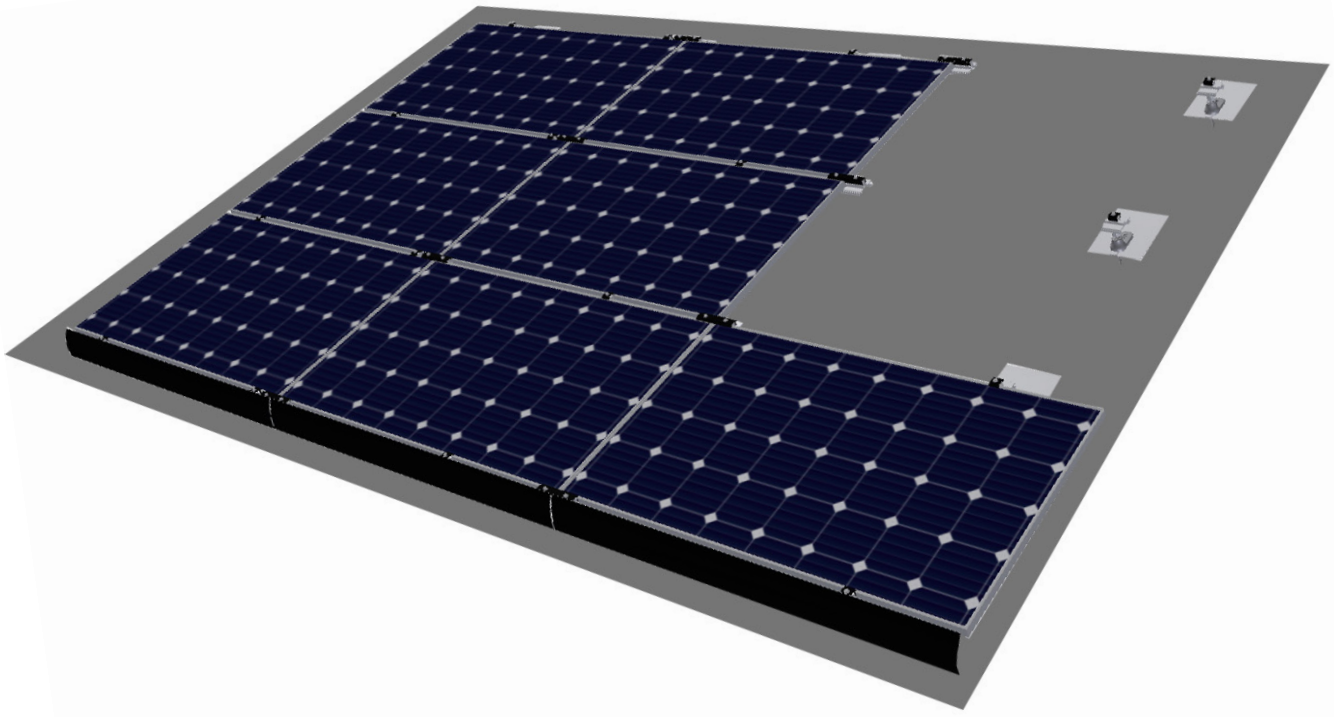
mounting systems

Element
Rail-Free On-Roof System
Installation Manual



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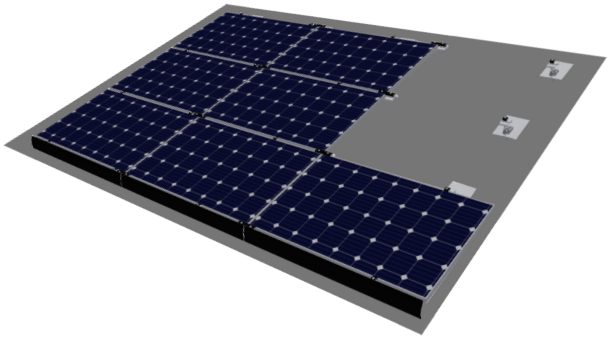


Element Installation Manual

Contents

1	**Introduction**	**1**
1.1	Short Description	1
1.2	About this Manual	1
1.3	Regulatory Information	2
2	**Technical Description**	**3**
2.1	System Overview	3
2.2	Element Components	4
2.3	Technical Data	6
3	**System Bonding and Grounding**	**7**
3.1	System Grounding	7
3.2	System Bonding	8
4	**Important Installation Information**	**9**
4.1	Conditions of Use	9
4.2	Required Tools	9
4.3	Fastener Torque Settings	9
5	**Planning the Module Area**	**10**
6	**Installation**	**11**
6.1	Flashing Installation	11
6.2	Racking Installation	12
6.3	Skirt and Module Installation	13
7	**Maintenance**	**15**
7.1	Inspection	15
7.2	Testing	15
8	**List of Evaluated and Approved Modules**	**16**

1. Introduction

1.1 Short Description

Element is a compact, versatile system for mounting PV modules on pitched roofs. The system allows modules to be mounted in portrait or landscape. The Element system is fully, integrally bonded.

1.2 About This Manual

This manual describes the installation of the Element mounting system and provides necessary information regarding components, system planning, and important safety warnings. Sections 1, 2, and 3 provide an overview as well as detailed information about the Element system and components. Section 4 provides basic module layout and planning information. Sections 5 and 6 provide detailed system assembly and installation instructions. Section 7 provides maintenance requirements, and the last remaining section provides detailed information on evaluated and approved modules.

Applicable Documents

Both this manual and the "Installation Instructions for PV Mounting Systems: General Information"[1] are an integral part of the Element system and must be adhered to for each installation. This document provides general information for Mounting Systems' products regarding standardization, safety, transport, maintenance, disassembly, and disposal.

It is important that you carefully read these Instructions as well as all applicable documents prior to carrying out any installation, maintenance, or disassembly work. These instructions provide you with the information required for the safe and complete installation and maintenance. Should you have any questions, please contact Mounting Systems.

Installation Personnel

Element and these instructions are intended for use by qualified personnel. Qualified personnel are those who have skills, knowledge, and training in the installation of photovoltaic mounting systems necessary to follow these instructions in order to safely use the required tools and to carry out the required procedures.

Intended Use

The Element system is intended for use only as a mounting system for photovoltaic panels and certain associated hardware and components. Any other usage or usage outside the intent or scope of these instructions is considered not as intended and may result in forfeiture of the system warranty. Please contact Mounting Systems with any questions regarding these requirements.

[1] "Installation Instructions for PV Mounting Systems: General Information" can be found on Mounting Systems' website: http://www.mounting-systems.us/downloads-technical-docs-warranty/

1.4 Regulatory Information

ANSI / UL 2703
The Element system is pending an ETL listing to UL 2703. Listing documents are available from the Mounting Systems website: www.mounting-systems.us. For additional information, contact Mounting Systems.

UL 2703 requires that listed PV systems be labeled to indicate their compliance with UL 2703. The Alpha+ system includes labels as shown in image 1.4.1 affixed to each module end clamp.

Image 1.4.1 ***UL 2703 label***

Fire Class Resistance Rating (ANSI / UL 1703)

The Element system is intended for roof mounting over a fire-resistant roof covering rated for the application. The Element fire rating is valid for roofs with slopes greater than 2:12 (9.5°).

- Class A for Steep Slope Applications when using Type 1, Listed Photovoltaic Modules.

The fire class rating is valid for systems installed at any height above the roof deck. It is also valid with and without the addition of the optional array skirt.

This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

Mechanical Load Rating (ANSI / UL 1703)

The Element system has been mechanically tested accoding to UL 2703 Edition 1 to the following load ratings:

- Downward Pressure: 10 PSF
- Upward Pressure: 5 PSF
- Down-Slope Load: 5 PSF

2. Technical Description

2.1 System Overview

The following is an overview of the major Element system components as shown in Image 2.1.1.

Note that the actual configuration of each individual system can vary depending on:

- Type of roof (substructure and roof cladding)
- Type of module
- Number of modules and configuration
- Local conditions

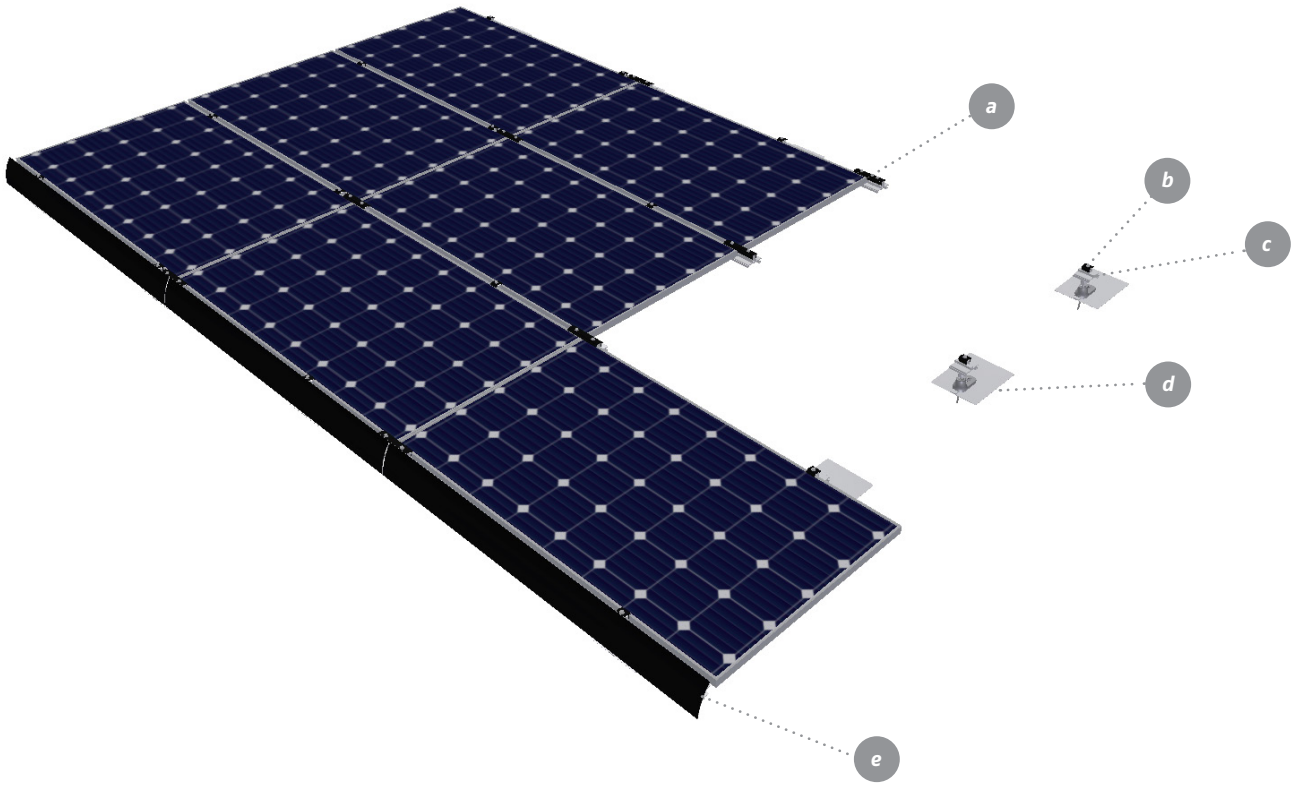


Image 2.1.1

a Element Splice
b Module clamp
c Standoff
d Flashing
e Optional Skirt

2.2 Element Components

Image 2.2.1 ***Flashing***

Image 2.2.2 ***Standoff***

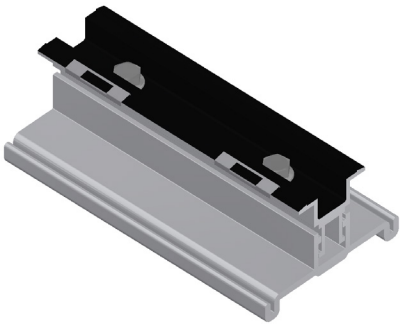


Image 2.2.3 ***Element Splice***

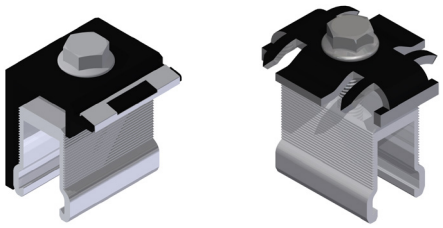


Image 2.2.4 ***Module Clamp***

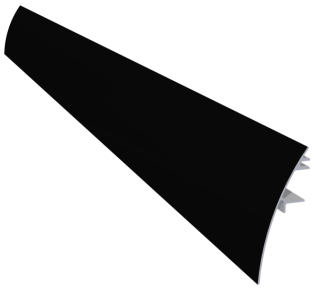
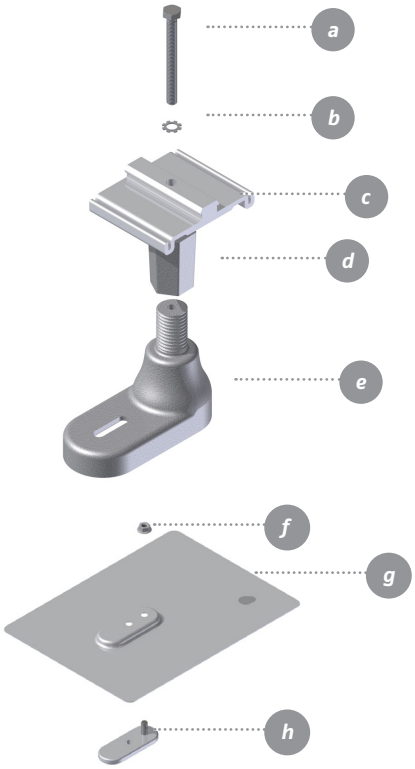


Image 2.2.5 ***Optional Skirt***

Element Component Assemblies

See below for an exploded view of the Element assemblies. All components ship fully pre-assembled.



Standoff Assembly

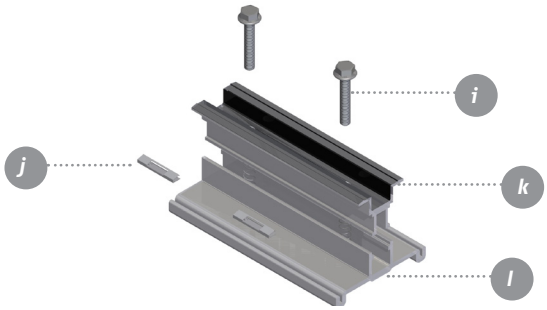
a. M8 x 80 flange bolt
b. M8 Star washer
c. Shelf
d. Hex sleeve
e. Standoff Base

Flashing Assembly

f. M8 serrated flange nut
g. Flashing
h. Flashing plate with M8x35 flush head stud

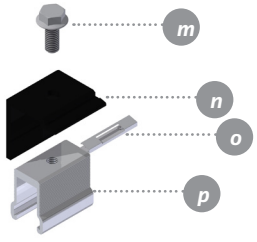
Splice Assembly

i. M8 x 45 serrated flange bolt
j. WEEB BMC
k. Splice Top
l. Splice Bottom



Module Clamp Assembly

m. M8 x 25 serrated flange bolt
n. Clamp body
o. WEEB BMC (end clamp only)
p. Click clamp



2.3 Technical Data

Application	*Pitched roof – on-roof*
Roof cladding	*Composition shingle*
Roof slope	*9.5° to 60° [1]*
PV modules	*Framed*
Module orientation	*Landscape, portrait*
Maximum Module Size	*77.5 in x 39 in x 2 in / 1970 mm x 1000 mm x 50 mm*
Size of module array	*Maximum 300 modules per grounding lug*
Distance between roof attachment points	*Up to 6 ft / 2 m [1]*
Maximum Module Cantilever	*1/3 of Roof Attachment Spacing, or Module Installation Guide*
Maximum System Voltage	*1000 VCD*
Standards	*IBC 2009* *IBC 2012* *ASCE 7-05* *ASCE 7-10* *UL 2703 pending* *ANSI / AISC 360-05* *ACI 318-08* *Aluminum Design Manual 2010* *Eurocode 1-DIN EN 191-1-1 – Actions on structures* *Eurocode 9 – Design of aluminum structures*
System Materials	*Extruded Aluminium EN AW 6063 T6, EN AW 6061 T6, EN AW 6005A T61* *Die Casted Aluminum A380*
Small parts	*Stainless steel A2 and Stainless Steel 304*
Color	*Mill finish, black powder coat*
Warranty	*10 Years [2]*

1 *Different maximum values may apply.*

2 *The Mounting Systems Warranty can be found online for more details.*

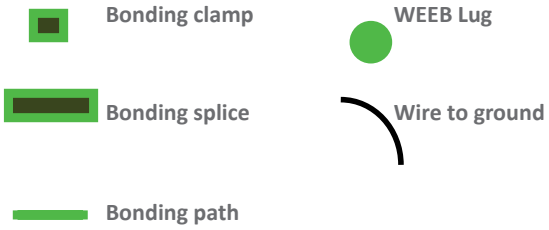


Image 3.1.1 ***Icons***

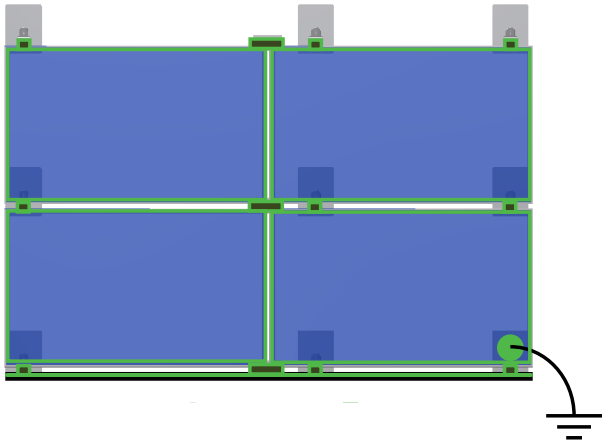


Image 3.1.2 ***Bonding path***

Image 3.1.3 ***WEEB-Lug 8.2 installed***

3. System Bonding and Grounding

3.1 System Grounding

When Element is properly installed, the entire system is integegrally bonded and grounded through a Wiley WEEB Lug 8.2. See Image 3.1.2 for the system bonding path.

Each separate module array requires at least one WEEB lug in order to gound the individual array. The WEEB Lug can be re-used a maximum of 5 times.

WEEB-Lug Installation

The WEEB-Lug 8.2 is preassembled with an M-8 T-head bolt, M8 nut, and a WEEB bonding washer. To install the WEEB-Lug:

- Select an appropriate and accessible standoff.
- Disassemble the WEEB-Lug from the T-bolt and nut.
- Remove the nut that is secured at the base of the standoff. Place the Lug with the WEEB on the stud and replace the nut.
- Ensure WEEB washer is aligned with lug body and that the bonding points make full contact with standoff base. Tighten the nut finger-tight to hold lug and WEEB in place.
- Torque the M8 nut to 10-12 ft-lbf.

Lay the wire in the lug wire channel and secure with the wire capture bolt.

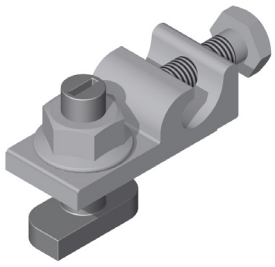


Image 3.1.4 ***WEEB-Lug 8.2***

AWG Wire Size	WEEB-Lug 8.2 Capacity
14-6	1 wire
10	2 wires
12	2 wires

Table 3.1.1 ***WEEB Lug 8.2 wire capacity***

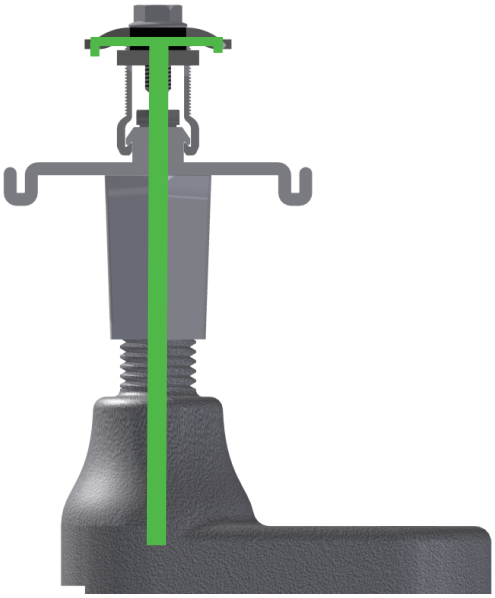


Image 3.2.1 ***Integrated bonding path***

3.2 System Bonding

When properly installed, Element is a fully, integrally bonded system. As shown in Image 3.2.1, there is a continuous bond path from the module frame down through the clamp, to the shelf and down to the standoff.

The system bonds to the module frames with both the module clamps and the splice.

The stainless steel mid clamp is designed to pierce the module frame anodization when torqued properly. These bonding points are shown in Image 3.2.2.

The splices, end clamps and aluminum mid clamps are all equipped with WEEB BMC(s) to ensure a high-ampacity bond from the module frame to the rest of the system. All of these components come pre-assembled with the WEEB, so no additional work in the field is required.

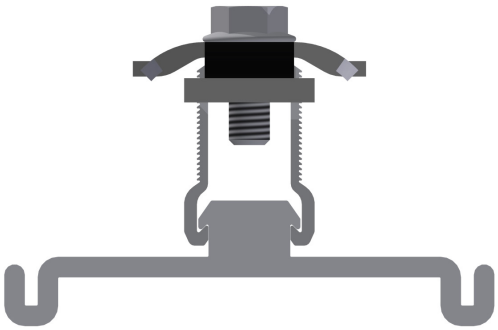


Image 3.2.2 ***Clamp and shelf bonding hooks***

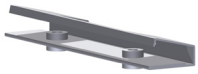


Image 3.2.3 ***WEEB BMC***

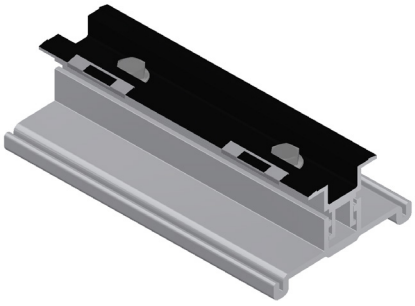


Image 3.2.4 ***Module Bonding, Splice***

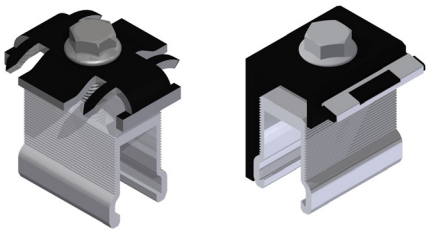


Image 3.2.5 ***Module Bonding Mid and End Clamp***

4. Important Installation Information

4.1 Conditions of Use

The Element On-Roof System has been designed in accordance to and/or compliance with the following codes and standards:

- International Building Code 2012
- California Building Code
- ASCE 7-05
- ASCE / SEI 7-10
- ANSI / AISC 360-05
- ACI 318-08
- Aluminum Design Manual 2010
- Eurocode 1-DIN EN 1991-1-1

The design of each system should be verified, e.g.

4.2 Required Tools

The only tool that is required for the installation of this system is:

- 1/2" hex socket (13 mm hex socket)

Other suggested installation aids:

- Chalk line
- String line
- Torque wrench
- Tape measure

Please adhere to the mounting steps listed and be sure to follow the safety instructions.

4.3 Fastener Torque Settings

Proper torque is important to a safe and secure installation. Please refer to the below table for the required torque speficications for all attachment points that are required during field installation.

Connection	*Torque Spec*
M8x100 Lag Screw	*10-12 ft-lbs* [1]
Flashing M8 stud/nut	*10-12 ft-lbs*
Shelf M8x80mm bolt	*10-12 ft-lbs*
Clamp M8x25mm bolt	*6-8 ft-lbs*
Splice M8x45mm	*10-12 ft-lbs*
WEEB Lug 8.2 M8 nut	*10-12 ft-lbs*

1 *Lag screw torque is estimated. It should be torqued until the rubber of the washer is visually compressed against the flashing*

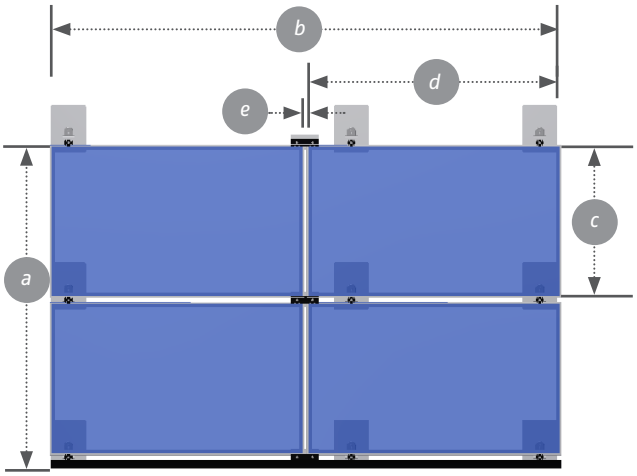


Image 5.1 ***Module area***

a Height of the module field: Number of modules vertically x (module length + 1 inch gap)

b Width of the module field: Number of modules horizontally x (module width + 3/8 inch gap)

c Vertical spacing of the standoffs = Module width + 1 inch gap

d Horizontal spacing of stanodffs: Dependent upon roof attachment method and site-specific parameters.[2]

e Distance between the modules = 3/8 inch

5. Planning the Module Area

For installation, the flashings must be fastened to the rafters of the roof. The spans between the roof fasteners will depend on the orientation of the modules, the spacing of the rafters, and the site conditions. The layout should be verified with a structural analysis by a licensed engineer.

To plan the array area, follow the below instructions:

1. Locate the rafters that will be used as the structural attachments. The spacing between the rafters will be determined in the site-specific documentation. Snap a vertical chalk line along these rafters.
2. Locate the bottom most row. Snap the first horizontal chalk line where the array will begin. From this first East-West line, use the hole locations on the provided install gauge to space the remaining East-West lines as shown in Image 5.2. The holes in the gauge will be determined by the width of the module used in the specific project plus a 1" gap for the module spacing.
3. Once all the chalk lines are snapped, verify the layout on the project specific documenation and proceed with the installation.

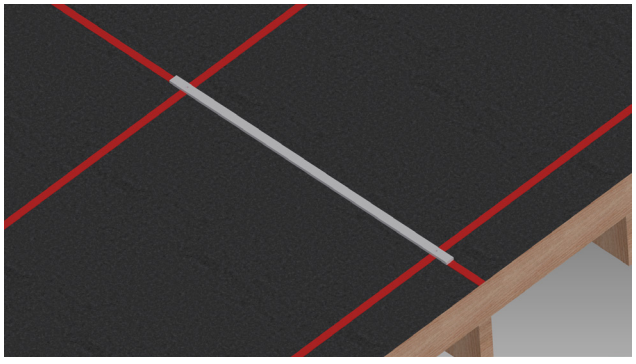


Image 5.2 ***Chalk lines measure with install gauge***

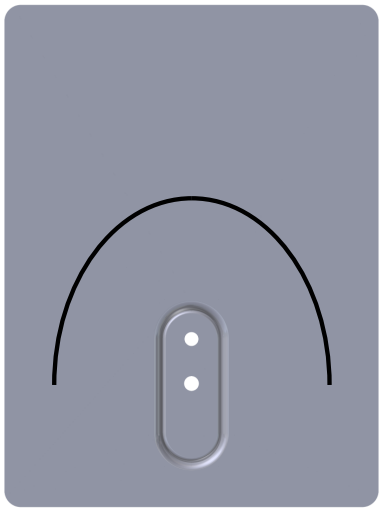


Image 6.1.1 ***Flashing with sealant***

Image 6.1.2 ***Flashing installed***

6. Installation

The permissible distance between the roof attachments depends on several factors and must be calculated specifically for each project.

6.1 Flashing Installation

1. Locate the intersections between the vertical and horizontal chalk lines that represent your rafter attachment locations.
2. Use a roofing bar to break the seals in the two shingle courses above.
3. Drill a 3" deep pilot hole with a 1/4" drill bit. Make sure the drill is perpendicular to the rafter.
4. Fill the pilot hole with a compatible roof sealant.

Option: For additional security, it may be desireable to add a U-shaped bead of sealant around the bolt hole on the underside of the flashing. The bottom of the U must be toward to roof ridge with the opening of the U downlope. Do NOT fully surround the bolt hole with sealant.

5. Reposition the flashing underneath the next course of shingles, ensuring the raised portion of the flashing is facing up. Position the flashing so the hole in the flashing aligns with the pilot hole.
6. Insert the lag screw with the pre-assembled EPDM bonded washer through the hole of the flashing and plate and into the rafter pilot hole. Torque the bolt until the rubber of the washer is visually compressed against the flashing, approximately 10-12 ft-lbs.
7. Repeat these steps for all the required roof attachments in the array.

6.2 Racking Installation

1. Remove the nut from the flashing assembly. Place the standoff assembly on the raised portion of the flashing, making sure the stud goes into the slot of the standoff base and the slot is facing upslope. Place the nut back on the stud and hand tighten to hold the standoff in place.

2. Repeat these steps to install the standoffs on all installed flashings.

3. Utilize a string line or chalk line to align the first row of standoffs in the North-South directions. To adjust, loosen the nut and slide the standoff base upsolpe and downslope along the flashing. Once the first row of standoffs is aligned, torque the nuts to **10-12 ft-lbs**.

4. Next, vertically adjust all the standoffs in the array. It is recommended to use a string line or laser on the shelf surface for this step. To vertically adjust the system, follow these steps:

   - Back out the through-bolt from the top of the shelf to loosen the components.

   - Rotate the hex sleeve to raise or lower the shelf height.

     NOTE: The hex sleeve is reverse threaded, so clockwise raises it and counterclockwise lowers it.

   - Once the standoff assembly is level in the vertical direction, re-tighten the through bolt on the shelf surface while holding the hex sleeve in place. Torque to **10-12 ft-lbs**.

5. Repeat these steps to align the entire array so that all the shelves are level, regardless of deformations in the roof's surface.

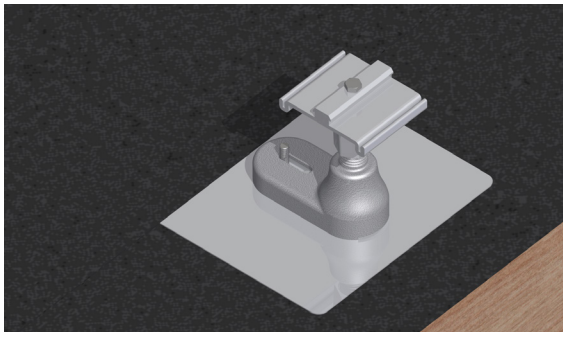


Image 6.2.1 ***Standoff placed on flashing***

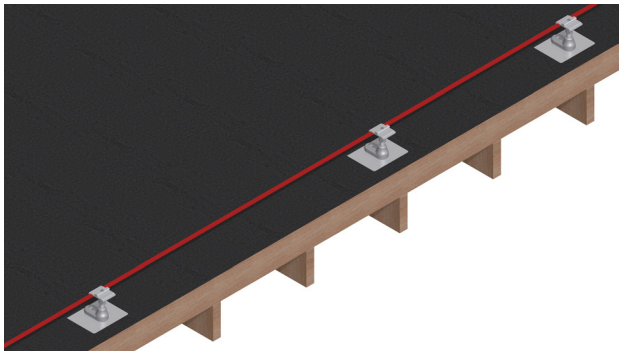


Image 6.2.2 ***North-South alignment of first row***

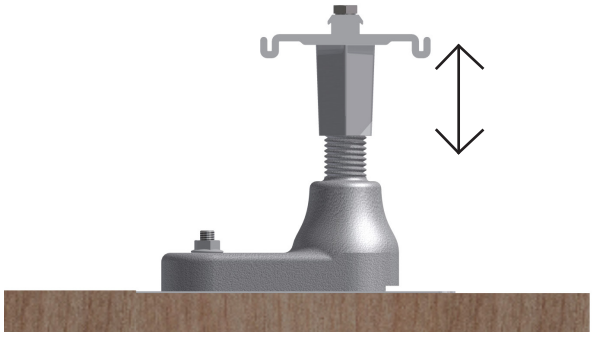


Image 6.2.3 ***Vertically adjust standoff***

6.3 Skirt and Module Installation

There is an optional skirt that comes with the Element System. The below instructions include steps for installations both with and without the skirt.

1. Beginning on the bottom-most row, install the mid clamps to the shelf by rocking it to one side of the protruding channel and then snapping the clamp across the other side to snap over the channel.

Note: For installation without the skirt, complete step 1 with end clamps, as opposed to mid clamps, and continue to step 5.

2. Once a mid clamp is installed on all standoffs in the first row, take the first skirt and start at one of the corners of the first row. Install the skirt by setting the vertical leg of the skirt in the shelf slot at an angle and rock the skirt against the mid clamp as shown in Image 6.3.2.

3. Install the next skirt on the next standoff. Insert the splice on the edge of the first skirt, and slide in the second skirt until the two skirts meet in the middle of the splice.

4. Continue installing the remaining skirts and splices in the same fashion.

5. If there is an edge column with two standoffs, place the first module there. If not, choose either corner and work across the row of the array. Lay the module so it rests flush against the clamp installed on the bottom row.

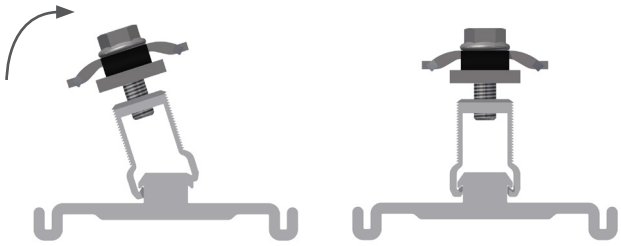


Image 6.3.1 ***Click clamp to shelf***

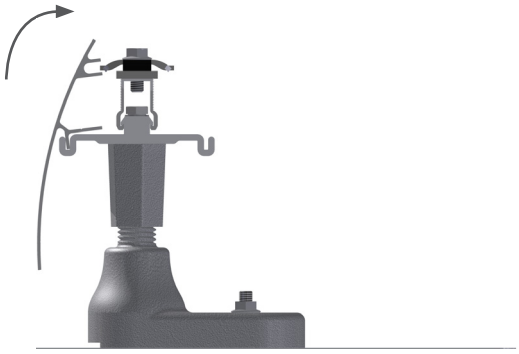


Image 6.3.2 ***Angle skirt to insert it in shelf and mid clamp***

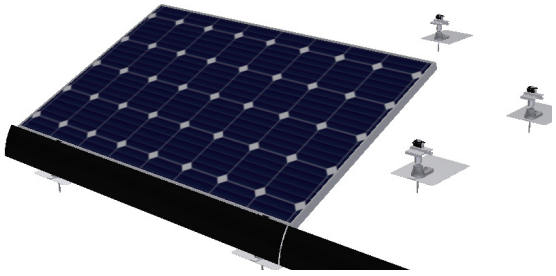


Image 6.3.3 ***Angle module to install***

6. Ensure the module sits properly into the bottom splice, then insert the second row of splices loosely to hold up the modules.

7. When the first row of panels is in place, tighten the first row of attachments, module clamps and splices. Torque the module clamps to **6-8 ft-lbs** and the splices to **8-10 ft-lbs**.

8. Install the first module of the second row, beginning with the same edge column as before. When this module is in place under the clamps and splice, tighten the two mid clamps below the module. Then, tighten the splice's first bolt to hold the module in place as shwon in Image 6.3.5.

9. Insert the next module in the row. Once it is in place, torque the second bolt of the first splice and the mid clamp. Then tighten the first bolt of the next splice.

10. Repeat these steps for the remainder of the array. Once all the modules are installed, place end clamps on the top-most row of standoffs to complete the array.

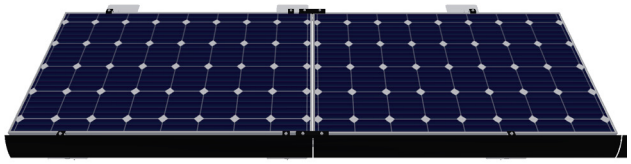


Image 6.3.4 ***First row installed***

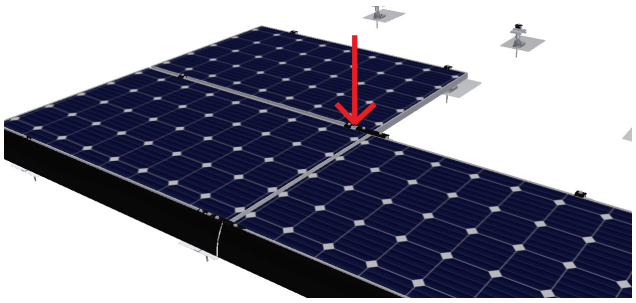


Image 6.3.5 ***Tighten first bolt on splice to support module***

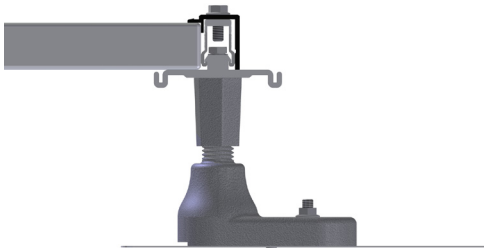


Image 6.3.5 ***End clamp on top row***

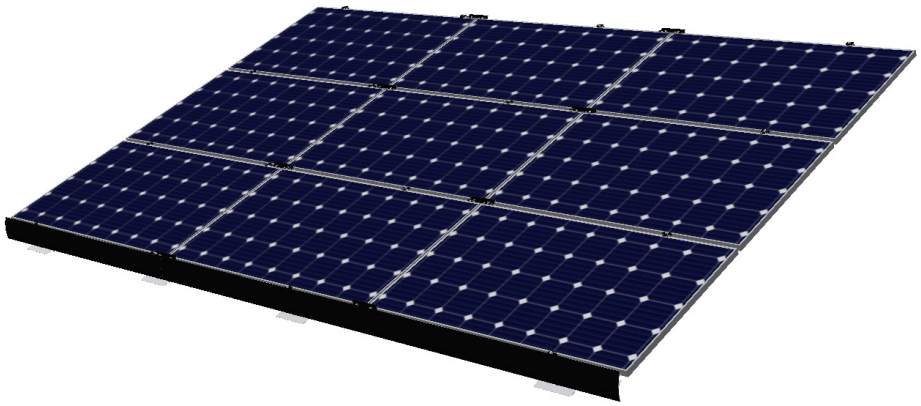


Image 6.3.2 ***Completed system***

7. Maintenance

When properly assembled, the Element is a reliable and trouble-free system and should require little ongoing maintenance or repair. Nevertheless, Mounting Systems recommends maintaining a regular inspection and maintenance schedule. Such a program can detect and address potential problems before they become serious and help ensure the system's excellent long-term durability and reliability.

The following procedure pertains only to the Element mounting system structure. Maintenance and repair of other PV system components should be carried out in accordance with the respective manufacturers' recommendations.

7.1 Inspection

The system should be visually inspected periodically for loose components, loose fasteners, and any corrosion. If any of these conditions are found, the affected components should be immediately adjusted, repaired, or replaced.

7.2 Testing

After one year in service, it is a good practice to check the torque settings of a representative sample of system connections, including module clamps and rail clamps. Do not exceed the recommended torque settings. If a disproportionate number of loose connections (more than 10% of connections) are found, it may be an indication of improper assembly and it may be necessary to take comprehensive corrective action.

A smaller sampling of connections can be tested annually thereafter. Mounting Systems recommends keeping records of the connections sampled each year and testing and, if necessary, adjusting previously untested connections in succeeding years. After all connections have been tested, sample sizes and test frequency can be reduced.

8 List of Evaluated and Approved Modules [1]

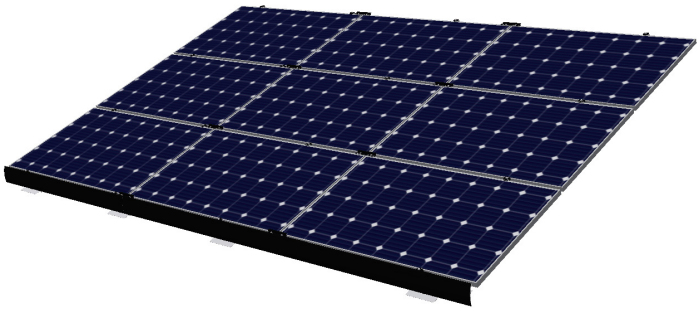
Manufacturer	Model
Jinko	60 cell modules model: JKMXXXP-60
Jinko	72 cell modules model: JKMXXXP-72
Trina	60 cell modules model: TSM-PD05.08-XXX
Yingli	60 cell modules model: YL-XXX-29B.

Note: XXX refers to the power class in watts (W) of the module.

1 Pending Testing Results

Element is to be used only with modules on this list or with those which include the Element system in their respective installation manuals.

mounting systems



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