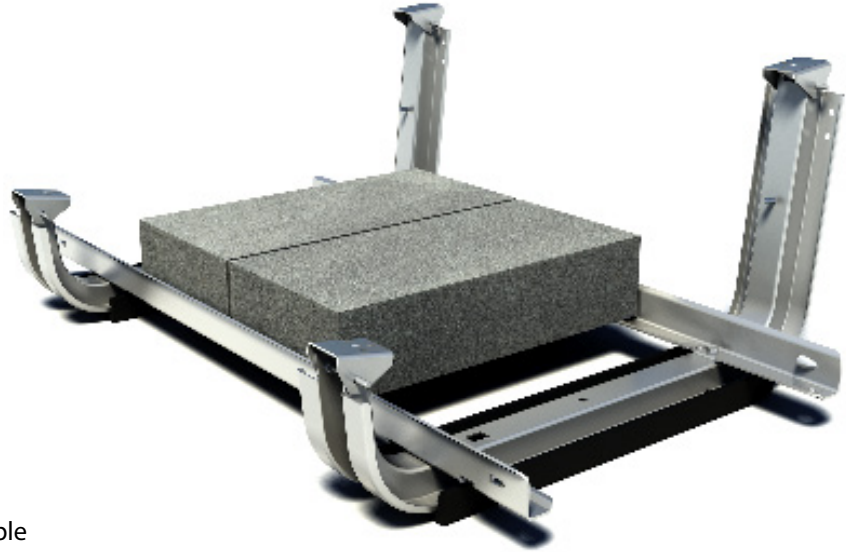


Installation Manual

2013 Edition v2.3

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Introduction

The IronRidge Ballasted Roof Mount is an intuitive and easy-to-install solar mounting solution that is scalable to even the largest commercial flat roof installations. Constructed of durable galvanized steel and aluminum with stainless steel hardware, the IronRidge Ballasted Roof Mount System is a superior product for even the most challenging roofs.

Customer Support

IronRidge makes every effort to ensure your mounting kit is easy to install. If you need assistance at any point with your installation or have suggestions on how we can improve your experience, call our customer support at 1-800-227-9523 or email us at service@ironridge.com.

Disclaimer

This manual describes the proper installation procedures and provides necessary standards required for product reliability and warranty. All installers must thoroughly read this manual and have a clear understanding of the installation steps and procedures prior to installation. Failure to follow these guidelines may result in property damage, bodily injury or even death.

Installer Responsibility

The installer is solely responsible for:

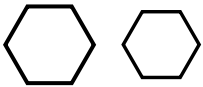
- Complying with all applicable local or national building codes, including any that may supersede this manual.
- Ensuring that IronRidge and other products are appropriate for the particular installation and the installation environment.
- Ensuring that the selected mount can support the array under live load conditions.
- Using only IronRidge parts and installer-supplied parts as specified by IronRidge. Substitution of parts may void the warranty.
- Ensuring safe installation of all electrical aspects of the PV array. All electrical installation and procedures should be conducted by skilled, licensed and bonded electricians. All work must comply with all national, state and local installation procedures, product and safety standards. These standards include but are not limited to applicable National Electrical Code (NEC®), National Electrical Installation Standards (NEIS™), UL Standards, and OSHA Regulations.
- Complying with roofing manufacturer's warranty terms including, but not limited to: protective barriers between the racking and roofing and roof penetrations. Removing all loose debris or gravel prior to installation.
- Ensuring that the installation is completed by a skilled, licensed and bonded building professional.
- Ensuring that the installation of all solar modules are installed within Roof Zone 1. Any modules that are not within Roof Zone 1 must be approved by a Licensed Professional Engineer in order to ensure proper ballasting and to verify structural capabilities of racking. See appendix defining Roof Zones.
- Ensuring that the installation of all solar modules be installed at a sufficient characteristic Length, "L" from roof obstacles. See appendix defining Characteristic Length, "L".
- Complying with all applicable fire codes including, but not limited to, keeping walkways clear and avoiding obstacles.
- The accuracy of all information provided to IronRidge. Any issues resulting from inaccurate information is the responsibility of the installer.
- Verifying that the roof slope (or pitch) does not exceed 5 degrees and that the change in elevation (or height) between adjacent Ballast Trays does not exceed three (3) inches.
- Confirming with the selected module manufacturer that the racking is compatible with the selected module. Please consult module manufacturer's installation guidelines in order to verify mounting compatibility.
- Verifying that proper ballasting has been installed per site specific PE approved engineering drawings.
- Selecting and sourcing the solid concrete ballast blocks. It is recommended that these solid concrete blocks have a minimum compressive yield strength of 3000 psi or greater OR comply with ASTM Designation C1491. Ballast Details: 4"x 8"x 16" (35 lbs typ); 2"x 8"x 16" (13.5 lbs typ).
- Periodically checking their installation and make adjustments as needed as the blocks could shift or disintegrate. It is also recommended that an industrial adhesive be used between ballast blocks when stacking.

Pre-Installation Checklist

- Determine the roofing manufacturer, material and warranty status. If the roof is under warranty, contact the local roofing manufacturer representative in order to schedule a pre-inspection and/or post-inspection as required by the roofing manufacturer. This process may take several weeks.
- Acquire written approval for solar installation and seismic anchor installation from roofing manufacturer, as required by the roofing manufacturer. This process may take several weeks.
- Verify that the selected PV module is compatible with the BRM system. Please consult module manufacturer's installation guidelines in order to verify mounting compatibility.
- Verify that all components have been ordered. For additional components, please contact IronRidge sales at sales@ironridge.com.
- Verify that the required amount of ballast blocks have been ordered. Applicable block sizes are: 4" x 8" x 16" (35 lbs Typ.) and 2" x 8" x 16" (13.5 lbs Typ.)
- Verify that your array does not interfere with roof obstacles and are within Roof Zone 1. Any modules that are not within Roof Zone 1 must be approved by a Licensed Professional Engineer in order to ensure proper ballasting and to verify structural capabilities of racking.

Tools Required

A torque wrench and cordless drill (non-impact) that support the following size



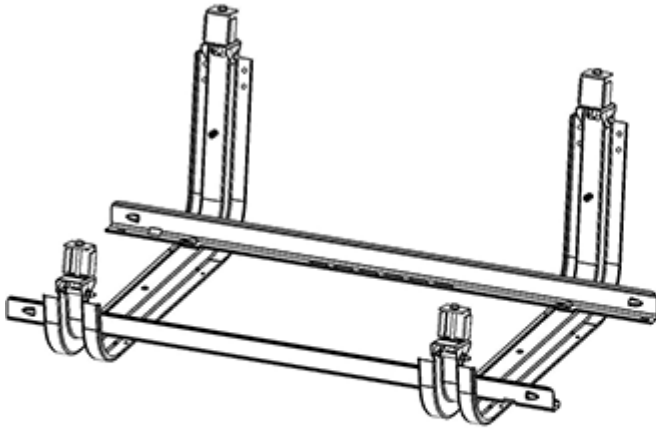
7/16"

3/8"

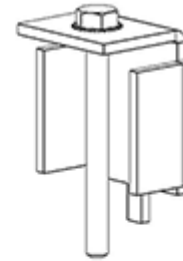
Torque requirements by location:

- A. Module Clamp Bolt (1/4" - 20 Bolt): 10 ft-lbs (120 in-lbs)
- B. Mounting Plate Nut (1/4" - 20 Nut): 5 ft-lbs (60 in-lbs)
- C. Mounting Plate and Ballast Tray Bolt and Wind Deflector Nut (1/4" - 20 Bolt): 7 ft-lbs (84 in-lbs)
- D. Wind Deflector TEK Screw (1/4" - 14 Screw): Torque until snug, do not overtighten.

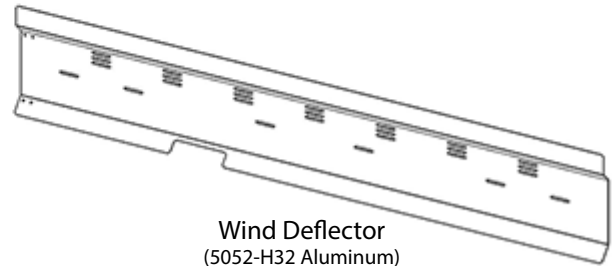
Core Components



Ballast Tray
(G90 Galvanized Steel)

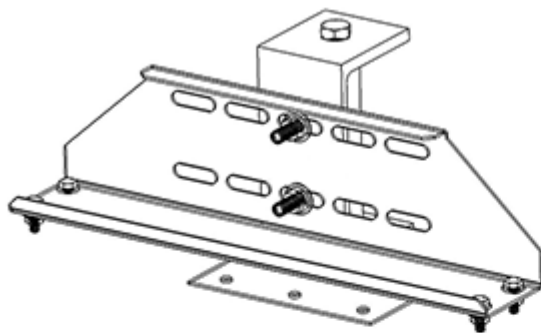


Module Clamp
(5052-H32 Aluminum)

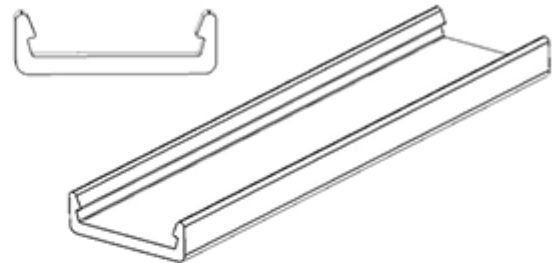


Wind Deflector
(5052-H32 Aluminum)

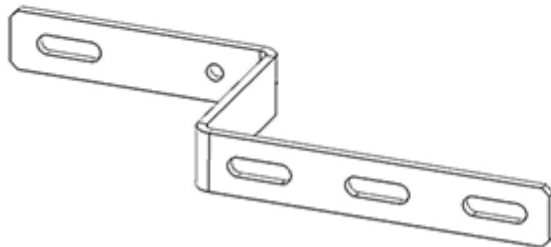
Optional Accessories



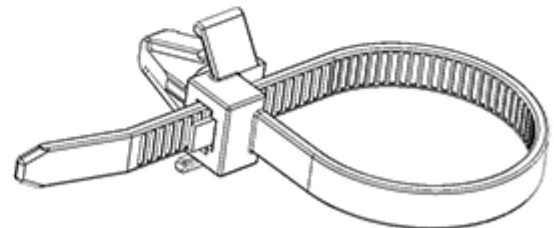
Seismic Anchor
(G90 Galvanized Steel and Aluminum)



Roof Pad
(100% Recycled Rubber)



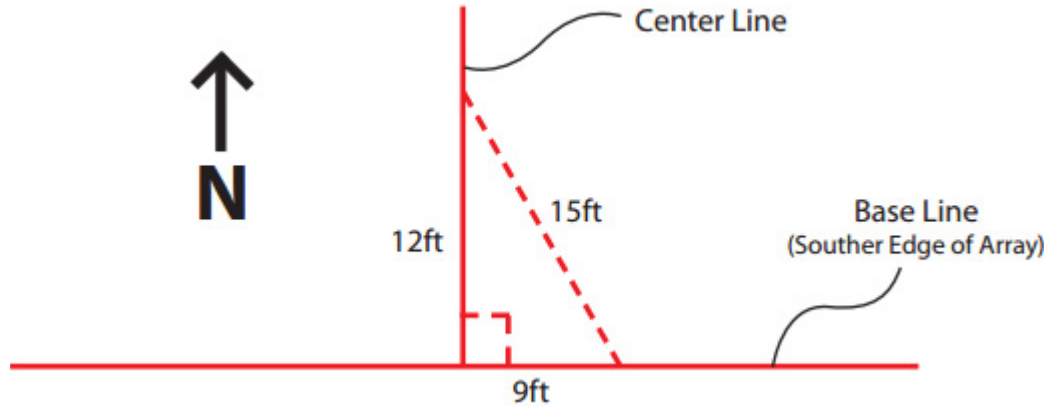
Microbracket Inverter
(5052-H32 Aluminum)



Wire Clip
(Weather Resistant Nylon 6.6)

Step 1. Array Layout

Locate the southern edge of the array and chalk a straight line from east to west. This will be your Base Line. Locate the center of the array and chalk a perpendicular line north to south. This will be your Center Line and your starting point for setting up the array.

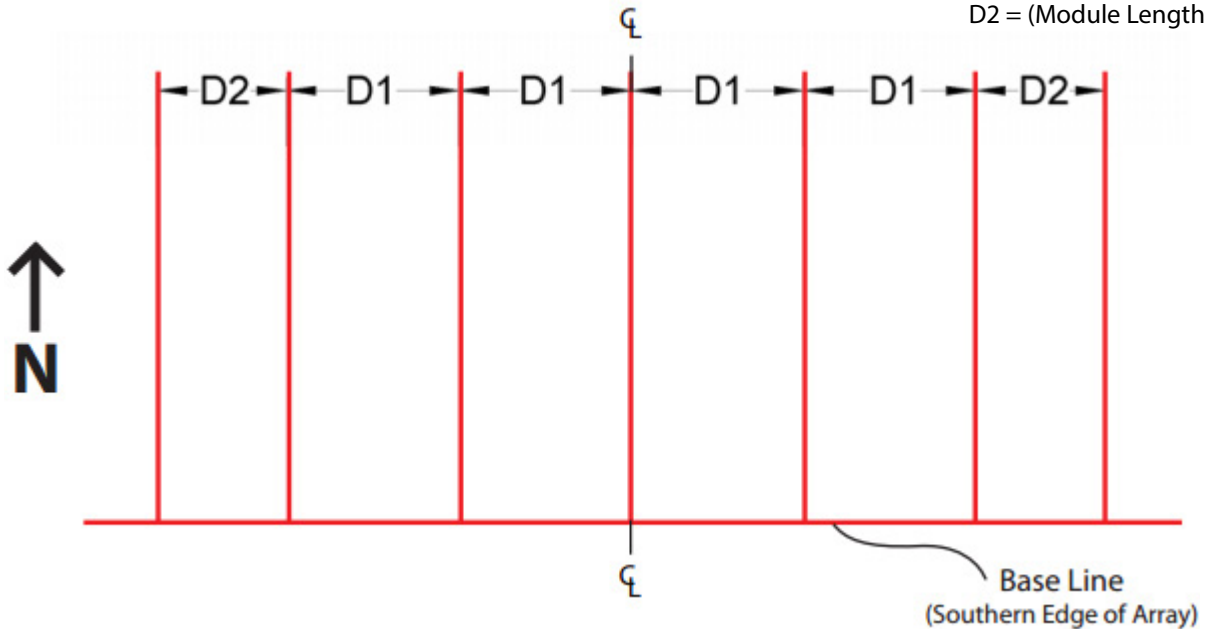


Step 2. Array Layout

Layout and chalk array as shown in illustration. For the internal modules, measure out from the Center Line the appropriate distance between the center of each Ballast Tray (D1). For trays on the east and west edges, use the "D2" distance to define this line. Once you have marked the appropriate distance between each Ballast Tray, chalk perpendicular lines from the Base Line for each Ballast Tray. For arrays with an even number of columns the Center Line will be the center Ballast Tray. For arrays with an odd number of E-W columns the Center Line will be the Ballast Tray nearest to the center of the array. (Note: If desired, pre-making the modules to the edge or center of the clamps or using a spacer stick may be used in lieu of the method described above.)

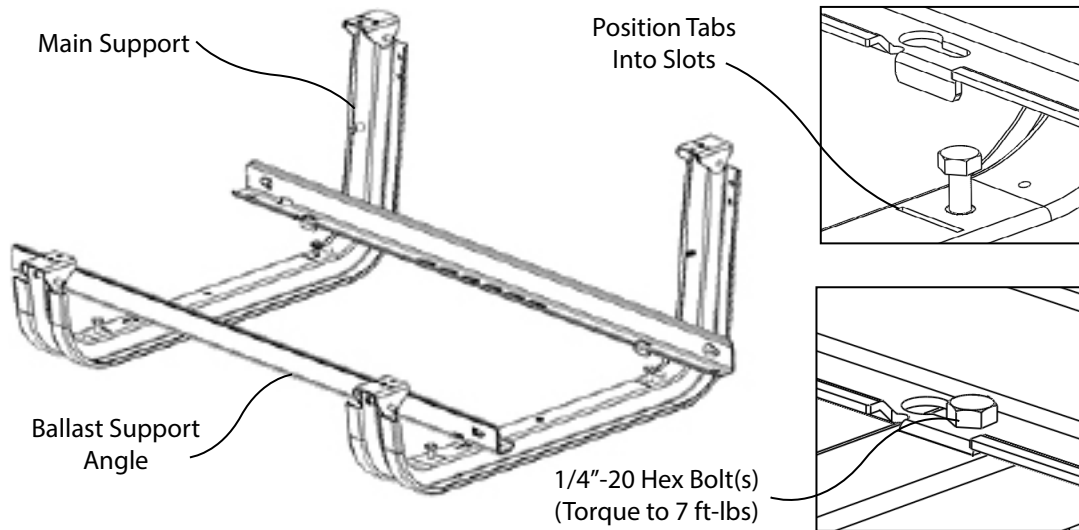
$$D1 = (\text{Module Length}) + 3/8''$$

$$D2 = (\text{Module Length}) - 16''$$



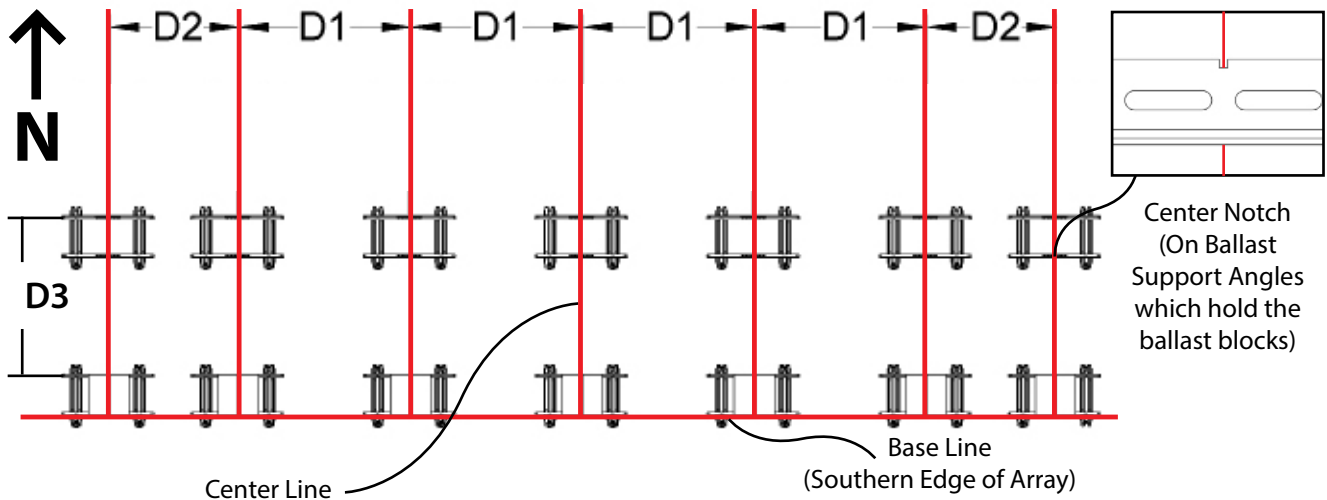
Step 3. Assemble Ballast Trays

To assemble the Ballast Trays, simply set two (2) Main Supports down and place two (2) Ballast Support Angles on top of them as shown below. The tabs on the Ballast Support Angles will fit into the slots located on the Main Supports and automatically locate the parts in the proper positions. Next, torque the four (4) 1/4"-20 Hex bolts to 7 ft-lbs (84 in-lbs). Note: Make sure that Ballast Support Angle tabs are fully inserted into the slots located on the Main Supports while tightening bolts. Assemble on clean, flat surface. If installing Roof Pads attach to Ballast Trays prior to placing on roof. See Roof Pad Installation instructions for reference. **IMPORTANT: The use of impact drills is not recommended.**



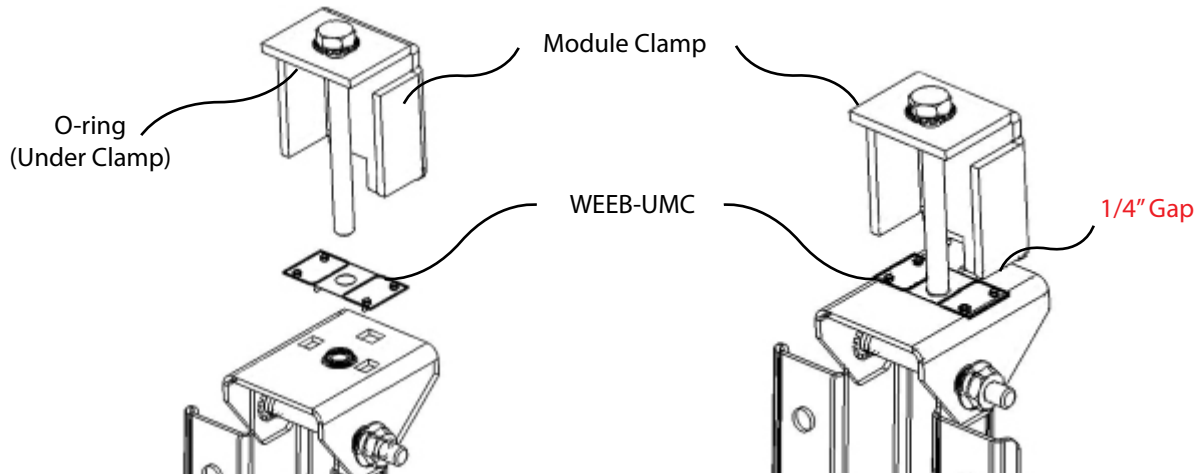
Step 4. Position Ballast Trays

First, place the south row of Ballast Trays on the Base Line and use the center notch on Ballast Support Angles (angles which hold the ballast blocks) to line up with the D1 and D2 marked lines. Next, place at least one full (or two half) ballast block(s) on the south row of Ballast Trays to secure in place. Placing ballast on other trays prior to installing modules may make installation more difficult. Then loosely place the next row of Ballast Trays. It may be helpful to make a hash mark on the east or west edge Ballast Tray to assist in loosely placing remaining rows. The equation to determine the distance from the north Ballast Support Angle to the north Ballast Support Angle on the next row is as follows: $D3 = \sqrt{\text{ModuleWidth}^2 - 46.932} + 21.97$



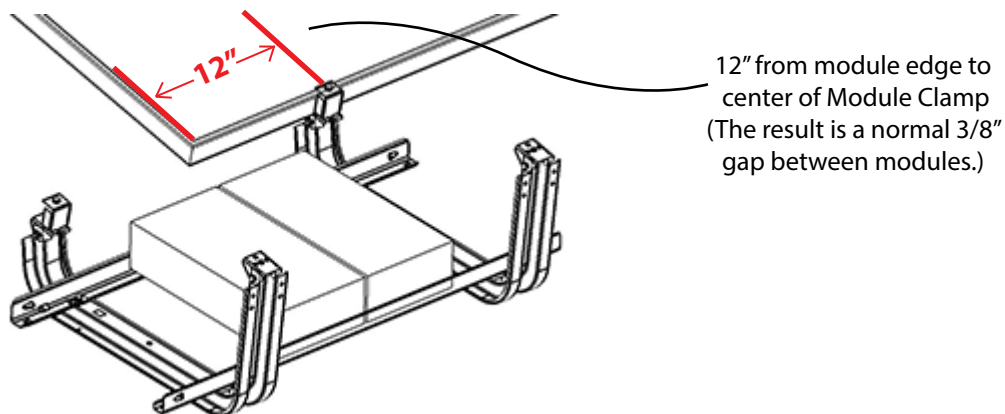
Step 5. Install WEEB and Clamp

Install a WEEB-UMC on each mounting place then loosely place Module Clamps by engaging the first few bolt threads, as shown below. Leave approximately 1/4" of space between the Module Clamp and the Mounting Plate so that the module can be placed under Module Clamp. The O-ring will hold the Module Clamp in place. However, the O-ring may need to be repositioned up as far as possible.



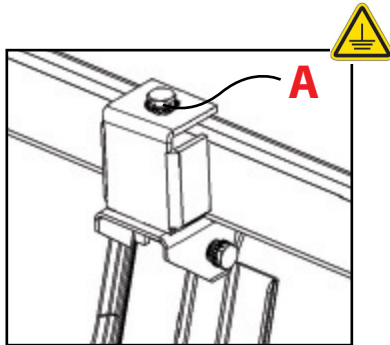
Step 6. Install Module

Place modules down one-by-one working out from the center of array. When installing the module, first set down the south edge of the module placing it underneath the Module Clamp. Then place the module underneath the Module Clamps on the second row of Ballast Trays, positioning the second row of Ballast Trays as needed. Make sure the Ballast Trays stay centered on the chalked lines. The edge of each module should measure 12" from the edge to the center of the Module Clamp, as shown below, and increases the difficulty of the installation.

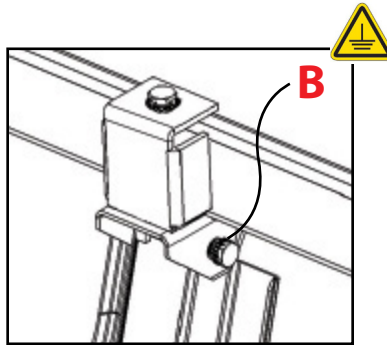


Step 7. Secure Module

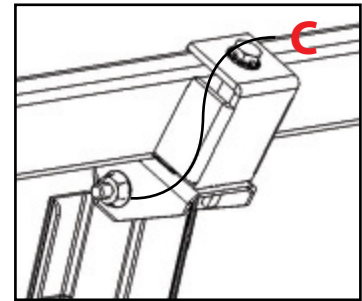
(Step A) To secure modules, first screw the Module Clamp Bolt and torque to 10 ft-lbs (120 in-lbs). Start with the modules south edge clamps first. Make sure that the module is positioned properly on the WEEB so that the WEEB teeth are underneath the module. (Step B) Next, secure Mounting Plate bolt and torque to 7 ft-lbs (84 in-lbs). (Step C) Then add nut to Mounting Plate Bolt and torque to 5 ft-lbs (60 in-lbs). Do not move Ballast Tray after clamping. Repeat process for remaining clamps. Repeat Steps 6 and 7 for each module working out from center of the array to either the East and/or the West.



Step A - Module Clamp Bolt
(Torque to 10 ft-lbs)



Step B - Mount Plate Bolt
(Torque to 7 ft-lbs)



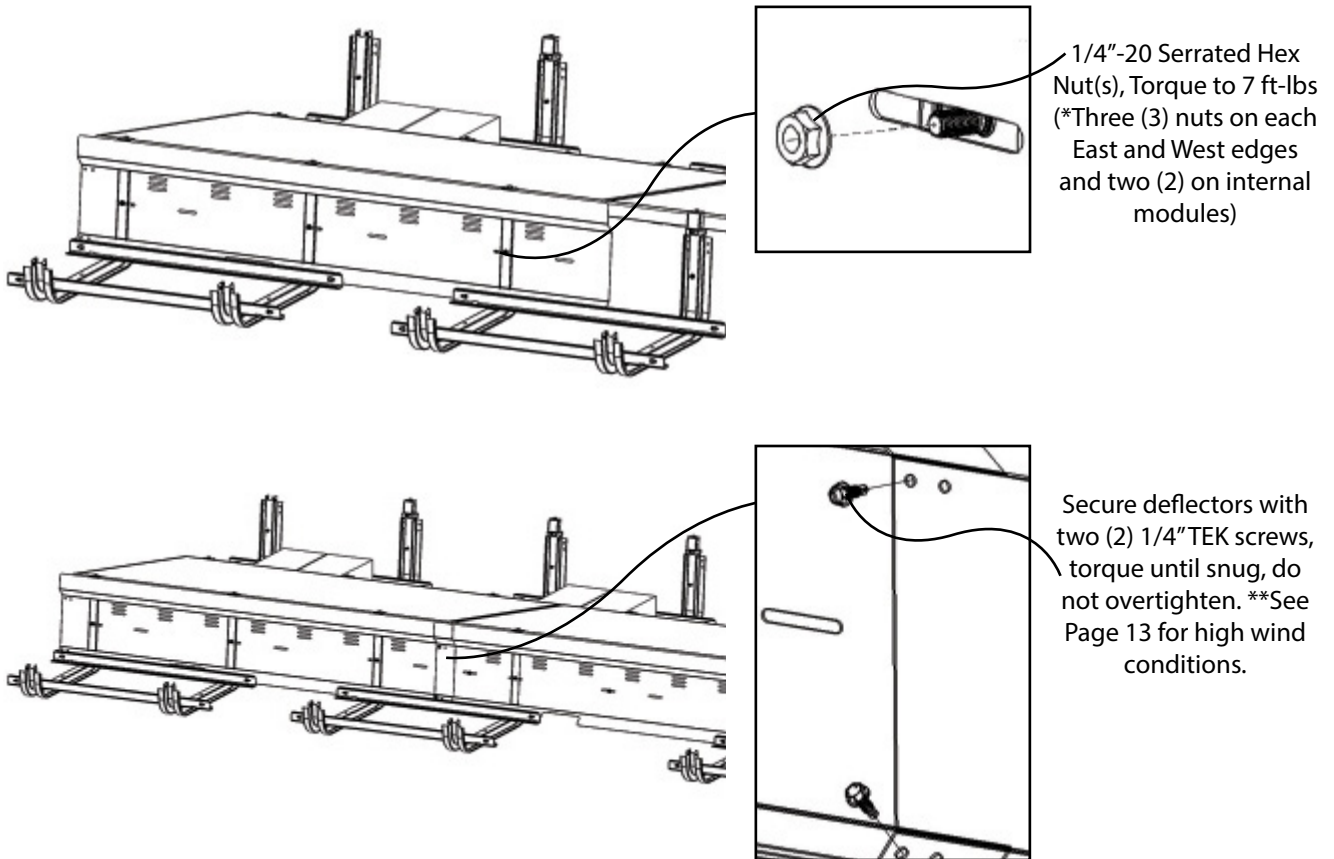
Step C - Mount Plate Nut
(Torque to 5 ft-lbs)

Important: While securing bolt on Module Clamp with one hand, it is helpful to use the other hand to pull underside of module snug to vertical faces of Module Clamp. Failure to do so may cause insufficient ground connection through WEEB penetrating features.

Step 8. Install Wind Deflector

To install the Wind Deflector, place deflector on the Ballast Trays working East to West. *Secure the first deflector with three (3) flanged nuts and torque to 7 ft-lbs (84 in-lbs). Repeat step for next deflector using two (2) flanged nuts. **Next, secure deflectors together with two (2) 1/4" TEK screws using the pre-drilled pilot holes on the topside (or east) deflector and torque until snug, do not overtighten. (It may be helpful to predrill holes on underside (or west) deflector prior to installing TEK screws.)

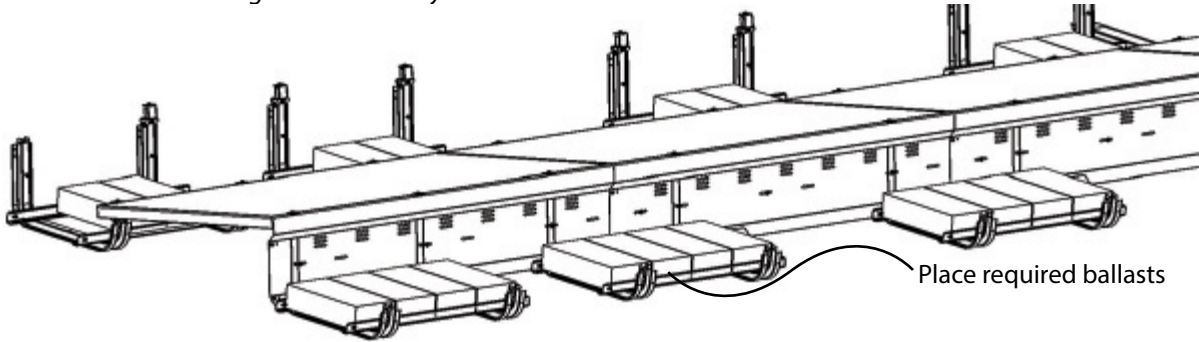
To help reduce the thermal expansion, it is recommended for a row of 12 or more modules to not connect together the 6th and 7th deflector. In other words, a maximum of 11 deflectors and a minimum of six deflectors are connected together with TEK screws. For example, a row with 11 modules all deflectors should be connected together with TEK screws. For a row with 12 modules, the sixth and seventh deflectors do not need to be connected together with TEK screws. There must always be a minimum of six deflectors connected together with TEK screws, if more than six deflectors exist in that row. (Connecting deflectors together with TEK screw provides stiffening which reduce ballast requirements.)



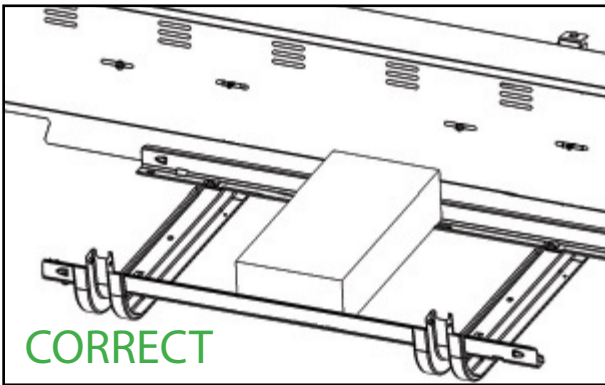
Important: If you were provided the (High) Wind Deflector Hardware Kit (#BRM-DFK) refer to Wind Deflector Hardware Kit Installation as this step will require two (2) additional TEK screws at each deflector connection.

Step 9. Place Ballasts

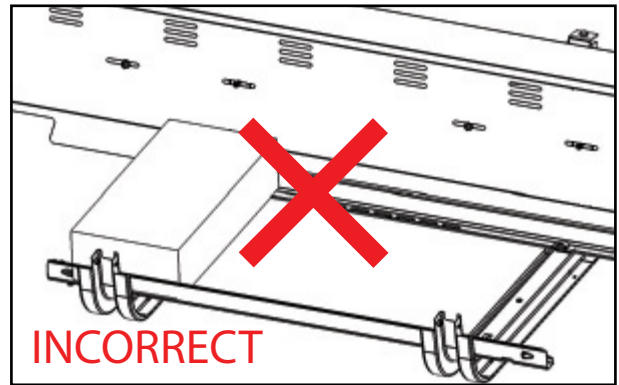
Place required ballast blocks centered on Ballast Tray with no gaps between them. Refer to stamped engineering report for proper ballast requirements and locations. Do not walk on ballast blocks as this may cause them to break. Ballast blocks are standard solid concrete blocks. Applicable block sizes are: 4" x 8" x 16" (35 lbs Typ.) and 2" x 8" x 16" (13.5 lbs Typ.) It is recommended that these solid concrete blocks have a minimum compressive yield strength of 3000 psi or greater OR comply with ASTM Designation C1491. It is also recommended that an industrial adhesive be used between ballast blocks when stacking two or more layers.



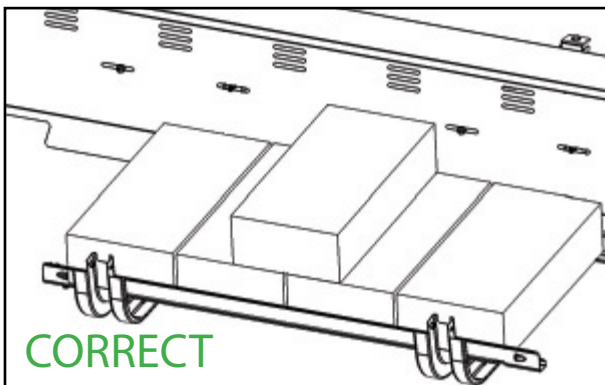
Important: When placing ballast blocks always center ballast blocks on tray and stack layer by layer. (See Examples Below)



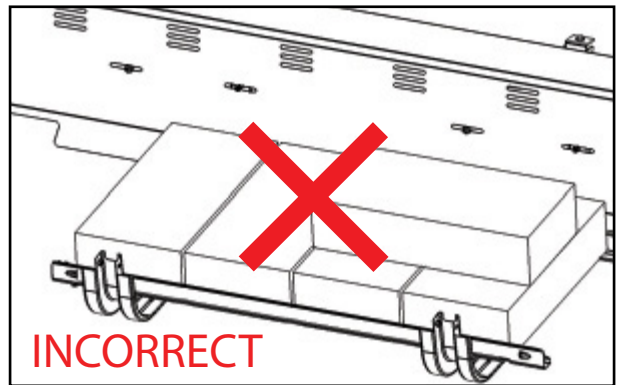
(1 Block)



INCORRECT



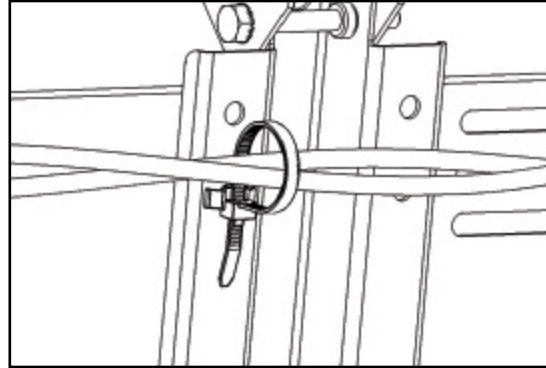
(5 Blocks)



INCORRECT

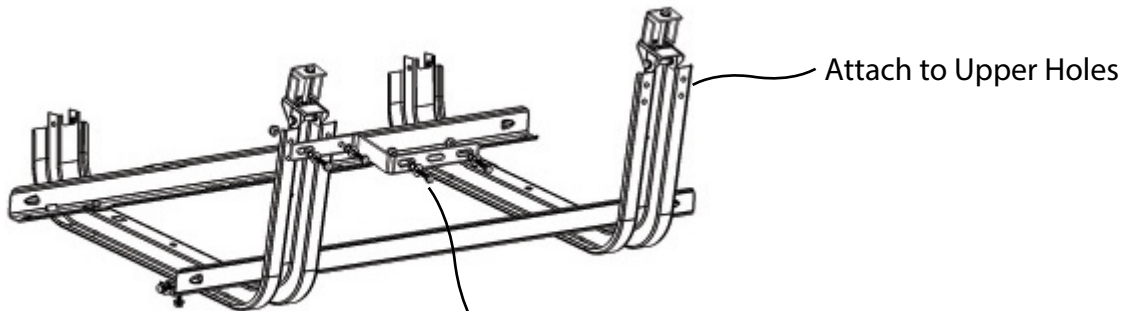
E-W Wire Clip Installation (Optional)

The E-W Wire Clip may be installed after or during module installation. To install the Wire Clips simply press the clip into the lower Ballast Trays mounting holes. Next, bundle the wire and use wire tie to hold in place as shown below. The E-W Wire Clips hold bundles up to 50 lbs and 1" in diameter.



Microinverter Bracket Installation (Optional)

To install the Microinverter Bracket attach bracket to tray and/or deflector with two (2) 1/4"-20 x 3/4" Hex Bolts, Nuts and Washers as shown below. Next, attach the microinverter to the bracket with two (2) 1/4"-20 x 1" Hex Bolts, Nuts and Washers. Ground per manufacturer's specifications. Bracket will fit most microinverters, refer to IronRidge Microinverter Compatibility List.



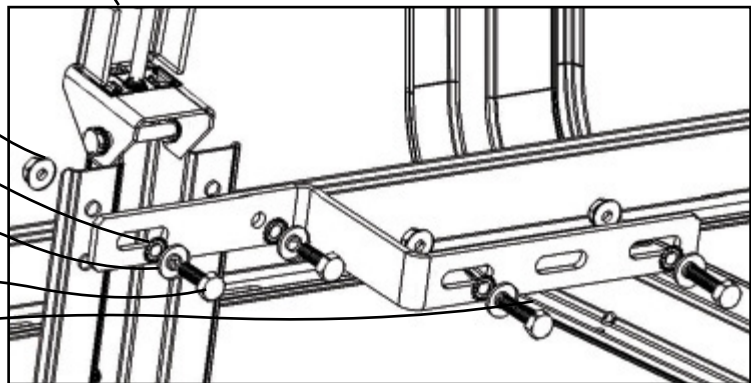
1/4"-20 Serrated Hex Nut(s)

Star Washer(s)

Flat Washer(s)

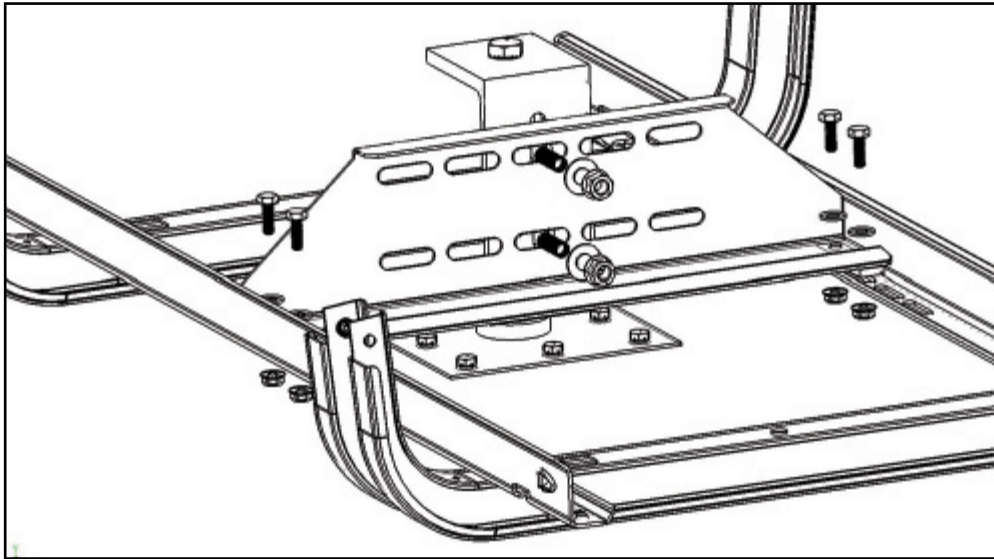
1/4"-20 x 3/4" Hex Bolt(s)

1/4"-20 x 1" Hex Bolt(s)



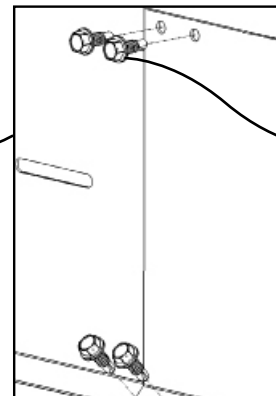
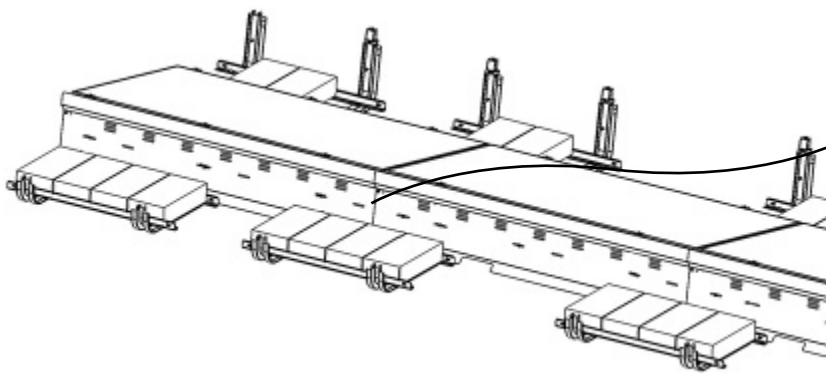
Seismic Anchor (Optional)

To install the Seismic Anchor, refer to IronRidge BRM Seismic Anchor Installation Manual and included EcoFasten’s ECO-44R-6” Installation Manual. Below is an illustration for reference only.



Wind Deflector Hardware Kit Installation (#BRM-DFK)

If you were provided with the Wind Deflector Hardware Kit (#BRM-DFK) you must secure deflectors together with four (4) 1/4” TEK screws using the pilot holes and torque to snug, do not overtighten. It may be helpful to predrill holes prior to installing TEK screws. Refer Step 7 for complete Wind Deflector installation.



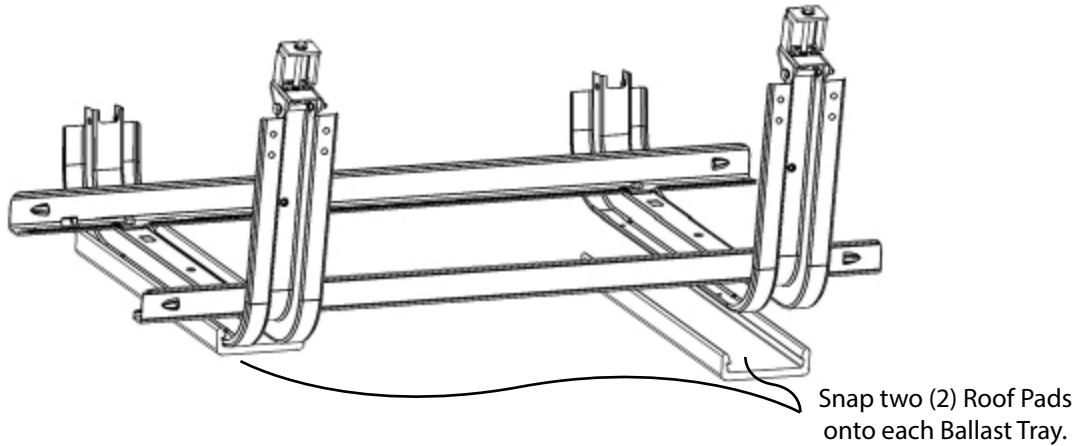
Secure deflectors with four (4) 1/4” TEK screws, as shown.

High Wind Site Examples (Module Size = 40” x 78”/ Importance Factor = 1.0):

- | | | |
|---------------|---------------------|------------------------|
| A. Exposure B | Wind Speed ≥ 120mph | Building Height ≥ 30ft |
| B. Exposure C | Wind Speed ≥ 100mph | Building Height ≥ 30ft |
| C. Exposure B | Wind Speed ≥ 110mph | Building Height ≥ 60ft |
| D. Exposure C | Wind Speed ≥ 90mph | Building Height ≥ 60ft |

Roof Pad (Optional)

To install Roof Pads, snap two (2) Roof Pads on to each Ballast Tray as shown below. Install prior to placing Ballast Trays down.

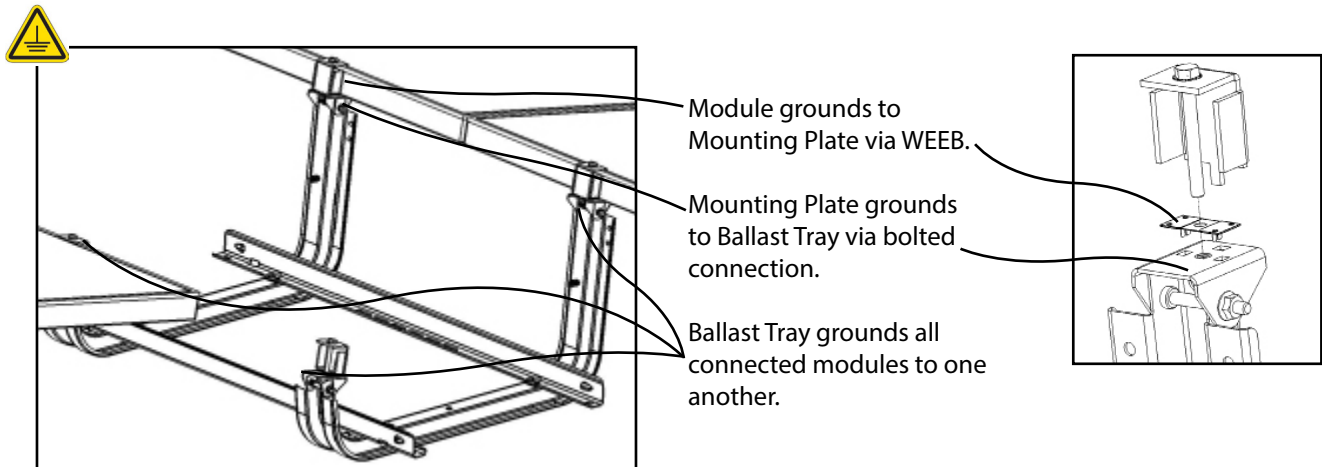


Grounding Setup

All electrical installation and procedures should be conducted by skilled, licensed and bonded electricians. All work must comply with all national, state and local installation procedures, product and safety standards. These standards include but are not limited to applicable National Electrical Code (NEC®), National Electrical Installation Standards (NEIS™), UL Standards, and OSHA Regulations.

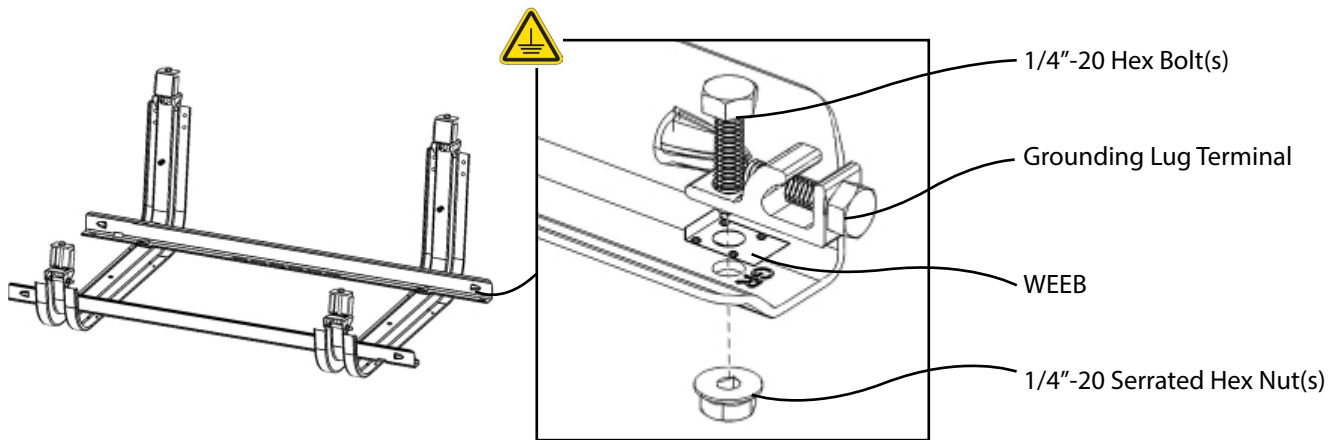
Refer to Wiley WEEB-UMC manual for proper WEEB installation and stamped electrical drawings for system grounding requirements. Grounding Lug locations are shown below for reference. There are four (4) grounding locations on each Ballast Tray located at each end of each Ballast Support Angle.

Grounding Path



Grounding Setup

Install one grounding lug at the end of each row or as required by local jurisdiction (AHJ).



Warranty Information

Effective for IronRidge, Inc. (“IronRidge”) mounting structure components (“Products”) manufactured after April 1st, 2012, IronRidge provides the following warranties, for Products installed properly and used for the purpose for which the Products are designed:

- finishes shall be free of visible defects, peeling, or cracking, under normal atmospheric conditions, for a period of three (3) years from the earlier of (i) the date of complete installation of the Product or (ii) thirty days after the original purchaser’s date of purchase of the Product (“Finish Warranty”);
- components shall be free of structurally-related defects in materials for a period of ten (10) years from the earlier of (i) the date of complete installation of the Product or (ii) thirty days after the original purchaser’s date of purchase of the Product;
- components shall be free of functionally-related manufacturing defects for a period of twenty (20) years from date of manufacture.

The Finish Warranty does not apply to: (a) surface oxidation of the galvanized steel components or any foreign residue deposited on Product finish; and (b) Products installed in corrosive atmospheric conditions, as defined solely by IronRidge; corrosive atmospheric conditions include, but are not limited to, conditions where Product is exposed to corrosive chemicals, fumes, cement dust, salt water marine environments or to continual spraying of either salt or fresh water. The Finish Warranty is VOID if (c) the practices specified by AAMA 609 & 610-02 – “Cleaning and Maintenance for Architecturally Finished Aluminum” (www.aamanet.org) are not followed by Purchaser for IronRidge’s aluminum based components; and (d) if the practices specified by ASTM A780 / A780M - 09 “Standard Practice for Repair of Damaged and Uncoated Areas of HotDip Galvanized Coatings” are not followed by Purchaser for IronRidge’s galvanized steel-based components.

The warranties above do not cover any parts or materials not manufactured by IronRidge, and exclude nonfunctionally-related defects, as defined solely by IronRidge. The warranties do not cover any defect that has not been reported to IronRidge in writing within twenty (20) days after discovery of such defect.

In the event of breach of or non-compliance with the warranties set forth above, IronRidge’s sole obligation and liability, and the sole and exclusive remedy for such breach or non-compliance, shall be correction of defects by repair, replacement, or credit, at IronRidge’s sole discretion. Such repair, replacement or credit shall completely satisfy and discharge all of IronRidge’s liability with respect to these warranties.

Refurbished Product may be used to repair or replace the defective components. Transportation, installation, labor, or any other costs associated with Product replacement are not covered by these warranties and are not reimbursable. These warranties additionally do not cover (a) normal wear, or damage resulting from misuse, overloading, abuse, improper installation (including failure to follow professional instruction and certification), negligence, or accident, or from force majeure acts including any natural disasters, war or criminal acts; and (b) Products that have been altered, modified or repaired without written authorization from IronRidge or its authorized representative; and (c) Products used in a manner or for a purpose other than that specified by IronRidge. A formal document proving the purchase and the purchase date of the Product is required with any warranty claim.

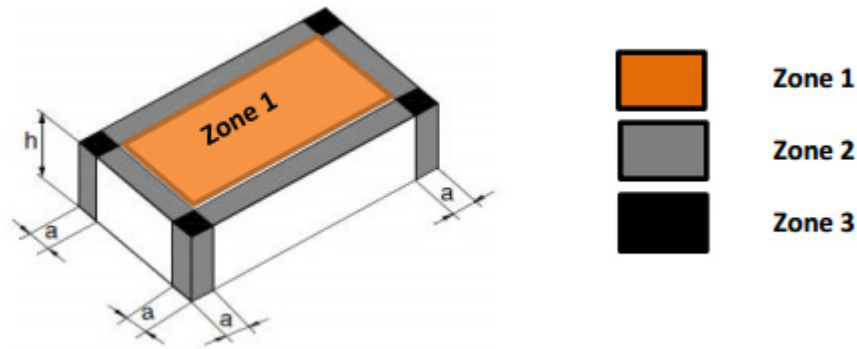
Except as set forth above, IronRidge sells the Products on an “AS IS” basis, which may not be free of errors or defects, and ALL EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES, INCLUDING ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, QUALITY, WORKMANLIKE EFFORT, CORRESPONDENCE TO DESCRIPTION, DESIGN, TITLE OR NON-INFRINGEMENT, OR ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE OR TRADE PRACTICE, ARE HEREBY DISCLAIMED.

Setback Distance and Roof Zone Definitions

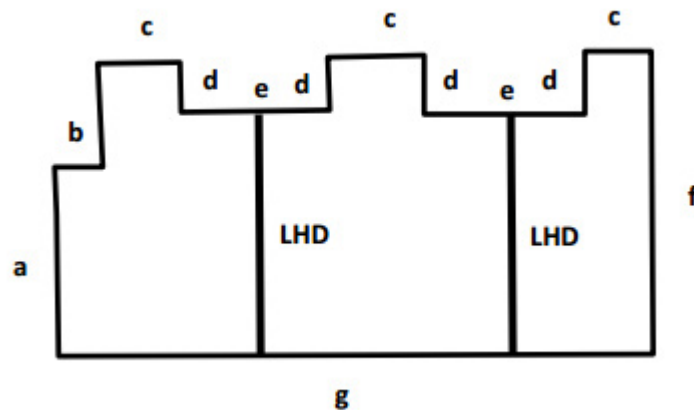
The Setback Distance allows for the definition of Roof Zones 1, 2, and 3. The BRM System is intended to be installed in Roof Zone 1. Therefore, the Setback Distance is the minimum required distance from the edge of the building to the BRM System. If your layout is within Roof Zone 2 or 3 or if you have additional questions regarding roof zone compliance, please contact IronRidge sales at sales@ironridge.com. Further description of the ASCE method used is described below.

The following describes the method developed by the ASCE building codes in order to define setback distance “a”. Setback distance “a” (ASCE 7-05), is defined as either:

- a) 10 percent of least horizontal dimension, LHD (least horizontal MAJOR dimension that is parallel to the wind direction) OR
- b) 40% of the building height (0.4h), whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft. (0.9 m).



Roof Zones (flat roof - ASCE building codes)



Example 1: Dimension “LHD” would be the Least Horizontal Distance because it is the least “major” horizontal dimension of the building.

Roof Obstruction Definition

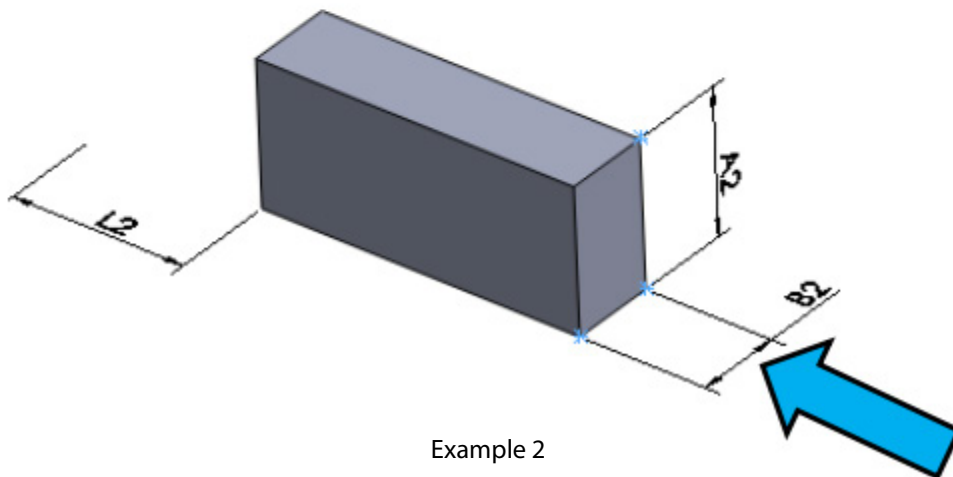
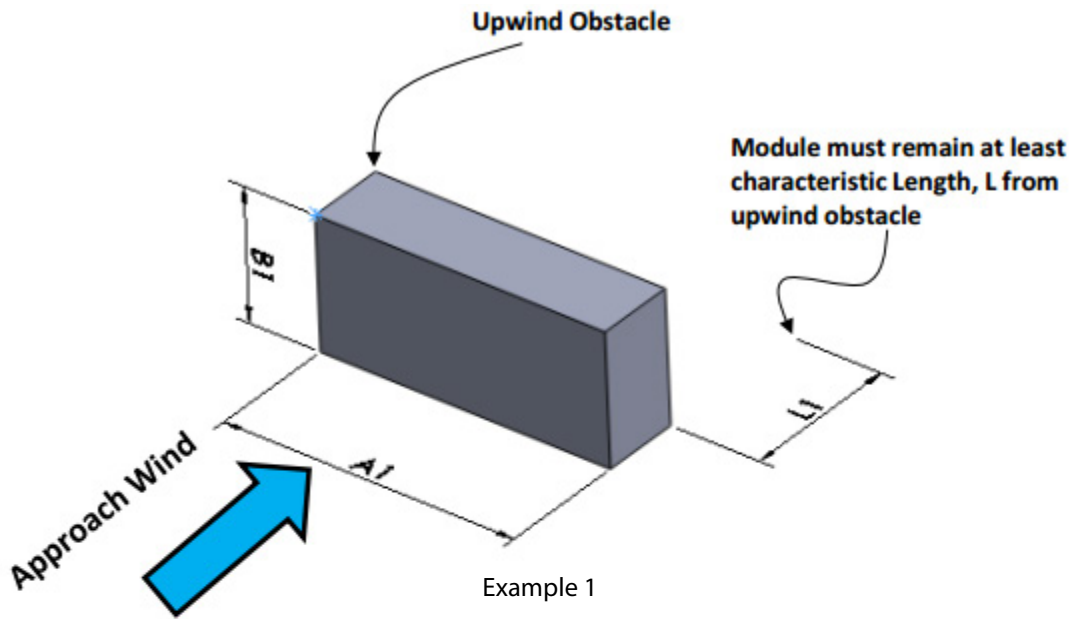
Description: If possible, modules should not be placed within a characteristic Length, L of an obstruction. If it is required that modules be placed within this characteristic Length, L then please contact IronRidge for further analysis.

$$L = A^{1/3} B^{2/3}$$

Where:

A = Greater dimension between height and width of obstruction.

B = Lesser dimension between height and width of obstruction.



The equation shown and the dimensions are based on the upwind face (normal to the flow).

Wind Importance Factor Reference Table

Occupancy Category	Criteria	Examples	If V < 100 mph	Hurricane Prone Regions with V > 100 mph
I	Low hazard to human life	Agricultural facilities, certain temporary facilities, minor storage facilities	0.87	0.77
II	All other structures	Houses, residential buildings, etc.	1.00	1.00
III	Substantial hazard to human life	Schools, community centers, healthcare, etc.	1.15	1.15
IV	Essential facilities	Hospitals, fire/police stations, water storage, power generating facilities, telecommunication towers	1.15	1.15

References:

1. SEI/ASCE 7-05 Minimum Design Loads for Buildings and Other Structures (ASCE) Chapter 1, Table 1-1 and Chapter 6, Table 6-1.



Experience. Technology. Answers.™

December 15th, 2011

To: Whom it may concern

Re: WEEB-UMC compatibility with IronRidge Ballasted Roof Mount System

From: Burndy, LLC

Burndy LLC has tested the use of the WEEB-UMC with aluminum module frames and the Iron Ridge Ballasted Roof Mount System. Wiley approves the use of the WEEB-UMC with the Iron Ridge Ballasted Roof Mount System, galvanized steel end clamp and solar modules with aluminum frames.

The WEEB-UMC must be used to bond the aluminum module frames to the Iron Ridge BRM mounting plate. The WEEB-UMC must be installed between the module frame and the mounting plate on the ballast mount assembly. Each bolt/nut combination that installs a WEEB-UMC must be tightened to at least 10 ft-lbs / 13.5 N-m of torque. 1/4"-20 hardware must be used.

All bolts used to install the WEEB-UMC must have general purpose anti-seize applied to their threads prior to installation.

The WEEB-UMC does not bond the aluminum mounting plate to the ballast pan.

Any installation that does not follow these instructions is done so without the approval of Burndy LLC. Please contact Burndy with any questions or concerns regarding this note.

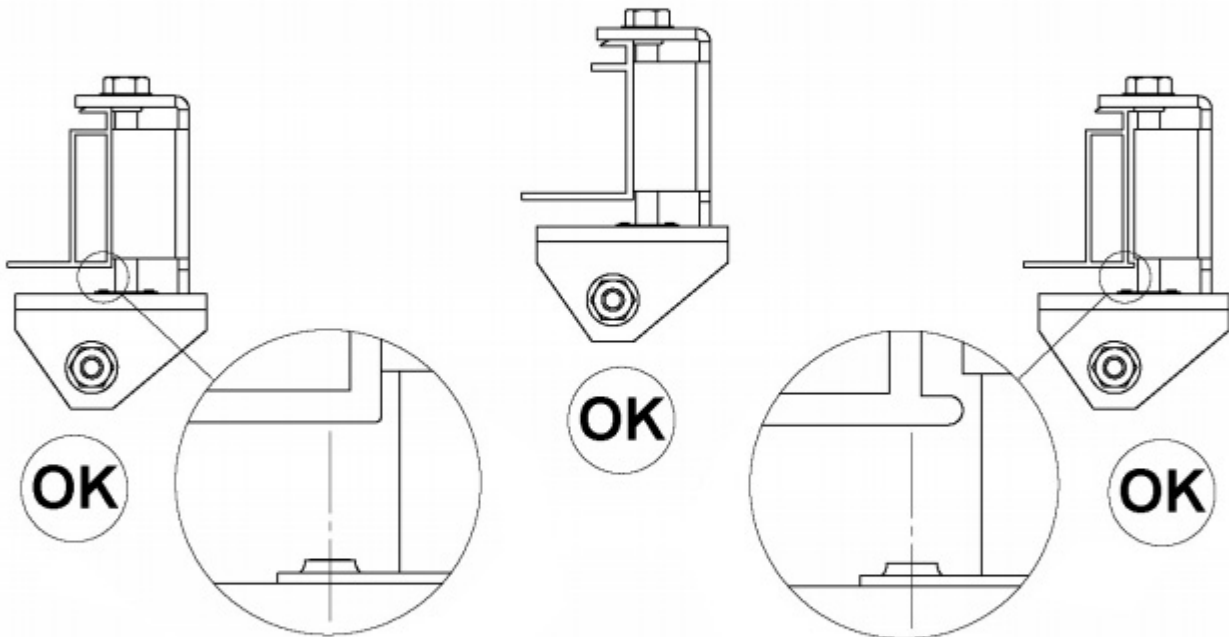
Paul Kovalov
Product Engineer
Burndy LLC
pkovalov@burndy.com
(845) 853-9908

WEEB COMPATIBILITY

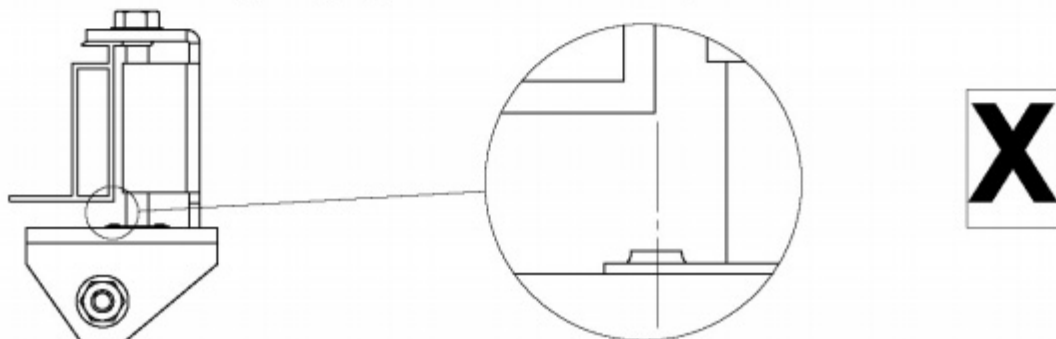
The WEEB family of products can be used to bond anodized aluminum, galvanized steel, steel and other electrically conductive metal structures. All installations shall be in accordance with NEC requirements in the USA and with CSA C22.1 in Canada. The WEEBs are for use with modules that have a maximum series fuse rating of less than 25A.

Standard Top Down Clamps

The WEEBs used for bonding the PV modules to the mounting rails are compatible with various cross-sections of module frames. The following are examples of module frames that are compatible. Notice that the WEEB teeth are positioned completely under the edge of the module frame.

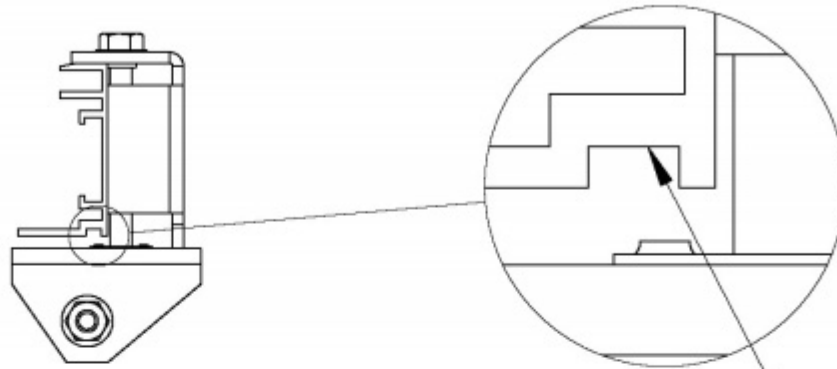


The following is an example of a module frame that is incompatible with the WEEB. The single lip on this module frame won't allow the teeth of the WEEB-UMC to fully engage the bottom flange.

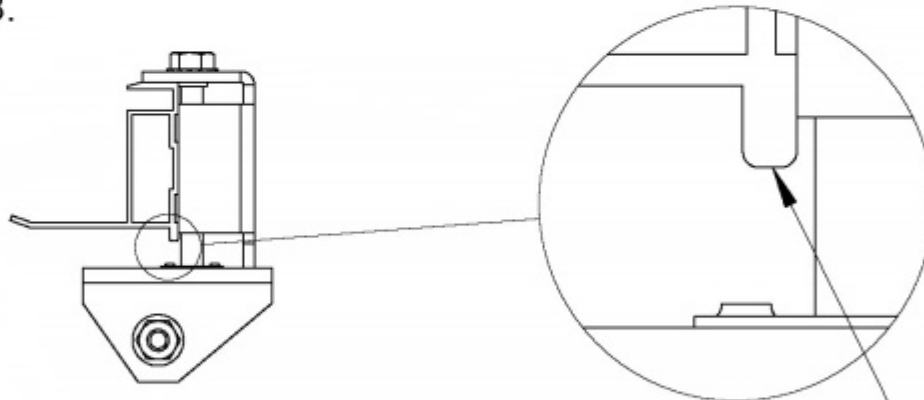


WEEB COMPATIBILITY

Module frames like those shown here may have a ridge or lip on the bottom edge of the frame that would prevent the WEEB teeth from fully embedding.



Shown here is an example of a lip that will prevent the WEEB teeth from properly penetrating the module frame. This type of frame is not compatible with the WEEB.



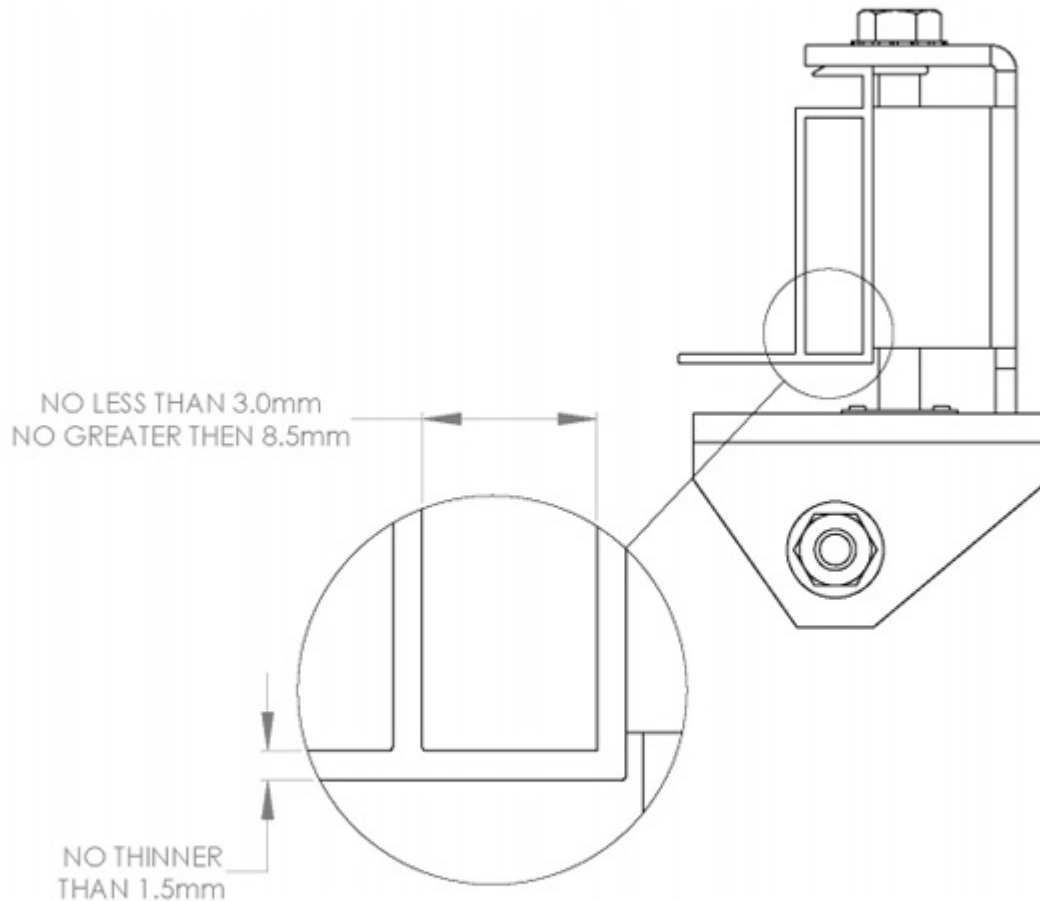
Shown here is an example of a groove that will prevent the WEEB teeth from properly penetrating the module frame. This type of frame is not compatible with the WEEB.

Important Note:

Inspect each module frame used with a WEEB to ensure that the bottom mounting face of the frame is flat, and that there are no hinderances to embedding WEEB teeth. Do not use a module with a frame that prevents the WEEB teeth from embedding fully.

WEEB-UMC on Boxed Module Frames

Certain module frames do not have enough structural strength to withstand the force required to embed a WEEB. These frames will deform and therefore not allow sufficient penetration of the WEEB teeth. The general requirements for minimum module frame thickness of "boxed" type module frames are illustrated below.



Important notes

1. Use general purpose anti-seize compound on fastener threads when installing WEEBs.
2. The NEC section 690.43 states, "Exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded in accordance with 250.134 or 250.136(A) regardless of voltage."
3. WEEBs are intended for SINGLE USE ONLY. Functionality will not be guaranteed if reused.