



# W SYSTEM

## Install Manual



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UAP PROVIDES  
PE STAMPED  
CONSTRUCTION  
PLANS

Each UAP racking system must be installed per the PE Certified Construction Plans

## Pre-construction warranty notes

UAP's racking systems are custom designed and engineered by licensed Professional Engineers (each a "PE") who follow the International Building Code (IBC) and all IBC referenced design and material standards recognized by each project's local jurisdiction. UAP's quality assurance process requires that each UAP racking system be delivered to the client accompanied by PE certified Construction Plans (Plans) including detailed drawings and a structural certification letter with note and calculations.

The top priority of UAP's quality assurance team is to deliver fully engineered and certified Construction Plans that comply with jurisdictional building code and support preservation of human life and safety. For these reasons UAP will only issue a product warranty after a project is installed, duly inspected by a qualified UAP inspector, and found to be 100% compliant with the certified Construction Plans.



# UAP W-System Installation Manual



## Pre-Construction Safety Notes

Safety is UAP's top priority. Please review these safety guidelines before installing the UAP Racking System.



### Personnel

Before starting construction, schedule and conduct a regular safety review and ensure compliance with all OSHA safety procedures and precautions related to rooftop solar installations. Only qualified workers with experience in rooftop construction should perform the installation. The installer must always wear appropriate PPE including fall protection and have adequate electrical knowledge to avoid accidental shock or injury from improper contact with the photovoltaic equipment being installed. Each project must have regular documented safety meetings, a site-specific safety plan, and a dedicated safety officer qualified to administer first-aid.



### Roof Anchors

All roof anchors specified in the Plans for attaching the racking system to the host building are selected to meet the calculated loads expected on the roof structure. Use of alternative anchors or attachment methods must pre-approved by UAP in writing. Always follow the anchor manufacturer's instructions and, if required, anchor verification testing must comply with local building codes and ordinances.



### Structural Attachment and Roof Load Capacity

Each UAP racking system must be secured to the building structure according to the PE Certified Construction Plans (Plans) provided with the racking system. UAP's structural plans are created based on an assessment of available building plans, completion of the appropriate UAP structural intake form, and on-site surveys. Any irregularities discovered during the post installation and attachment process must be reviewed by UAP's structural engineer before proceeding.



### Roof Repairs and Flashing

Repairing and flashing the racking system mounting posts must follow best roofing practices and should be carried out by, or with the approval of, the roofing contractor responsible for any existing installer's warranty, or a roofing contractor certified by the roofing system manufacturer who has committed in advance to the process of recertifying any existing manufacturer's roof warranty.

# Required Tools & Equipment



Sliding chop saw



Sawzall



Portable band saw



Drill



Impact drill



Generator



Spare blades



Spare bits



Sockets & Wrenches



Torx 40s



Drivers



Extension cords



Level & Square



Markers



Chalk line



String line



Tape Measure



Knives



UAP Stands

## Module rail spacer templates

Review module installation manual to make panel rail spacing templates (material doesn't matter but typically wood 2x4s) UAP can provide templates as needed.

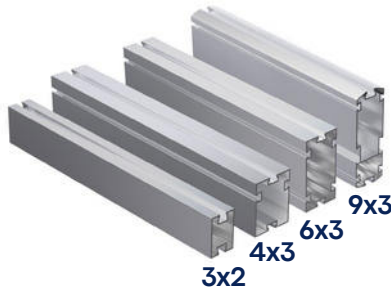
## JOB SITE PPE



# Main Components Parts

## Note

Structural Attachments Addressed in Separate Structural Attachment Installation Manual



## UAP's Fleet

6061-T6/6005 T-6 Aluminum

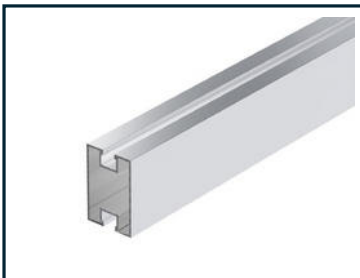
### UAP 4x3 Strut



#### Extruded 6000 Series Aluminum used as a:

- Post to support the main rail (top chord)
- Top chord to support the UAP 3x2 module rails
- High-capacity brace (knee or lateral)
- High-capacity module rail

### UAP 3x2 Strut



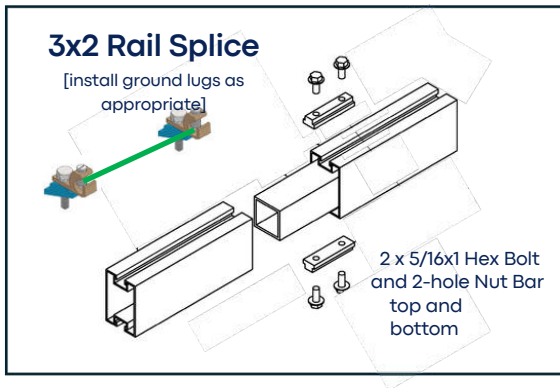
#### Extruded 6000 Series Aluminum used as a:

- Panel rail
- Brace (knee or Lateral)
- High-capacity module rail Array edge stiffener

UAP extruded products are 80% recycled industrial aluminum



# Rail & Strut Splices



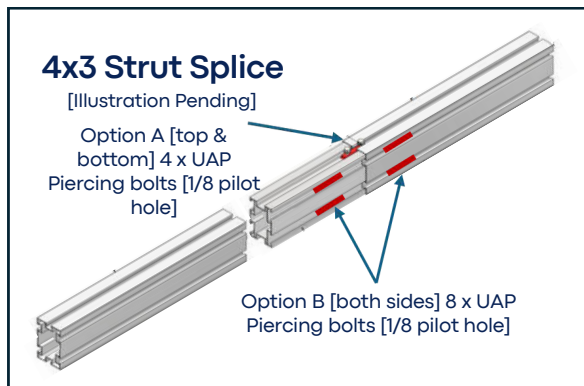
## 3x2 Splice Kits

For module rail alignment only (no exposure to structural tension)

Each UAP 3x2 Splice Kit includes:

- 4 x 5/16 x 1 SS Hex Bolts and washers,
- 2 x 2-hole Nut Bar
- 4 x 5/16 angle nuts.

**Note:** 3x2 panel rail splices should be staggered and never used within 4' of the first or last frame in an array.



## 4x3 Splice Kits

For alignment and structural tension capable

- **Option A** where the 4x3 splice is not exposed to tension.
- **Option B** where 4x3 splice is exposed to tension.

8 x 5/16 SS Piercing bolts (drill a 1/8 pilot hole)



# UAP Hardware Components

## Commercial Fasteners

- 1/2-13x1-1/4 SS Hex Bolt
- 5/16-18x3/4 SS Hex Bolt
- 5/16-18x1-1/4 SS Piercing Bolt
- 5/16x1-3/4, 2, and 2-1/4 SS Hex Bolts
- 5/16, 1/2 SS Flat and Lock Washers

**Note:** Bolts used with Angle Nuts have Loctite glazed threads to facilitate engaging the angle nut to rail, and strut keyways.

Lower Brackets



Upper Bracket Plate



Nut Bar



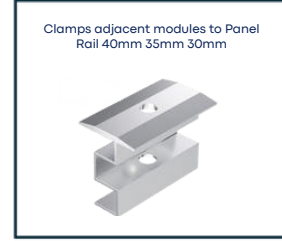
Cleat



C-Clip



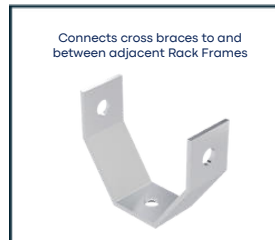
Waffle Clip



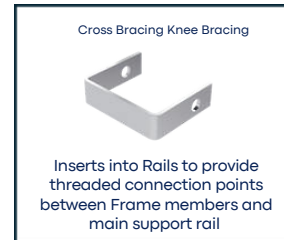
Angle Nut



Outer Bracket



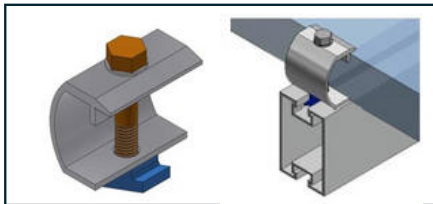
Inner Bracket – U-Nut



# UAP Hardware Kit Pre Assemblies

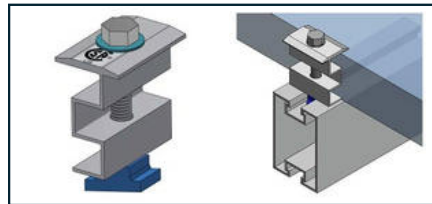
## UAP C-Clip Kit:

C-Clip + Angle Nut + 5/16 SS Hex Bolt & Washer  
Clamps modules to module rails



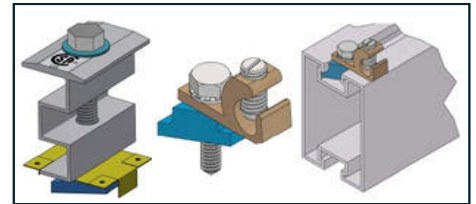
## UAP Waffle Clip Kit :

Waffle Clip + Angle Nut + 5/16 SS Hex Bolt & Washer  
Clamps modules to module rails



## UAP Waffle Grounding Kit:

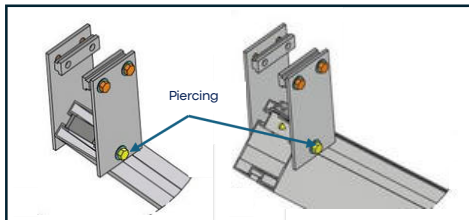
UAP Waffle Clip Kit + Grounding WEEB  
UAP Panel Rail Grounding Kit  
IlSCO 1/0 Grounding Lug + UAP Piercing Screw +  
UAP Angle Nut



UAP's grounding kits for UL2703 module to rail grounding

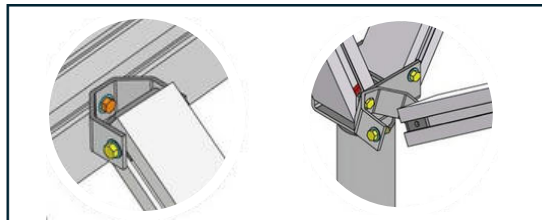
## UAP Upper Bracket Kit:

2x-Upper Bracket Plate+2x5/16 Nut Bar+4x-5/16x1" SS  
Hex Bolt+2x5/16x1.25" SS Piercing Bolts+1xU-Nuts Attaches 4x3  
top chords to 3x2 and 4x3 knee bracing



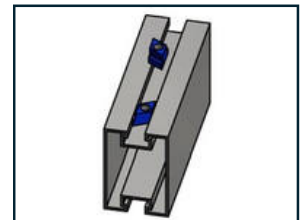
## UAP Outer Bracket Kit:

UAP Outer Bracket + 5/16 x 5" SS Through Bolt + Washer Set +  
Nut Attaches lateral braces to the upper and lower sides of  
adjacent frames.



## Note

UAP – AN31 Angle Nut must turn  
90° to fully engage the keyway

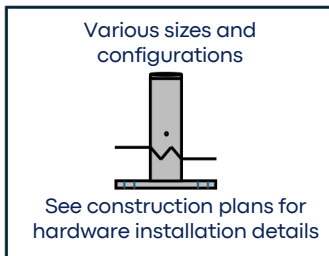


# W-System Posts and Structural Members

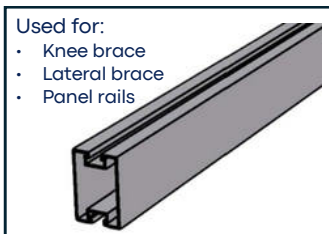
## Notes

- UAP Installation Manual for Attachment Posts is a separate document available upon request.
- Field cut UAP's Posts, Rails, and/or Strut as directed in the PE approved plans (the "Plans").
- Follow layout guidelines in the Plans to be sure splice points fall within designated areas.
- Be sure the knee brace angles are within the tolerances specified in the Plans.
- Upon completion of the racking system UAP will conduct a QC inspection as part of the Warranty process.

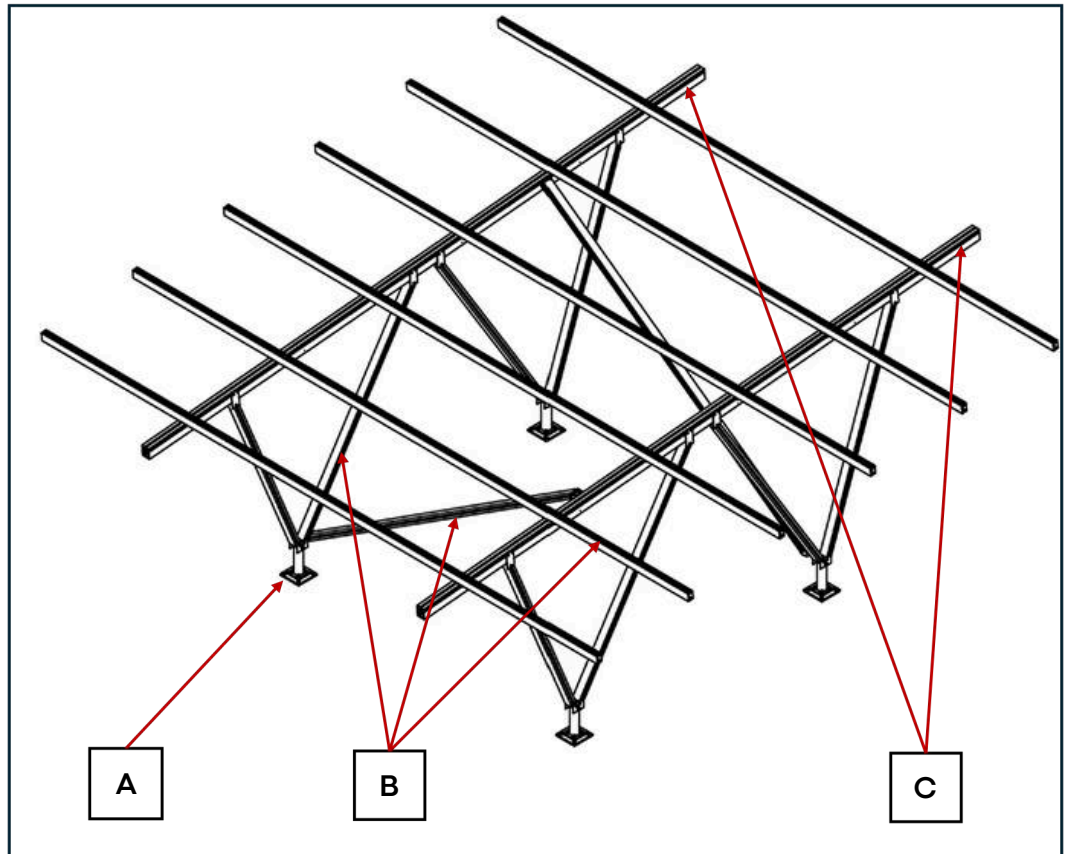
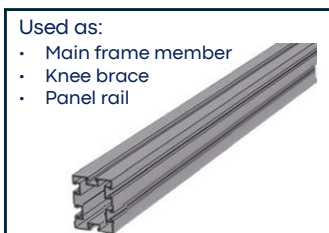
**A - Attachment Post**



**B - UAP 3x2 Rail**



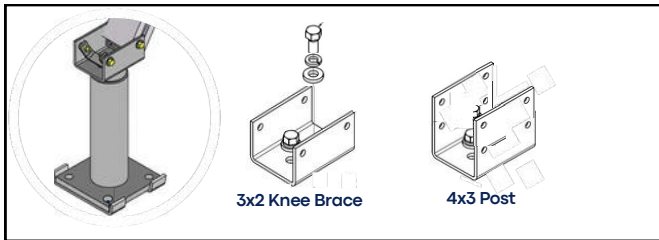
**C - UAP 4x3 Strut**



# W-System Posts and Structural Members

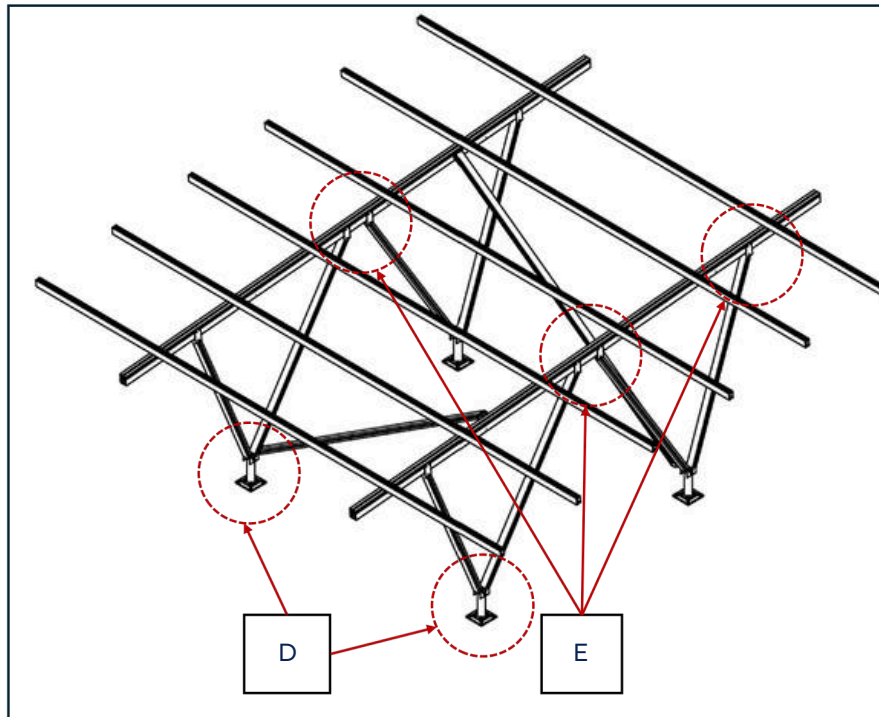
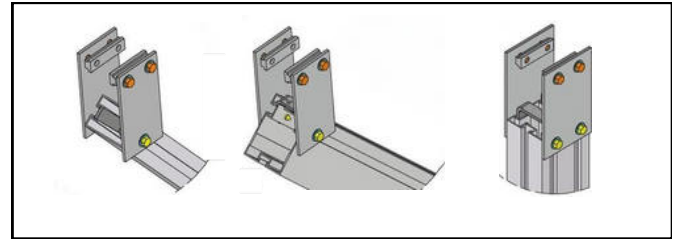
## D - UAP Lower Bracket Kit for Posts:

UAP Lower Bracket + 2x -  $\frac{1}{2}$  x 1" SS Hex Bolt + Washer Set + 4x 5/16 x 1.25" UAP 5/16 SS Piercing Screw + Washer + 2x UAP 5/16 U-Nut  
Bracket installed after roof repair to accommodate a boot



## E - Upper Bracket Kit:

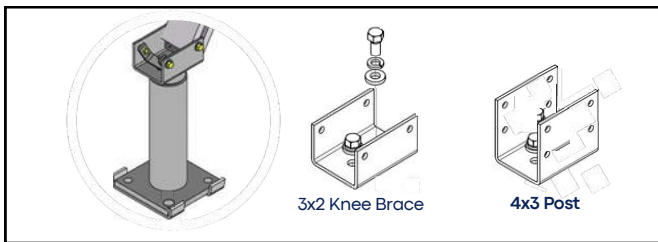
2x - UAP Upper Bracket Plate + 2x UAP 5/16 Nut Bar + 4x - 5/16 x 1" SS Hex Bolt w/Loctite + 2x or 4x - UAP 5/16 x 1.25" SS Piercing Bolts + 1x or 2x UAP U-Nuts  
Attaches 4x3 and 6x3 top chords to 3x2 and 4x3 knee bracing and support posts



# W-System Posts and Structural Members

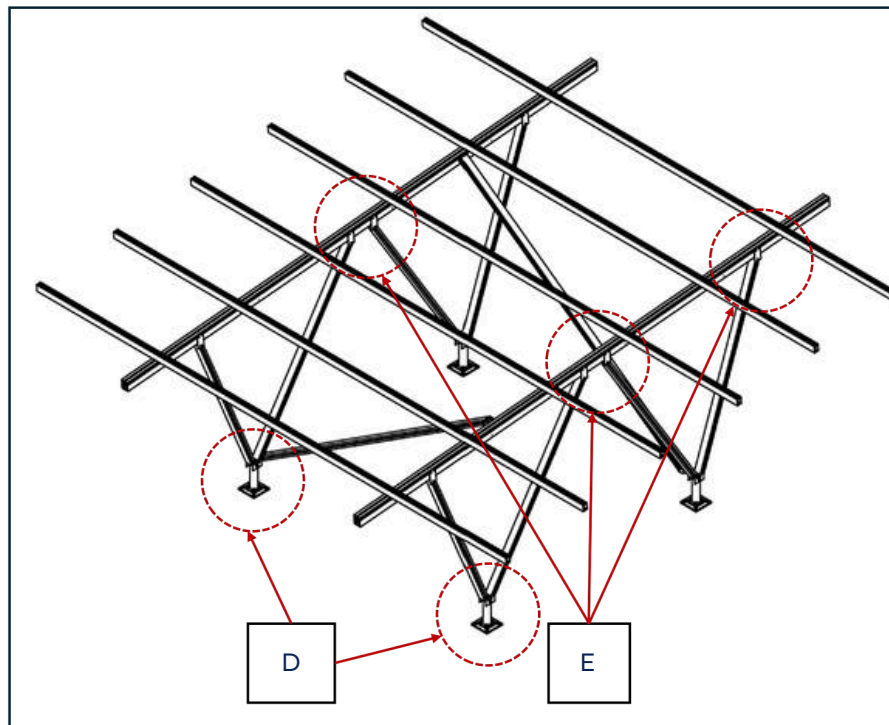
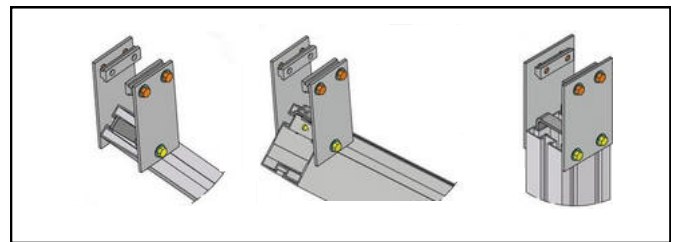
## D - UAP Lower Bracket Kit for Posts

UAP Lower Bracket + 2x -  $\frac{1}{2}$  x 1" SS Hex Bolt + Washer Set + 4x 5/16 x 1.25"  
UAP 5/16 SS Piercing Screw + Washer + 2x UAP 5/16 U-Nut :  
Bracket installed after roof repair to accommodate a boot



## E - Upper Bracket Kit

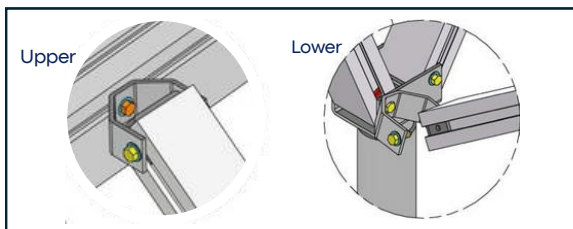
2x - UAP Upper Bracket Plate + 2x UAP 5/16 Nut Bar + 4x - 5/16 x 1" SS Hex  
Bolt w/Loctite + 2x or 4x - UAP 5/16 x 1.25" SS :  
Piercing Bolts + 1x or 2x UAP U-Nuts  
Attaches 4x3 and 6x3 top chords to 3x2 and 4x3 knee bracing and  
support posts



# W-System Mechanical Attachments

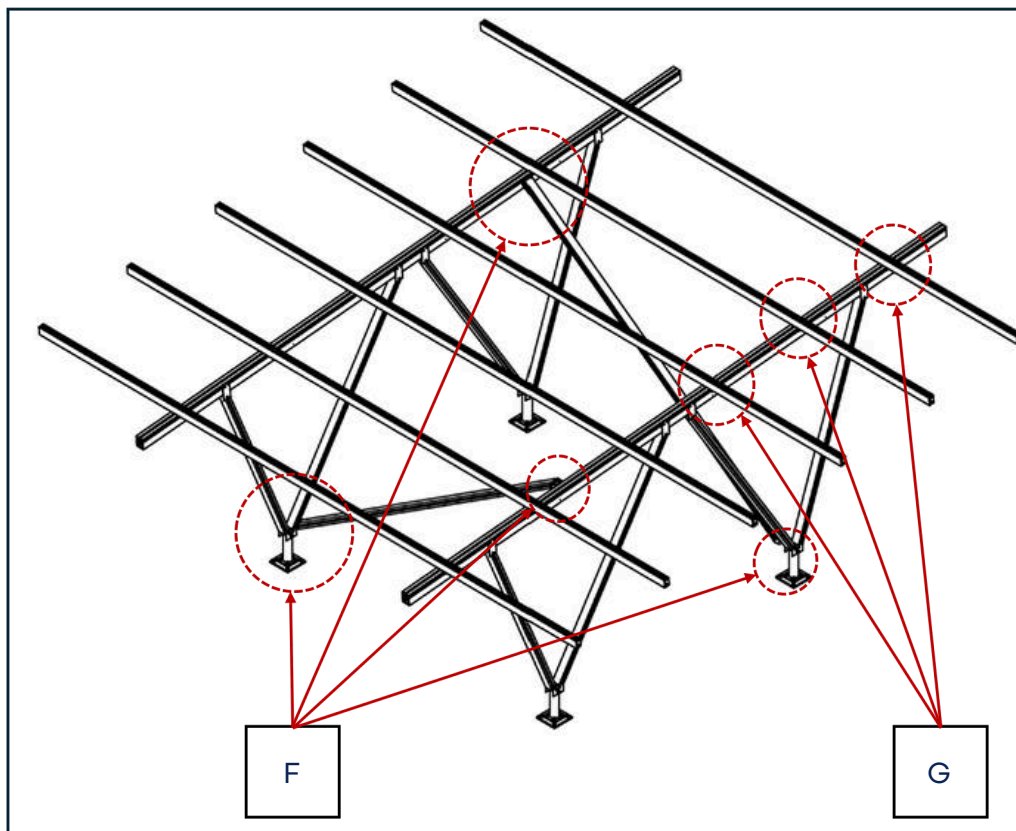
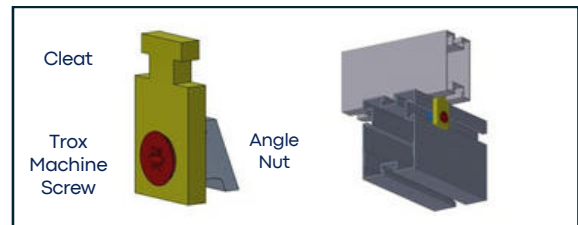
## F - UAP Outer Bracket Kit:

UAP Outer Bracket + 5/16 x 5" SS Through Bolt + Washer Set + Nut Attaches lateral braces to the upper and lower sides of adjacent frames.



## G - UAP Cleat Kit:

UAP Cleat + UAP Angle Nut + Lobed Flathead SS Machine Screw Anchors module rails to main support rails.





# Post Installation

- Concrete Decks >5" Cast Concrete
- Decks [straight waffle] Steel Bar-Joist
- Wood Truss
- Other [Gypsum Plank, Wood Joist, Concrete in Corrugated Steel Pan, Precast Hollow Core Concrete Slab, etc.]

**Note:** Each post installation guide is based on either an in-person site visit by UAP's structural engineer or an intake form provided through the Universal Renewables website. In cases where the roof structure is variable (changes from one type of structure to another) the appropriate intake form must be completed.

In cases where a change in roof structure is detected during the Post installation, UAP must be contacted and the attachment strategy confirmed by UAP's structural engineer.



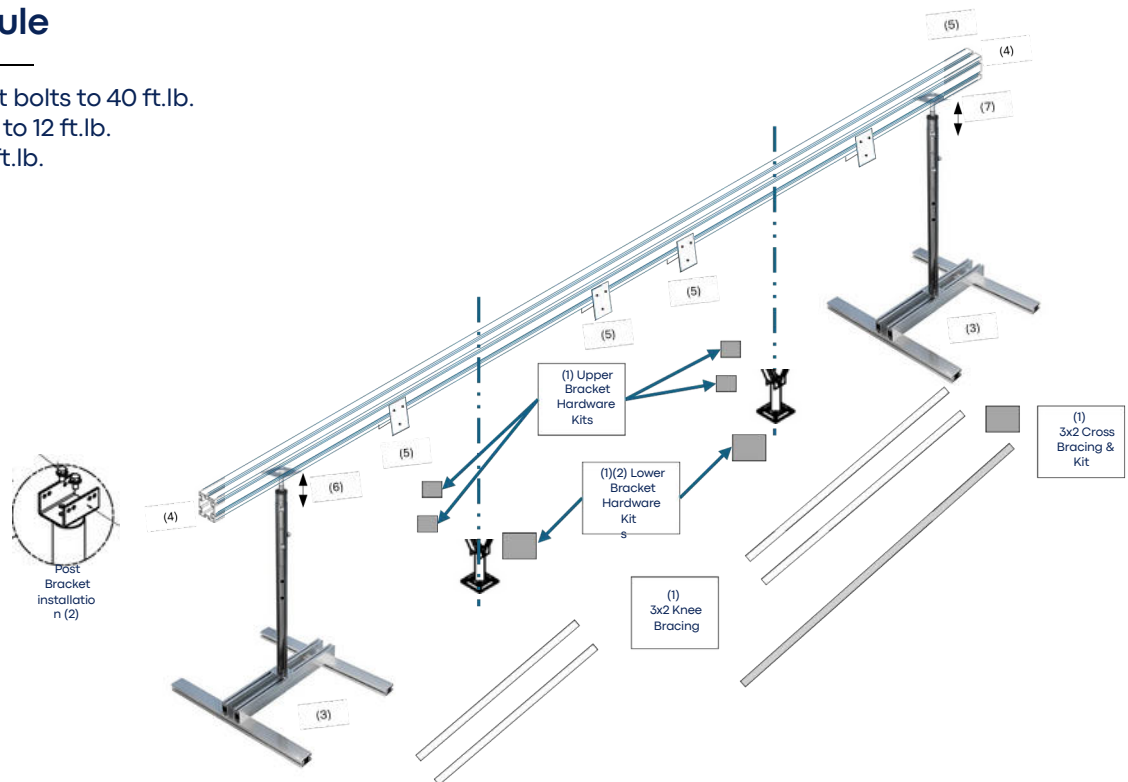
# W-System Frame Assembly

Illustrations Pending

1. Distribute hardware and bracing kits as illustrated in the Plans
2. Install the lower bracket hardware on previously installed post, torque to 25 ft.lb. and mark.
3. Set two or three UAP support stands in line and directly above the first set of pre-installed frame posts.
4. Put the 4x3 top chord on top of the stands [follow Plans for splice locations if called for]
5. Slide the UAP upper bracket plates from the kit into the lower slot on each side of the top chord [arrange near each of the knee brace attachment points]
6. Using the UAP stand adjuster screws adjust the height of the low end to the height shown on the Plans.
7. Adjust the stand on the high end until the correct tilt angle is achieved [double check the low end, adjust as needed]

## Torque Schedule

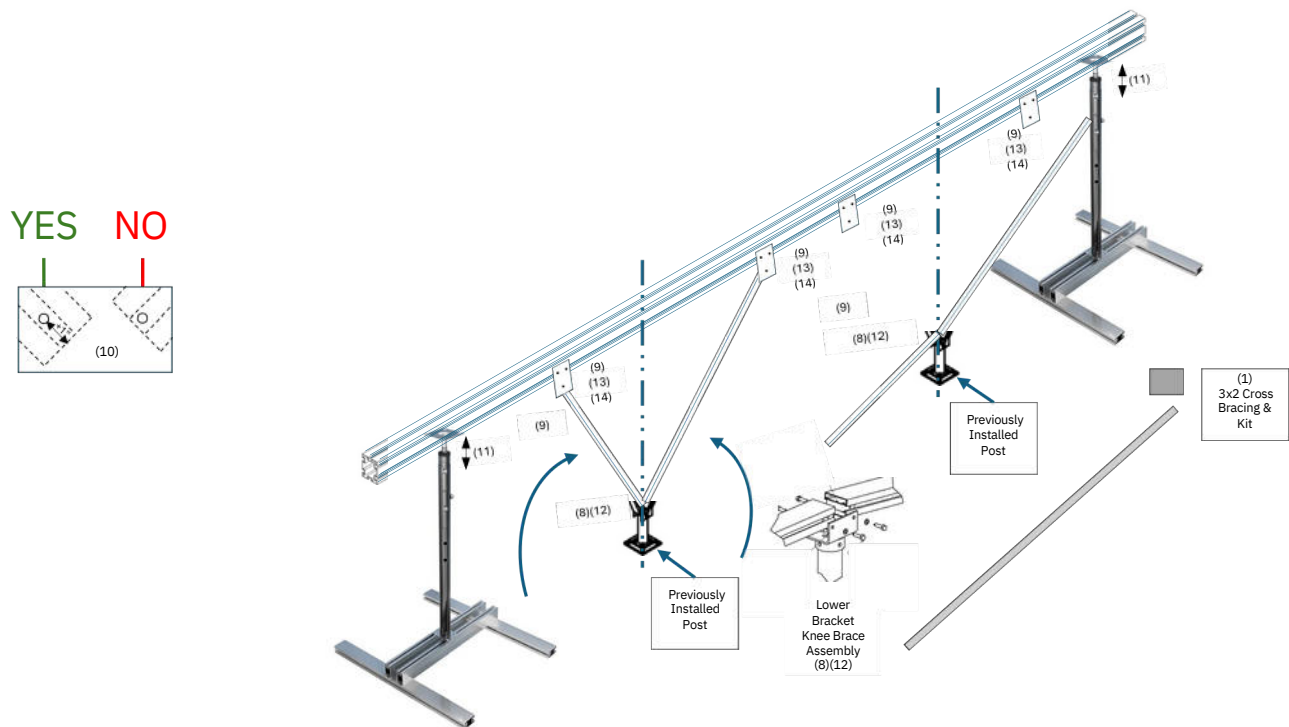
- 1/2" lower bracket bolts to 40 ft.lb.
- 5/16" frame bolts to 12 ft.lb.
- Panel clips to 10 ft.lb.



# W-System Frame Assembly

Illustrations Pending

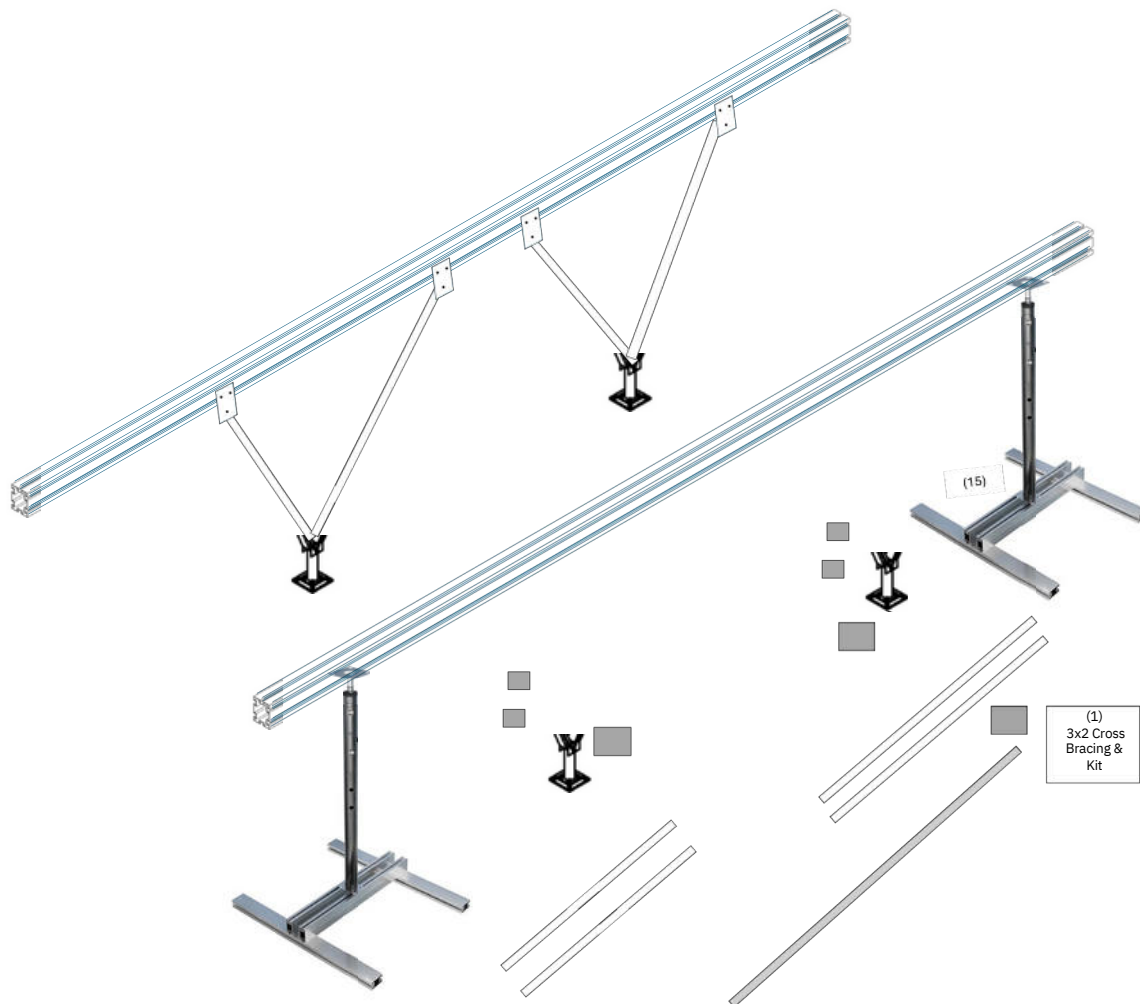
8. Review the Plans and lay the end of each knee brace into its respective lower bracket, allow loosely pre-installed angle nuts to slide well into the brace keyways.
9. Swing each knee brace up to its respective upper bracket, allowing the loosely pre-installed angle nuts to slide well into the brace keyways [both ends].
10. Check the 4x3 Top Chord and the depth of the upper and lower bracket angle nuts in their keyways to be sure they are within the 1" tolerance [detail below].
11. Make a final adjustment to the Top Chord tilt angle using height adjustment screw on the UAP stand.
12. Tighten all four of the lower bracket 5/16 penetrating bolts on each post. After they pierce the 4x3 wall, torque to 12 ft.-lb. and torque mark.
13. Adjust the upper brackets [square], tighten, torque, and torque mark each of the bracket plate's 5/16 hex bolts to 12 ft.-lb.
14. Tighten the upper bracket 5/16 penetrating bolts. After they pierce the 4x3 wall, torque to 12 ft.-lb. and torque mark.



# W-System Frame Assembly

Illustrations Pending

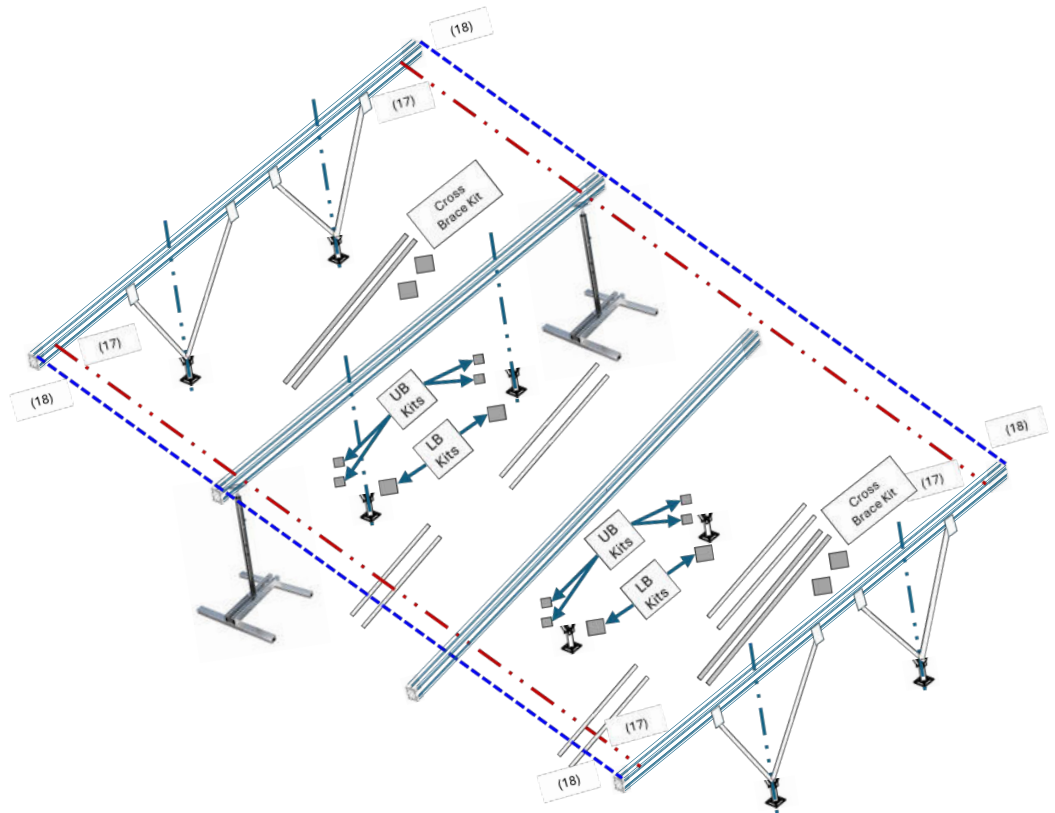
15. Remove stands and move to the frame posts opposite end of array and align over the frame posts
16. Repeat items 1 – 14 being sure the ends of the Top Chord are the same distance from the frame posts as those in the first frame, then readjust heights and verify the tilt.



# W-System Frame Assembly

Illustrations Pending

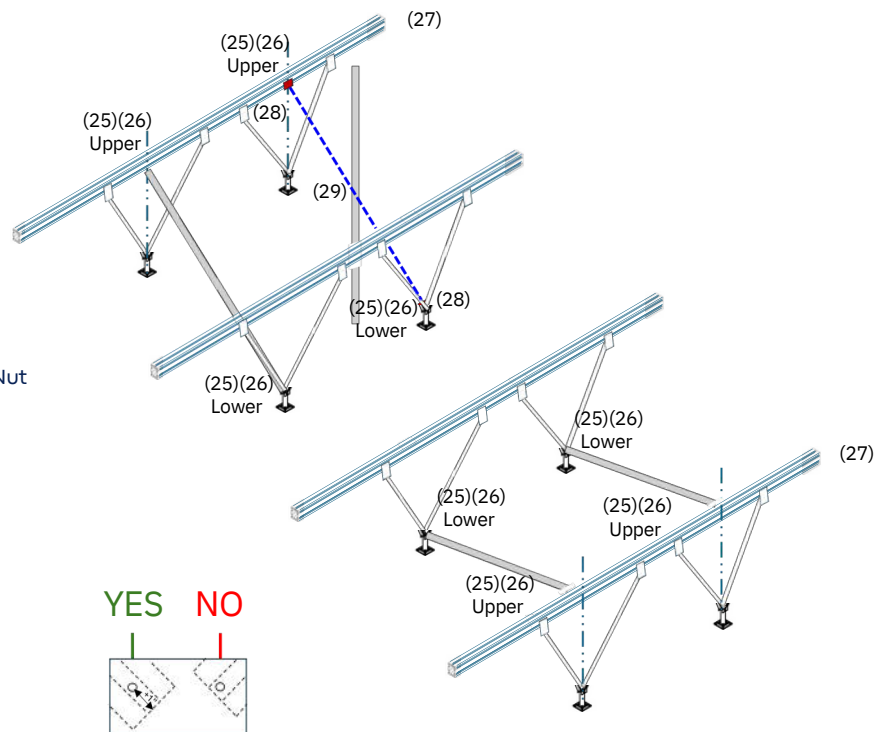
17. Run two string-lines [or lasers] from the first frame to the last frame [brace frames temporarily using a level to verify they are straight, keep string taught]
18. Measure distance between both ends of the leveled and braced frames to be sure they are the same
19. Move UAP stands to the middle [next] frame, repeat items 1-5
20. Adjust the low end of the Top Chord to the string line and the end of the Top Chord should be in line with the ends of the previously installed Top Chords. Readjust until aligned.
21. Repeat items 8-14.
22. Move to next frame, repeat items 19-22 until all frames are installed.
23. When all the frames are installed check for alignment and make minor adjustments by loosening the upper plates at the nut bar [once tightened do not loosen the piercing bolts].



# W-System Cross Bracing Assembly

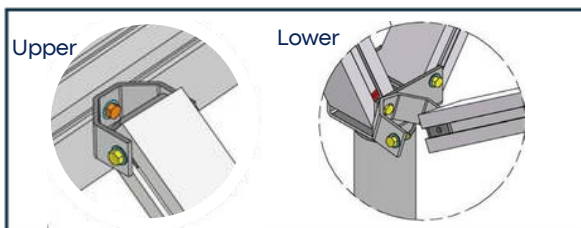
Illustrations Pending

24. Layout the cross-bracing kits per the Plans [see previous illustrations].
25. Locate and mark the upper and lower Outer Bracket installation points.
26. Loosely install the upper and lower Outer Brackets [use hardware kits].
27. Using a level adjust the frames on the high side of the brace so they are vertical and true, check for level throughout the brace installation.
28. Turn the upper and lower Outer Brackets until parallel, tighten, torque to 12 ft.-lb. and mark.
29. Measure the distance between the upper and lower Outer Bracket bolt holes, add 2.5 inches. [critical measurement take time to get it right].
30. Cut a 3x2 rail to the adjusted measurement.
31. Allow loosely pre-installed angle nuts to slide +1" into the brace keyways.
32. Tighten piercing bolts until they pierce the 3x2 wall, then torque to 12 ft.-lb. and mark.
33. Repeat items 23 – 33 until all cross bracing is installed.



## F – UAP Outer Bracket Kit:

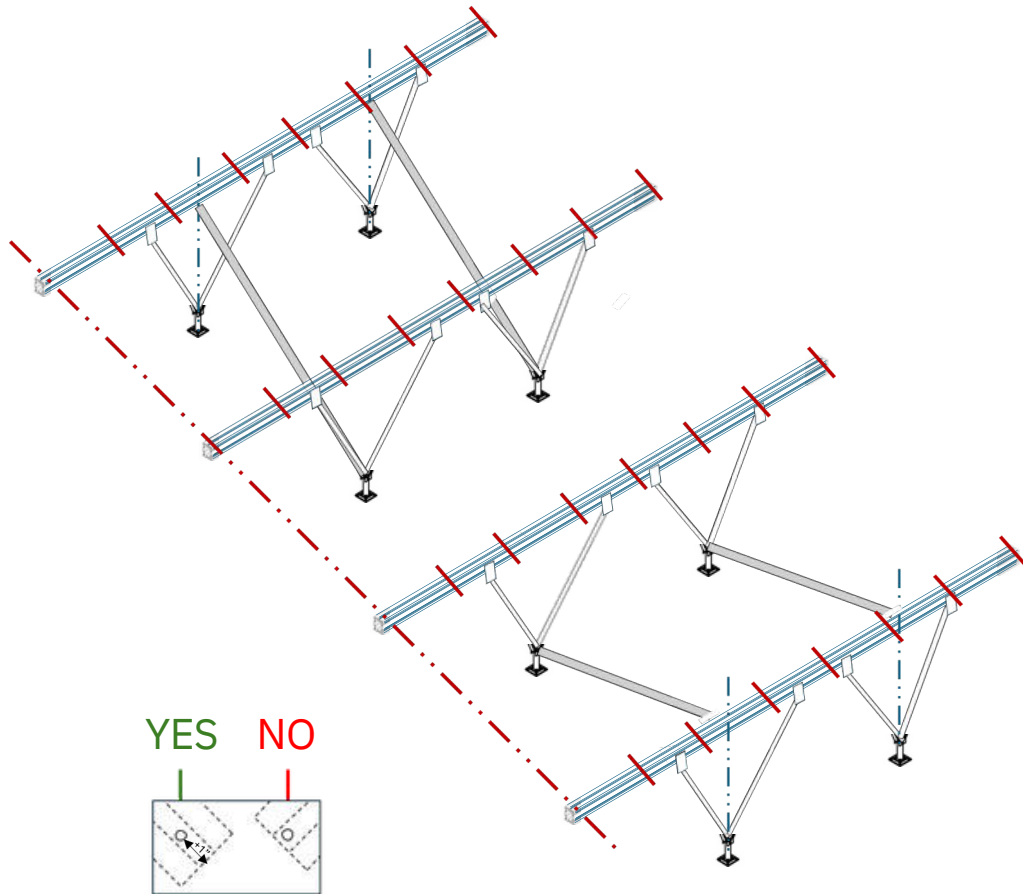
UAP Outer Bracket + 5/16 x 5" SS Through Bolt + Washer Set + Nut  
Attaches lateral braces to the upper and lower sides of adjacent frames.



# W-System Panel Rail Installation

Illustrations Pending

34. Check the solar module make and model against the equipment specified in the Plans, if different check with UAP to verify hardware specifications.
35. Using the rail spacing provided in the module installation manual, make spacers from 2x4 lumber, be sure to account for the module rail thickness [make two of each length]
36. Locate the measurement for the starting point on the Plans, typically several inches from the low end of the Top Chord.
37. Use the spacers to mark the panel rail locations across the first and last frames, verify the last panel rail falls on the same spot on the first and last frames [measure from the end of the Top Chord]
38. Run a string line between the first and last Top Chord as shown in the diagram and mark each panel rail location.

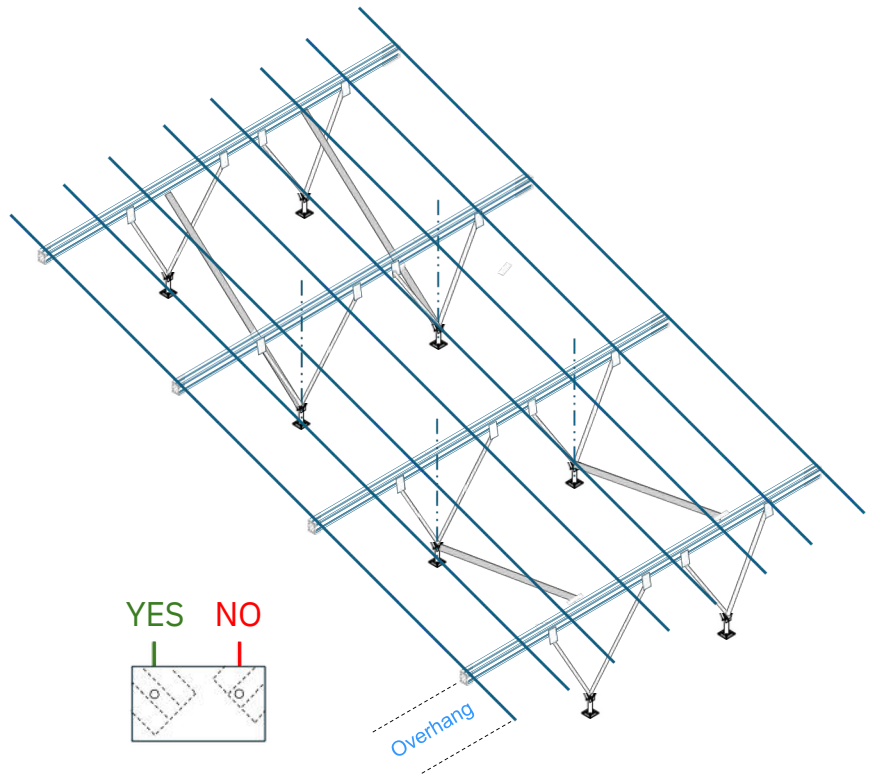
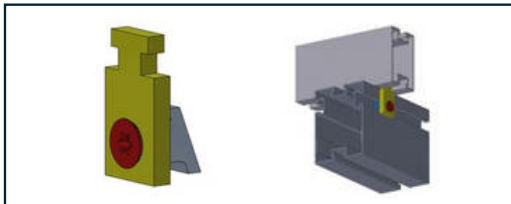


# W-System Panel Rail Installation

**Illustrations Pending**

39. Lay the panel rails across the top chords, adjust the overhang according to the Plans [trim excess after module installation].
40. Install panel rail splices [bond where needed - see splice detail].
41. Align panel rails across parallel frame marks [Item 37-38].
42. Distribute the Cleat Kits – two for each location where a panel rail crosses over a Top Chord.
43. Install the cleat Kits by inserting the cleat key in the panel rail keyway and the angle nut into the Top Chord keyway.
44. Beginning at the first frame tighten the machine bolts on both sides of the top chord using a Torx T-40 driver be sure the angle nut fully engages the keyway and torque to 12 ft.lb., and mark.
45. If a frame is not already level [vertical above the frame posts] - use a level to adjust the frame so it is vertical and true, then install the cleats along that top chord [Items 43-44].

**UAP Cleat Kit:**  
UAP Cleat + UAP Angle Nut + Lobed Flathead SS Machine Screw  
Anchors module rails to main support rails.

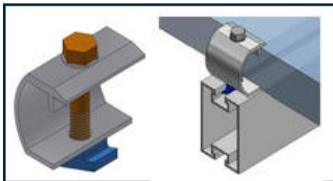


# W-System Module Installation

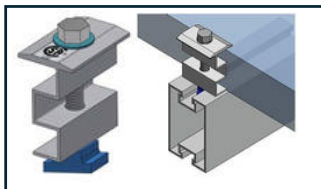
**Illustrations Pending**

46. Lay the panels in portrait along the first frame leaving a 1/2" gap between modules.
47. Align with the frame and install the C Clip Kits by inserting the angle nut into the panel rail keyway and torque to specifications being sure the angle nut rotates fully engaging the keyway.
48. Set panels in portrait along the bottom of the array.
49. Align with the panel rails and install the Waffle Clip Kits by inserting the angle nut into the panel rail keyway and torque to specifications, being sure the angle nut rotates fully engaging the keyway. [Note: be sure to follow UL 2703 grounding and bonding procedures by installing the grounding clamps and lugs per grounding instructions on following page.]
50. Repeat items 47 & 48 until all modules are installed.
51. Install Grounding Lugs on the panel rails adjacent to grounding clamps [ground wire not included].

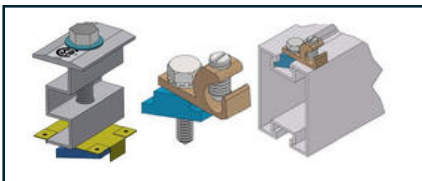
UAP C-Clip Kit:



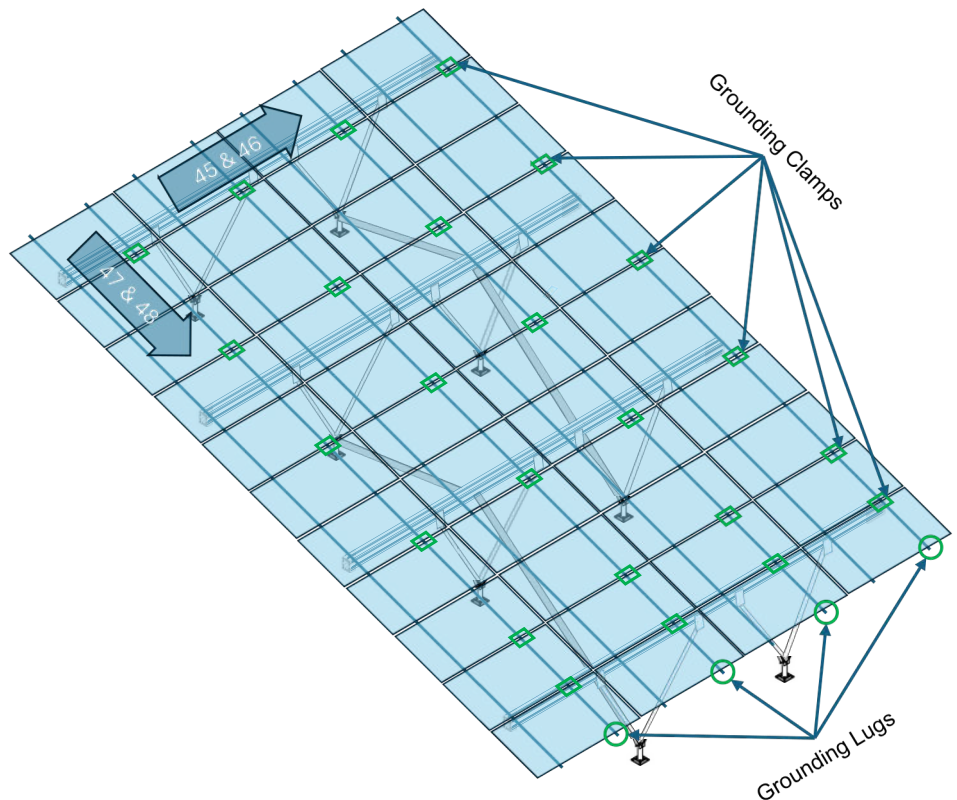
UAP Waffle Clip Kit :



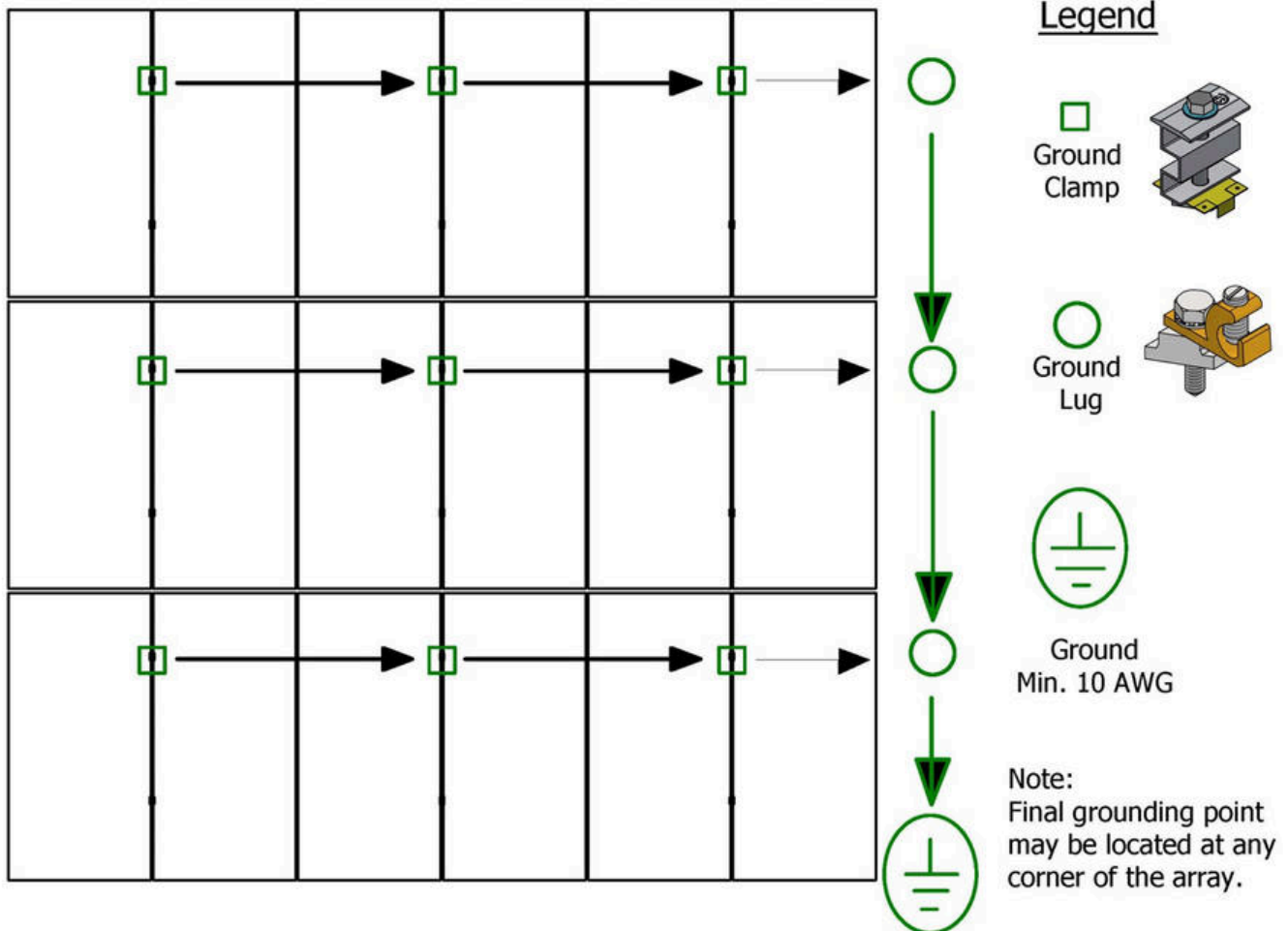
UAP Waffle Grounding Kit: UAP  
Panel Rail Grounding Kit:



UAP's grounding kits for UL2703 module to rail grounding



# Typical Grounding System





# Notes

UL2703 verified compatible modules [Note: UAP is constantly updating the list of UL2703 compatible modules – let us know your preferred module and we will submit for approval]

Modules tested to date are from the following manufacturers: Aptos Solar; Canadian Solar, Elin Energy; Heliene; Hyundai; JA Solar; Longi; Maxis; Meyer Burger; Mission Solar; M Solar; Panasonic; Phono Solar; Q-Cells; REC Solar; Runergy; SEG Solar; Silfab Solar; Solar 4 America, Solaria; Star Solar, Sunpower.

## Grounding/Bonding

- Only grounding/bonding devices listed in this manual have been approved for use with this racking and qualified per UL2703 installation details provided in this document
- This racking system may be used to ground and/or mount a PV module complying with UL2703 only when the specific modules has been evaluated for grounding and/or mounting in compliance with the included instructions.
- Installation must be done in strict accordance with this instruction manual and the UAP provided site-specific plans
- Routine maintenance of a module shall not involve breaking or disturbing the bonding path of the system unless appropriate measures are taken to reestablish the bonding path.

## Periodic Inspection

Periodic re-inspection of installed racking components must take place to identify any loose components, loose fasteners or corrosion. Loose or corroded components or fasteners must be tightened to specifications or replaced immediately per UAP approved O&M procedures.

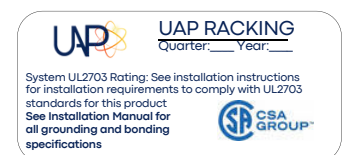
## Design Load Rating

System Level Allowable Design Load Rating: Custom design load ratings are evaluated and approved by UAP's structural engineer and provided with each set of site-specific plans.

This system is designed to be expandable and is not limited by a maximum number of PV modules. The size of customer specified PV modules is evaluated by UAP's structural engineer and accounted for in the approved PE certified plans. Modular rail lengths can accommodate up to +30 modules in portrait or 14 modules in landscape according to the racking configuration.

## Label

After the racking system is fully assembled, a single Marking Label should be applied to the rail at the edge of the array. **Note: The sticker label should be placed such that it is visible, but not outward facing.**





# Notes

**UL2703 verified compatible modules [Note: UAP is constantly updating the list of UL2703 compatible modules – let us know your preferred module and we will submit for approval]**

Modules tested to date are from the following manufacturers: Aptos Solar; Canadian Solar, Elin Energy; Heliene; Hyundai; JA Solar; Longi; Maxison; Meyer Burger; Mission Solar; M Solar; Panasonic; Phono Solar; Q-Cells; REC Solar; Runergy; SEG Solar; Silfab Solar; Solar 4 America, Solaria; Star Solar, Sunpower.

## Sharp Edges and Piercing Module Clamps

Ensure wiring is kept away from any sharp edges that may have resulted from cutting rails etc. Module clamping kits include preinstalled bonding nodes which are designed to pierce the module frame when tightened to proper torque.

## Site-Specific Engineering Drawings

This manual is to be used in conjunction with the UAP provided site-specific engineering drawings and related installation details developed and approved for your specific project.

