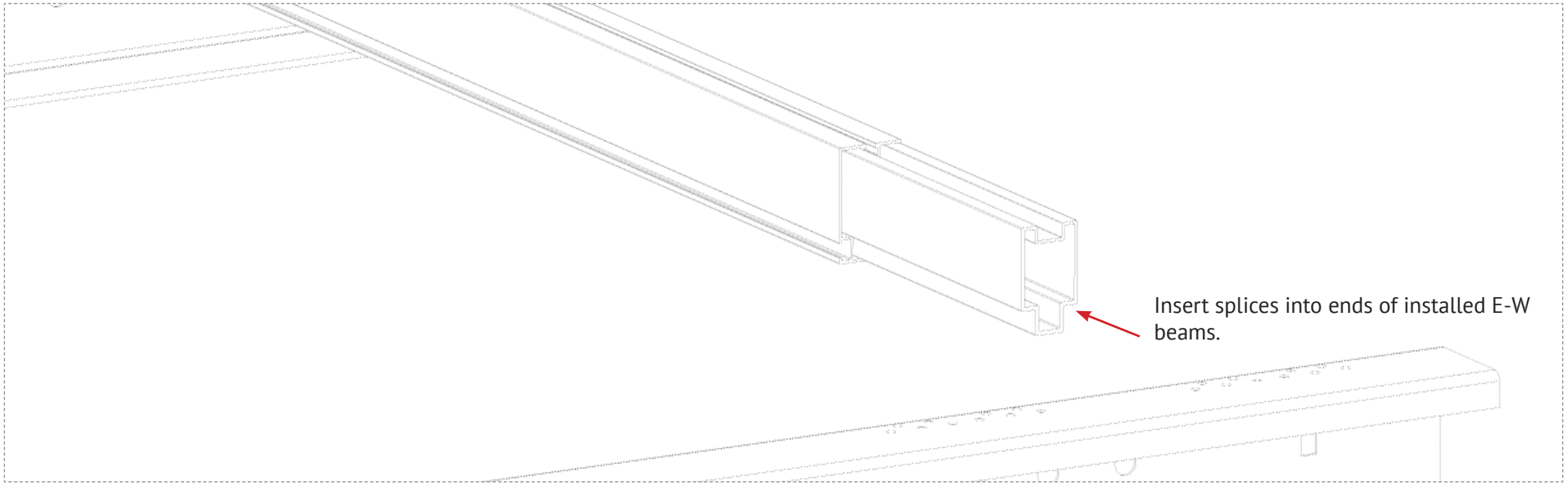




Install first set of top row E-W beams starting at either end of table







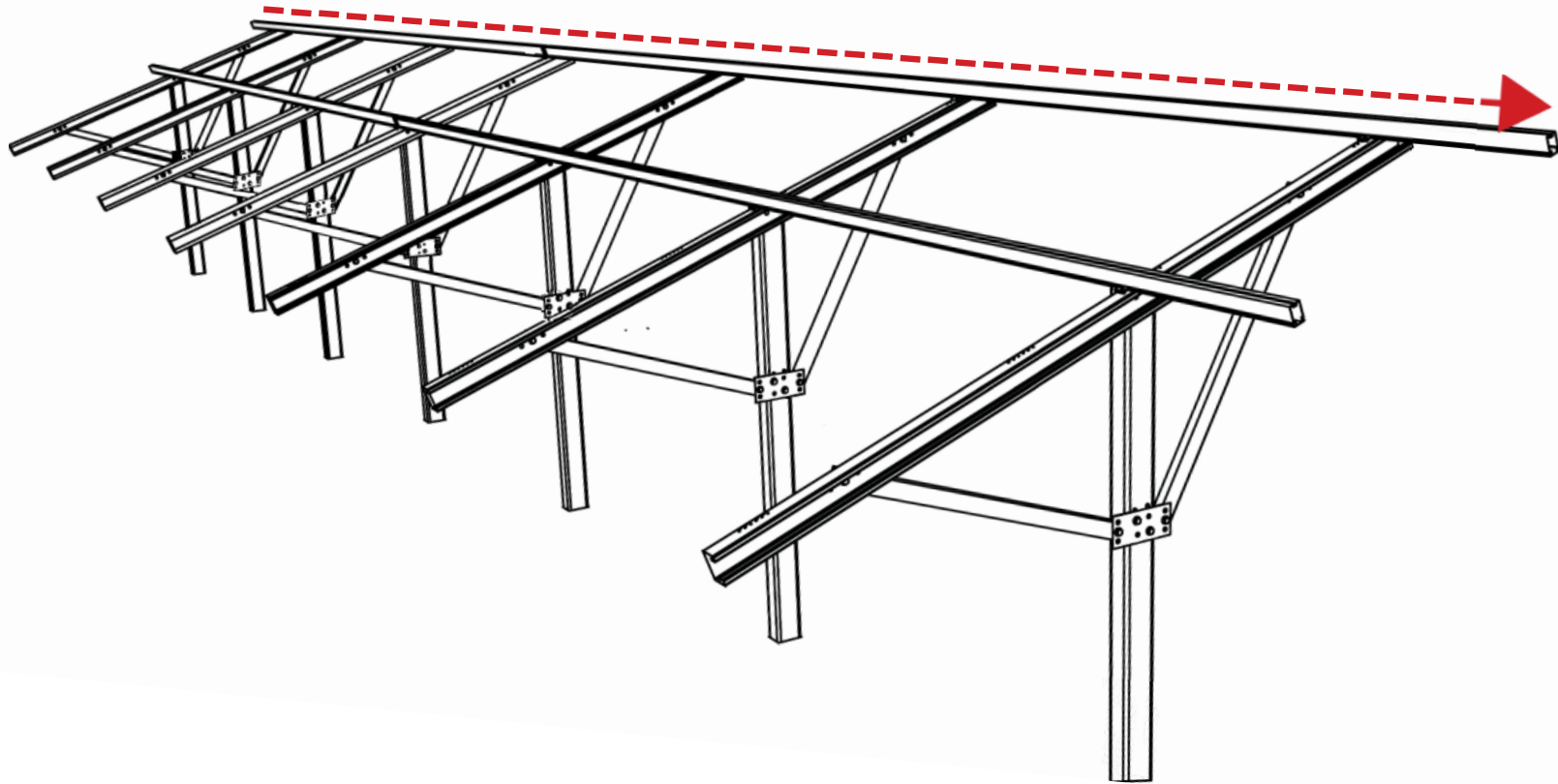


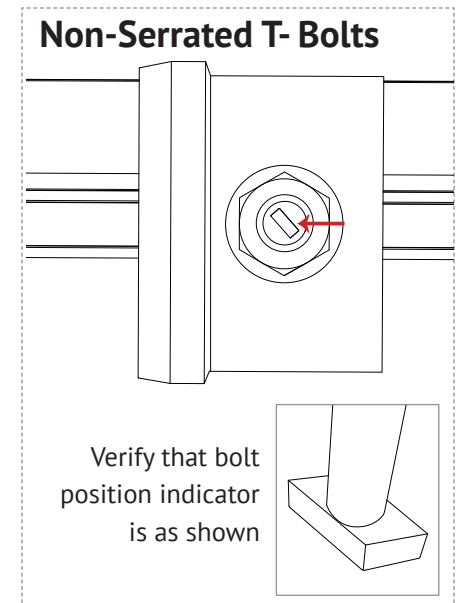
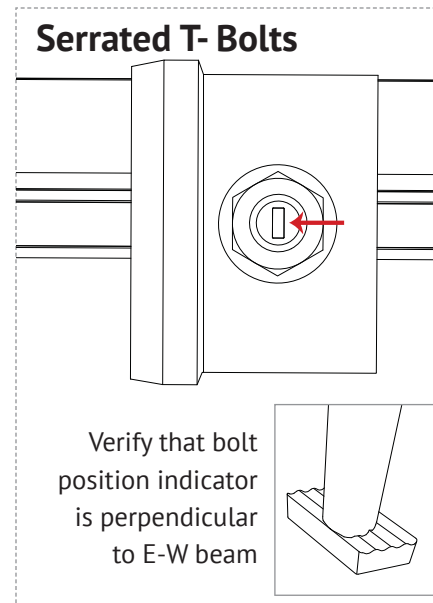
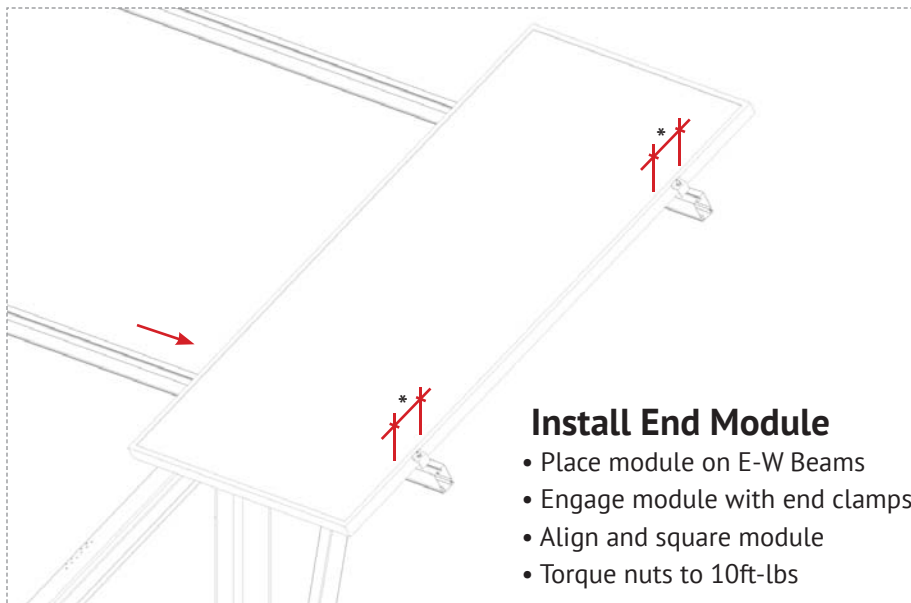
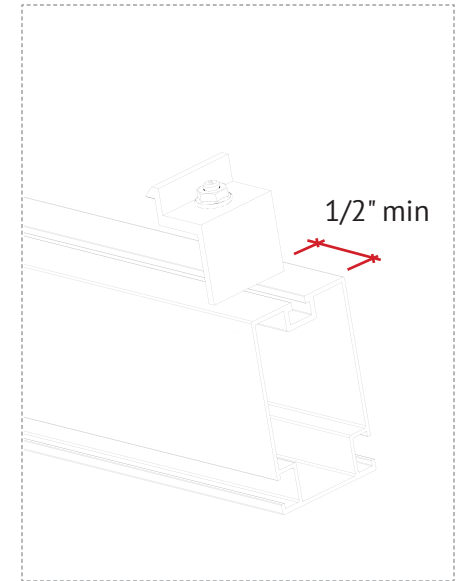
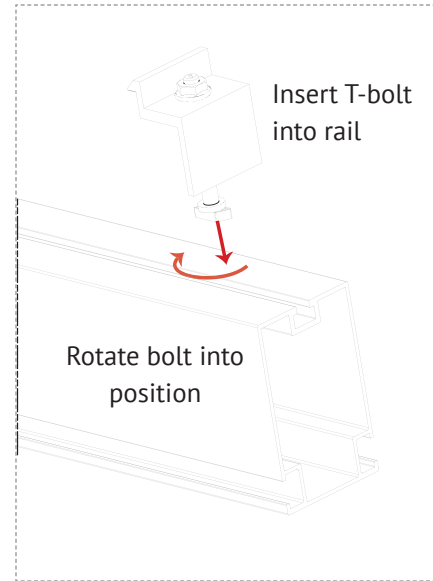
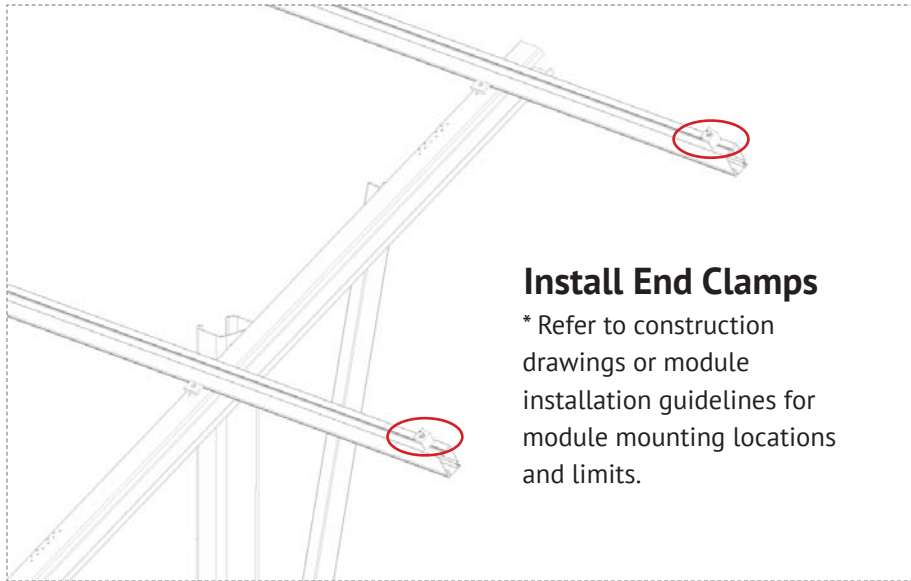
**GFT** GROUND  
FIXED  
TILT

# COMPLETE TOP ROW E-W BEAM INSTALLATION

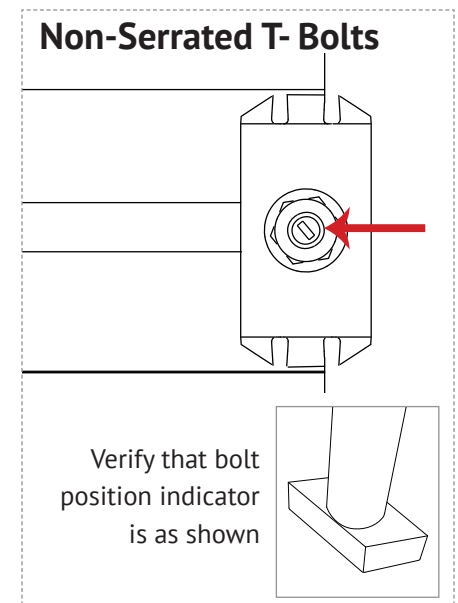
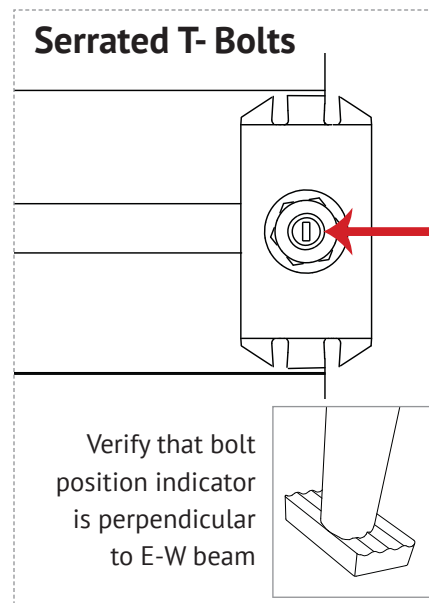
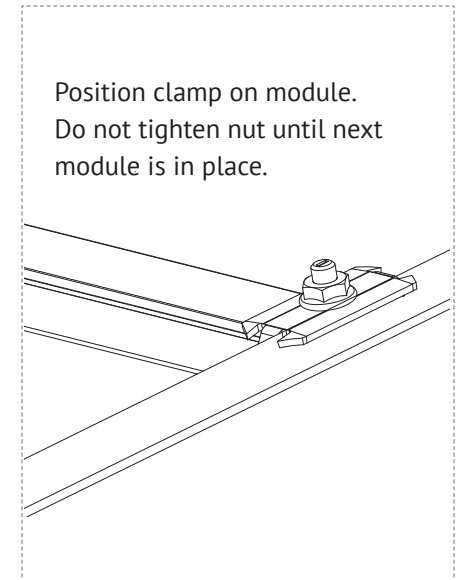
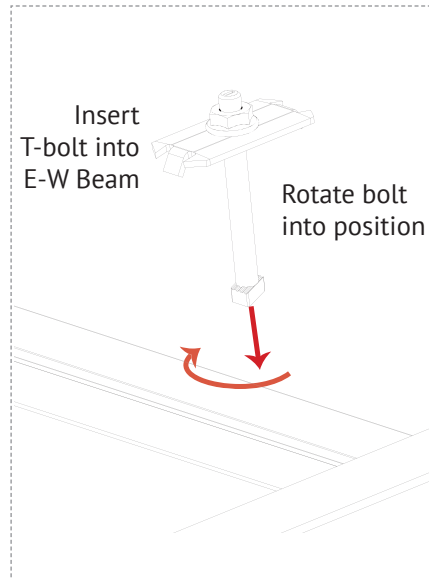
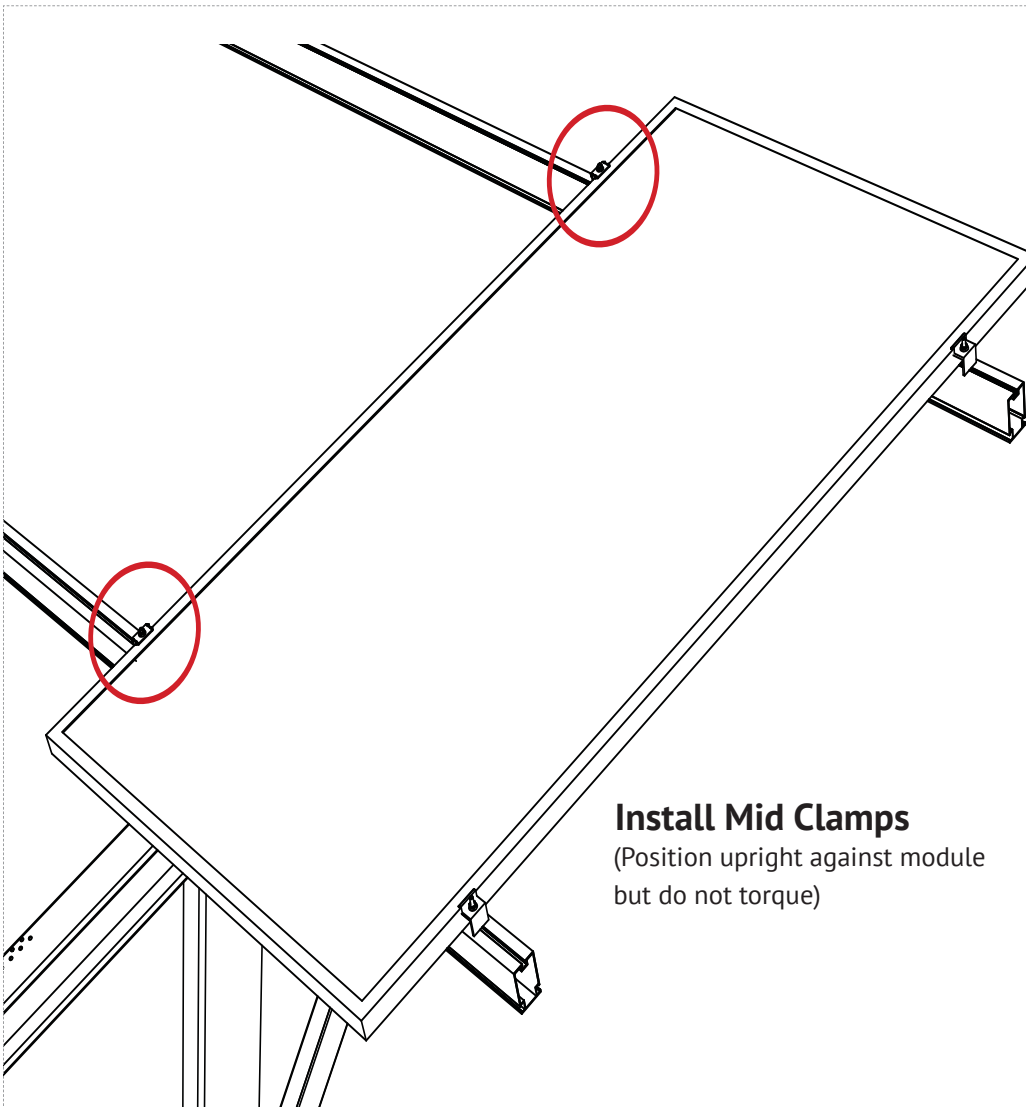
17

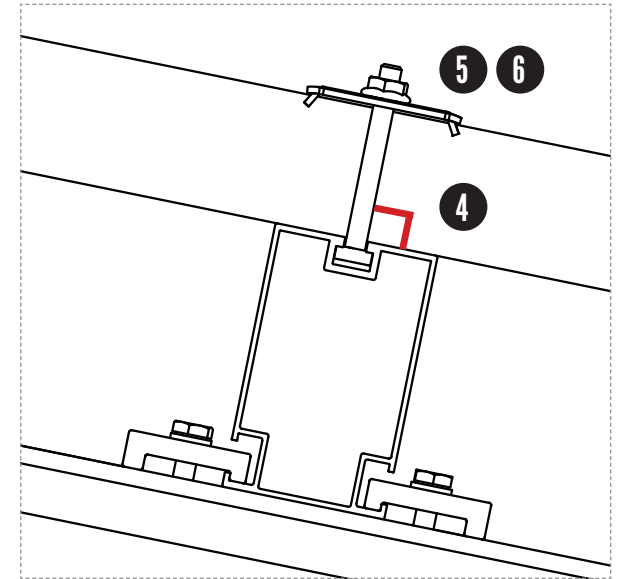
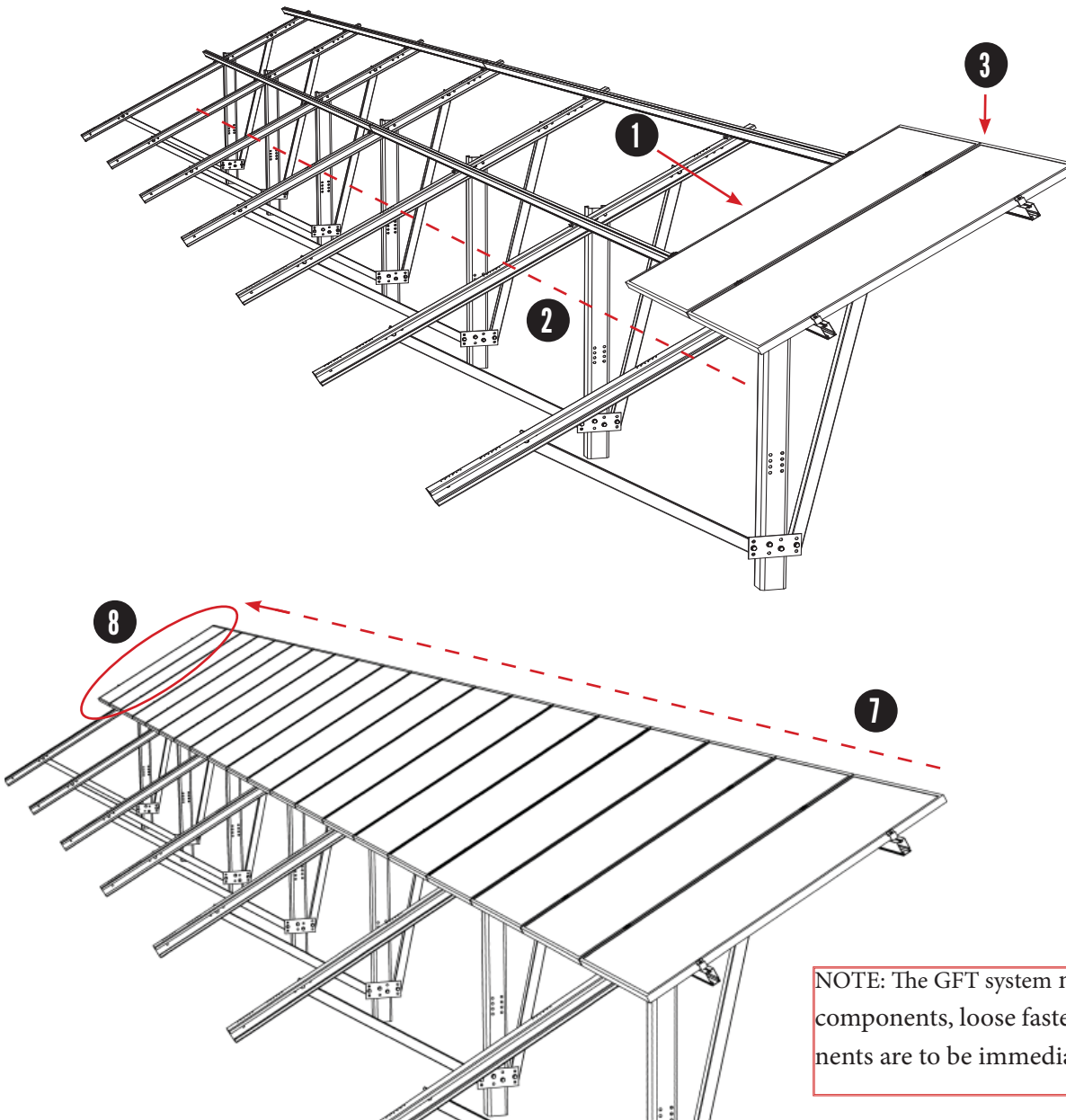
INSTALLATION GUIDE : PAGE





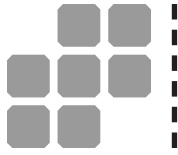






1. Place module on rails and engage with Mid Clamps
2. Align and square modules
3. Verify module gap (1/4")
4. Verify Mid Clamp bolt shafts are perpendicular to E-W Beam.
5. Verify position of indicator mark on bolt
6. Torque nuts to 10 ft-lbs
7. Repeat installation of clamps and modules to complete top row
8. Install End Clamps on last module

NOTE: The GFT system must be periodically re-inspected for loose components, loose fasteners and any corrosion, such that if found, the affected components are to be immediately replaced.

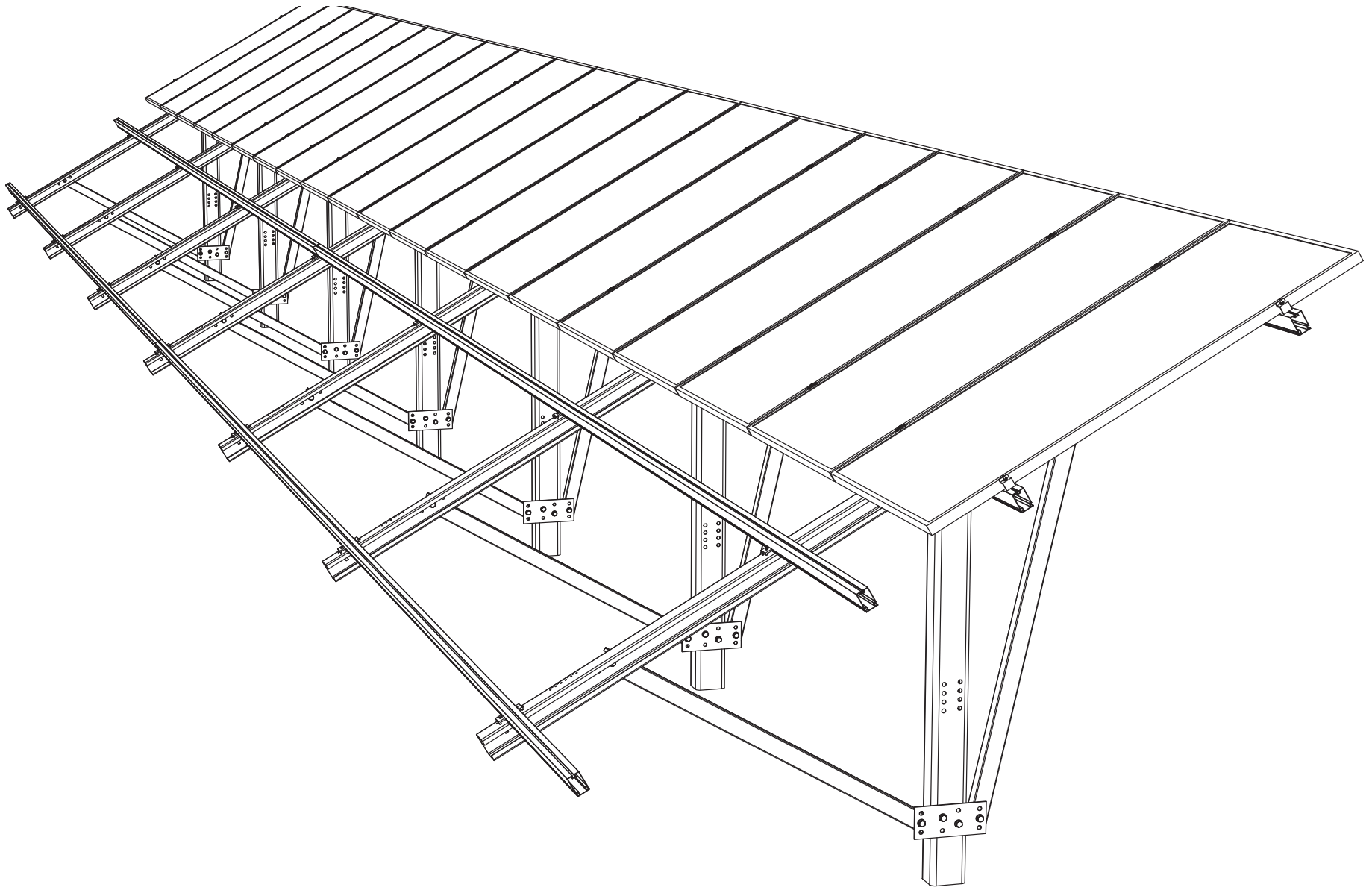


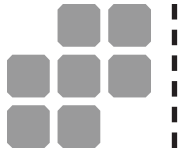
**GFT** GROUND  
FIXED  
TILT

REPEAT  
INSTALLATION OF **E-W BEAM ON BOTTOM ROW**

21

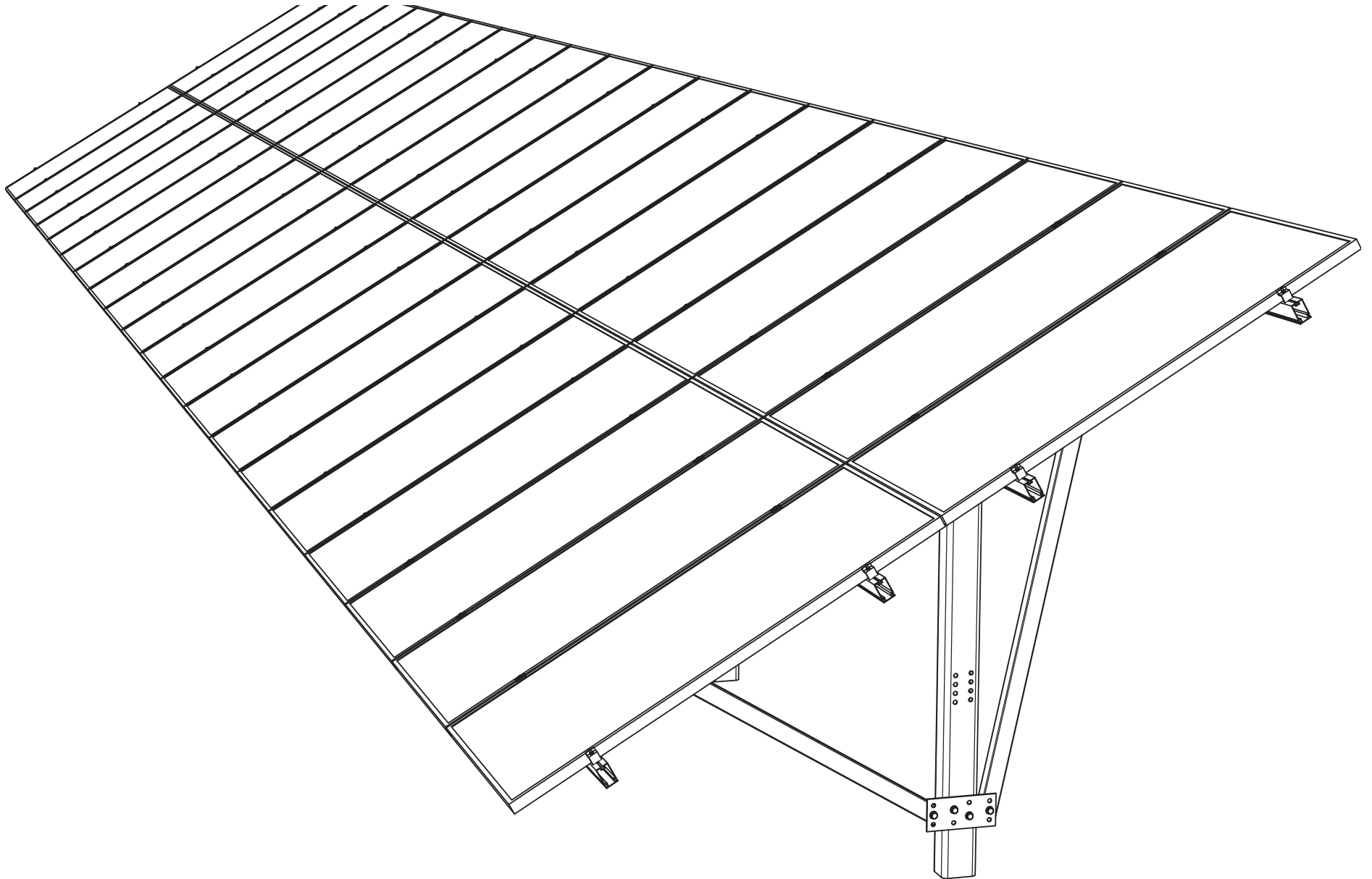
INSTALLATION GUIDE : PAGE

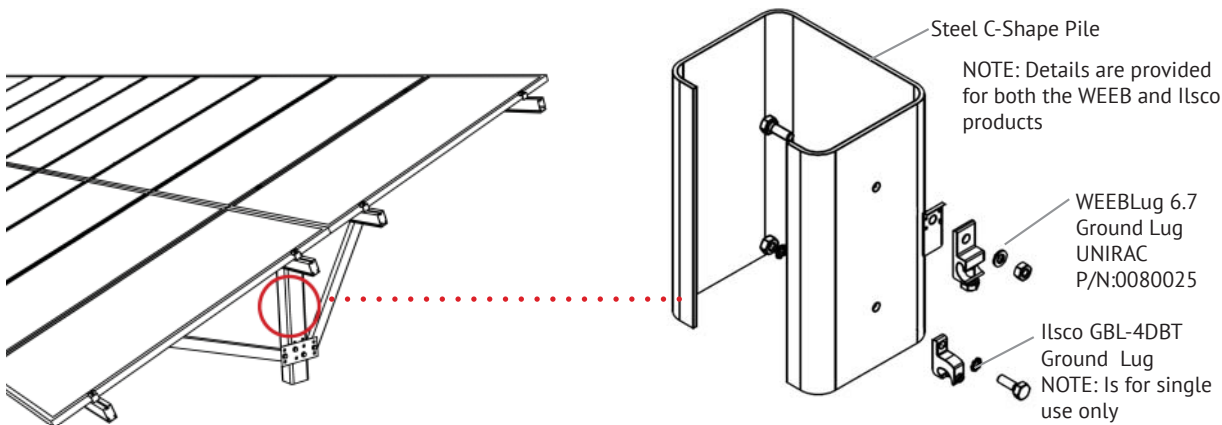




**GFT** GROUND  
FIXED  
TILT

REPEAT  
INSTALLATION OF **MODULES ON BOTTOM ROW** : **22**  
INSTALLATION GUIDE : PAGE





The following grounding & bonding components have been certified to be compatible with Unirac GFT:

- Wiley WEEBLug (P/N 0080025) Torque 1/4" mounting hardware to 10ft-lbs. See product data sheet for conductor size and conductor fastener torque.
- IlSCO Lay-in Lug (P/N GBL-4DBT) Torque 10-32 mounting hardware to 5ft-lbs. See product data sheet for conductor size and conductor fastener torque.

| Ground Lug | Bolt size | Drill size |
|------------|-----------|------------|
| WEEBLug    | 1/4"-20   | 17/64"     |
| IlSCO      | #10-32    | 7/31"      |

The entire Unirac GFT table has been classified for grounding & bonding to UL2703. The bonding path has been evaluated from the PV module frame all the way through to the pile. The following are suggestions to aid in grounding of the table for the project electrical engineer of record, and by the local authority having jurisdiction. This racking system may be used to ground and/or mount a PV module complying with UL1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

## GROUND LUG MOUNTING DETAILS

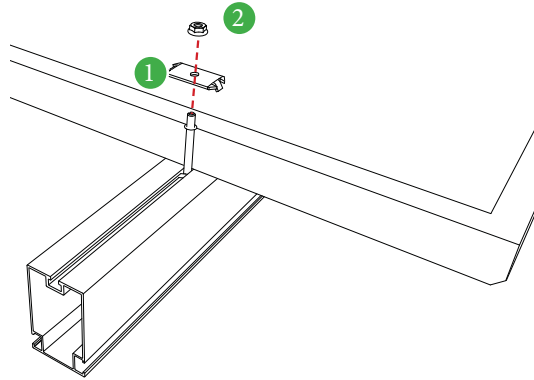
Details are provided for both the WEEB and IlSCO products. The WEEBLug has a grounding symbol located on the lug assembly. The IlSCO lug has a green colored set screw for grounding indication purposes. One lug is recommended per GFT table. Installation must be in accordance with NFPA NEC70, however the electrical designer of record should refer to the latest revision of National Electrical Code (NEC) for actual grounding conductor cable size. Unirac GFT is intended to be used with PV modules that have a system voltage less than or equal to 1,000VDC. A minimum 10AWG, 105°C copper grounding conductor should be used to ground the system according to the (NEC) and the authority having jurisdiction. It is the installers responsibility to check local codes, which may vary. NOTE: Any holes drilled to attach the ground lugs should be de-burred before use. **NOTE: Only the IlSCO GBL-4DBT ground lug is single use only, all other GFT components are multiple use.**

## TEMPORARY BONDING CONNECTION DURING ARRAY MAINTENANCE

When removing modules for replacement or system maintenance, any module left in place that is secured with a bonding mid-clamp will be properly grounded. If a module adjacent to the end of a row is removed, or if any other maintenance condition leaves a module without a bonding mid clamp, a temporary bonding connection must be installed as follows:

- Attach IlSCO GBL-4DBT or WeebLug 6.7 to both modules on either side of the module that has been removed. Note: The lug should be attached to the manufacturers designated grounding point on the frame.
- Install a solid #6 AWG copper wire to both grounding lugs. **NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION.**





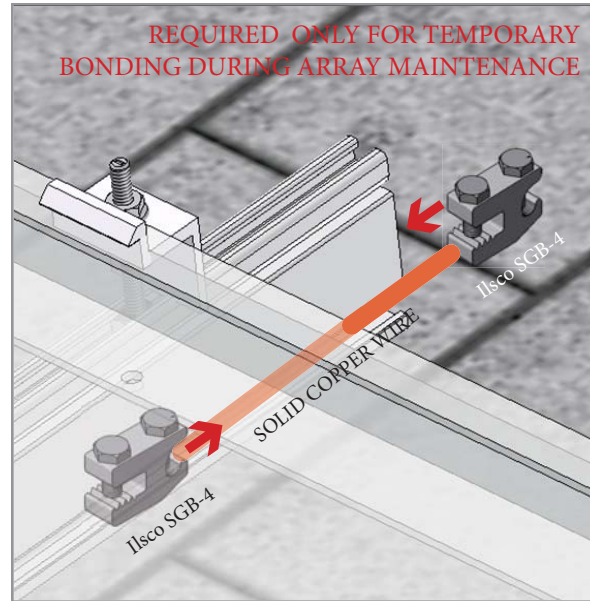
## BONDING MIDCLAMP ASSEMBLY

- 1 Stainless steel Midclamp points, 2 per module, pierce module frame anodization to bond module to GFT rail through clamp.
- 2 Serrated flange nut bonds stainless steel clamp to stainless steel T-bolt

## TEMPORARY BONDING CONNECTION DURING ARRAY MAINTENANCE

When removing modules for replacement or system maintenance, any module left in place that is secured with a bonding Midclamp will be properly grounded. If a module adjacent to the end module of a row is removed or if any other maintenance condition leaves a module without a bonding mid clamp, a temporary bonding connection must be installed as shown

- Attach IlSCO SGB4 to wall of GFT rail  
(Rail shown in picture is not a GFT rail but a representative rail for demonstration only)
- Attach IlSCO SGB4 to module frame
- Install solid #6 AWG copper wire jumper to IlSCO lugs



## ELECTRICAL CONSIDERATIONS

GFT is intended to be used with PV modules that have a system voltage less than or equal to 1000 VDC. For standard system grounding a minimum 10AWG, 105°C copper grounding conductor should be used to ground a 1000 VDC system, according to the National Electric Code (NEC). It is the installer's responsibility to check local codes, which may vary. See below for interconnection information.

## INTERCONNECTION INFORMATION

There is no size limit on how many GFT & PV modules can be mechanically interconnected for any given configuration, provided that the installation meets the requirements of applicable building and fire codes.

## GROUNDING NOTES

The installation must be conducted in accordance with the National Electric Code (NEC) and the authority having jurisdiction. Please refer to these resources in your location for required grounding lug quantities specific to your project.

The grounding / bonding components may overhang parts of the array so care must be made when walking around the array to avoid damage.

Conductor fastener torque values depend on conductor size. See product data sheets for correct torque values.

Mid clamps do not need to be repositioned for re-use.

The GFT system is to be used only in combination with modules that are included in the tables below.

| Manufacturer              | Module or Series  |
|---------------------------|---|
| AU Optronics (BenQ Solar) | PM Series   |
| Canadian Solar            | CS5A-M, CS6P-M, CS6P-P, CS6X-P, ELPS CS6A-MM, ELPS CS6P-MM, CS6U-P, CS6U-M, CS6K-MS, CS6K-M, CS6K-P   |
| CentroSolar America       | C-Series, E Series  |
| CertainTeed               | CTXXXMxx-01, CTXXXPxx-01, CTXXXMxx-02   |
| ET Solar                  | ET AC Module, ET Module   |
| Flextronics               | FXS   |
| Hanwha SolarOne           | HSL 60  |
| Heliene Inc.              | 72M, 72P, 72M-BLK, 60M, 60P, 60M-BLK, 36M, 36P  |
| Hyundai Heavy Industries  | MG Series, RG Series, RW Series   |
| Jinko                     | Jinko 60 JKMxxx-P-60, Jinko Eagle 60 JKMxxxPP-60, Jinko Eagle MX60 JKMSxxxPP-60, Jinko MX60 JKMSxxxP-60, Jinko Black 60 JKMxxxPP-60B-J4, Jinko 72 JKMxxPP-72, Jinko Eagle 72 JKMxxPP-72, Jinko Eagle MX72 JKMxxxPP-72, Eagle PERC 60, Eagle PERC 72 |
| Kyocera                   | KD-F Series, KU-60  |
| LG Electronics            | MONO NEON, MONO X, NeON 2 LGxxxN1C-G4, NeON 2 LGxxxN2W-G4, NeON LGxxxN2W-B3, NeON LGxxxS1C-G4, Mono X LGxxxS2W-G4   |
| Mission Solar             | MSE Mono, MSE PERC  |
| Neo Solar Power Corp.     | D6MXXE4A, D6MXXB4A, D6MXXE4AME  |
| Panasonic                 | VBHNxxxSA06, VBHNxxxSA06B, VBHNxxxSA11, VBHNxxxSA11B, VBHNxxxSA15, VBHNxxxSA15B, VBHNxxxSA16, VBHNxxxSA16B, VBHNxxxKA   |
| Phono Solar Technology    | Standard Modules  |

| Manufacturer    | Module or Series  |
|-----------------|---|
| Q-Cells         | Q.PEAK-G3.1 XXX, Q.PEAK BLK-G3.1 XXX, Q.PLUS BFR G3.1 XXX, Q.PLUS-G3 XXX, P.PRO G3 XXX, Q.PRO BFR-G3 XXX, Q.PEAK-G3 XXX, Q.PEAK BLK-G3 XXX, Q.PLUS BFR G4.1 XXX, Q.PRO BFR G4 XXX, Q.PRO BFR G4.1 XXX, Q.PRO BFR G4.3 XXX, Q.PEAK-G4.1 XXX, Q.PEAK-G4.1/MAX XXX, Q.PEAK BLK G4.1 XXX, Q.PRO G4 XXX, Q.PLUS G4 XXX, Q.PEAK-G4.1/TAA XXX, Q.PEAK BLK G4.1/TAA XXX, Q.PLUS BFR G4.1/TAA XXX, Q.PLUS BFR G4.1/MAX XXX, B.LINE PLUS BFR G4.1 XXX, B.LINE PRO BFR G4.1 XXX, Q.PRO EC-G4.4 XXX, Q.PRO L-G2 XXX, Q.PEAK L G4.2 XXX, Q.PLUS L G4.2 XXX, Q.PLUS L G4.1 XXX, Q.PRO L G4.2 XXX, B.LINE PLUS L G4.2 XXX, B.LINE PRO L G4.1 XXX, B.LINE PRO L G4.2 XXX, Q.PLUS L-G4.2/TAA |
| Renesola        | 60-Cell Modules   |
| Sharp           | ND-240QCJ, ND-250QCS, ND-Q235F4   |
| Silfab          | SLA-M, SLA-P, SLG-P, SLG-M  |
| SolarWorld      | Sunmodule Plus, Sunmodule Pro, Sunmodule Protect  |
| Sun Edison/MEMC | F-Series, R-Series  |
| Suniva          | MV Series, Optimus™ Series  |
| SunPower        | AC, E-Series, Sig Black, X-Series, P-Series   |
| Suntech         | STP"XXX"  |
| Trina           | PA05, PD05, DD05  |
| TSMC Solar      | TS-150C2 CIGS   |
| Yingli          | Panda 60, YGE 60, YGE-Z 60, YGE-U72   |