

Attn: Sean McDonald, CEO, IronRidge Inc.

Date: February 27th, 2025

Re: Engineering Certification for the IronRidge Design Assistant – XR and AIRE Pitched Roof Systems

The IronRidge Design Assistant (DA) software includes structural analysis for the IronRidge XR system (XR10, XR100 and XR1000 rails) and AIRE system (A1 and A2 Rails), when used in pitched roof applications. The IronRidge XR and AIRE Flush Mount Systems are proprietary rooftop mounting systems used to support photovoltaic (PV) modules installed in portrait or landscape orientation and set parallel to the underlying roof surface. PV modules are supported by extruded aluminum rails and secured to the rails with IronRidge mounting clamps. The rails are side mounted to a selected roof attachment with stainless steel bonding hardware and the attachment is secured directly to the underlying roof structure.

This letter certifies that the IronRidge Design Assistant, used for the structural analysis of the IronRidge XR or Aire Flush Mount Systems, complies with the following codes and design criteria. When the IronRidge XR and AIRE flush mount systems are installed according to the IronRidge DA project report and manufacturer's installation guidance, compliance with below codes and design criteria is met.

Building Codes:

1. ASCE/SEI 7-10, 7-16, 7-22, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers
2. International Building Code, 2012-2024 Edition
3. International Residential Code, 2012-2024 Edition
4. AC428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES
5. Aluminum Design Manual 2015 & 2020, by The Aluminum Association, Inc.
6. ANSI/AWC NDS-2015 & 2018, National Design Specification for Wood Construction, by the American Wood Council
7. SEAOC (Structural Engineer Association of California) report PV2-2017 Wind Design for Solar Arrays

Sincerely,



EXPIRES: 12/31/2025

Nancy Elaine Schubert, P.E.

The IronRidge DA meets the above code requirements provided the following Design Criteria.

Design Criteria:

- a. Structure Risk Category II, III.
- b. Basic Wind Speed 90-180 (mph) per ASCE 7 Chapter 26 Figures 26.5-1B & 26.5-1C.
- c. Wind Exposure Category = B, C & D.
- d. Topographic Factor $K_{zt} = 1.0$.
- e. Roof Zones per ASCE 7-16, 7-22 Chapter 30 for Gable or Hip roofs.
- f. Exposed modules per ASCE 7-16, 7-22 Chapter 29.
- g. Ground Snow Load = 0-120 (psf) per ASCE 7 Fig. 7.2-1.
 - a. No other special snow conditions are considered including unbalanced, drifting, sliding, retention, ponding snow or rain on snow surcharge.
- h. Building Height Max = 60', defined as the average of the roof eave height and the roof ridge height measured from grade for roofs with pitches above 10 degrees and defined as the eave height for roofs with pitches less than or equal to 10 degrees.
- i. Roof Pitch = 8-60 degrees.
- j. Seismic Importance = 1.0.
- k. Minimum 2" clearance and maximum 10" clearance from top of PV panel to roof surface.

Roof Attachments that are analyzed in the Ironridge DA online tool are limited to IronRidge and QuickMount branded products. Third party supplied roof attachments are not reviewed; when using third party attachments the structural capacity, connection to IronRidge Rails and applicability to a specific project are to be verified by a registered design professional.

The IronRidge DA online tool is intended to be used under the responsibility of a registered design professional where required by the authority having jurisdiction. Any user of the IronRidge DA shall have sufficient structural engineering knowledge and experience to understand the required design criteria per the above applicable building codes, verify if the IronRidge DA is applicable to the project, and select the appropriate values for all input parameters within the IronRidge DA.

This certification excludes evaluation of:

1. The structure to support the loads imposed on the building by the array; including, but not limited to, strength and deflection of structural framing members, fastening and/or strength of roofing materials, and/or the effects of snow accumulation on the structure.
2. The capacity of the solar module frame to resist the loads.

Project Details			
Name	Jose Gonzalez	Date	05/30/2025
Location	3059 Old Stage Road North, Coats, NC 27521	Total modules	18
Module	JA Solar : JAM54S31-405/MR (30mm)	Total watts	7,290
Dimensions	Dimensions: 67.8" x 44.65" x 1.18" (1722.0mm x 1134.0mm x 30.0mm)	Attachments	30
ASCE	7-10	Rails per row	2



System Weight	
Total system weight	951.8 lbs
Weight/attachment	31.7 lbs
Racking weight	98.6 lbs
Distributed weight	2.5 psf

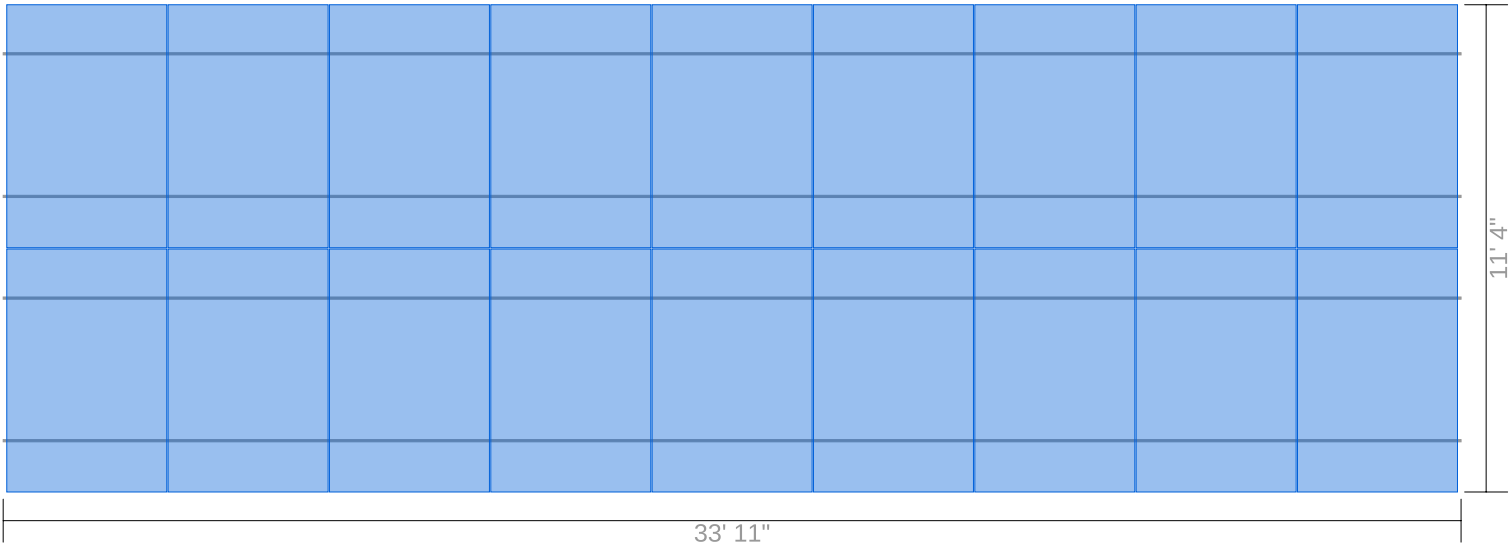
Load Assumptions	
Wind exposure	C
Wind speed	120 mph
Ground snow load	15 psf
Attachment spacing portrait	5.3333'

Roof Information			
Roof Material Family	Comp Shingle	Roof material	Comp Shingle
Risk category	II	Roof attachment	Halo UltraGrip (Rafter attached) [Global] [US]
		Staggered attachments	Yes
Attachment hardware	T Bolt		
Specific gravity	0.42		

Roof Plane A					
Height	15 ft	Slope	23 °	Rafter spacing	16 in

Roof Plane A: Roof Section 1		
Details		Weights
Panels: 18	Provided rail: 168' [12 x 168"]	Total weight: 951.8 lbs
Rail orientation: East-West	Attachments: 30	Weight/attachment: 31.7 lbs
Panel orientation: Portrait	Splices: 8	Total Area: 384.2 sq ft
Entry type: Graphical	Clamps: 32	Distributed weight: 2.5 psf

Diagram



Segments								
Identifier	Columns	Row length	Rail length	Cantilever	Rail	Attachments	Splices	Clamps
A	9	33' 11"	33' 11"	11"	84' [6 x 168"]	15	4	16
Row segment totals (x 2) →					168' [12 x 168"]	30	8	32

Span Details XR10 - Portrait		
Zone	Max span	Max cantilever
1	6' 8"	2' 8"
2	5' 11"	2' 4"
3	4' 8"	1' 10"

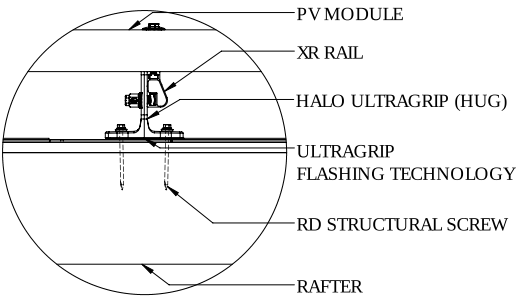
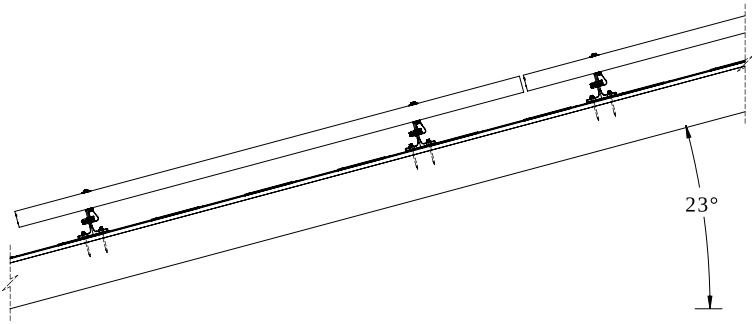
Reaction Forces XR10 - Portrait					
Zone	Uplift (PSF)	Down (lbs)	Uplift (lbs)	Lateral Par (lbs)	Lateral Perp (lbs)
1	13.8	222	187	58	4
2	24.6	222	362	58	4
3	N/A	N/A	N/A	N/A	N/A

Attachment Span Details Halo UltraGrip (Rafter attached) [Global] [US] - Portrait	
Zone	Max attachment span
1	6' 8"
2	5' 11"
3	4' 8"

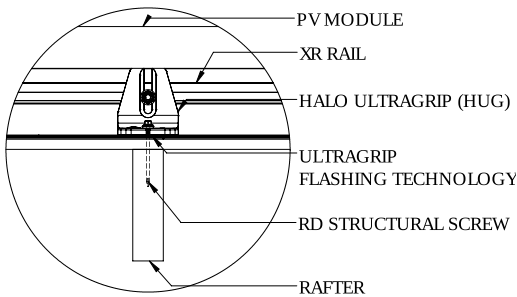
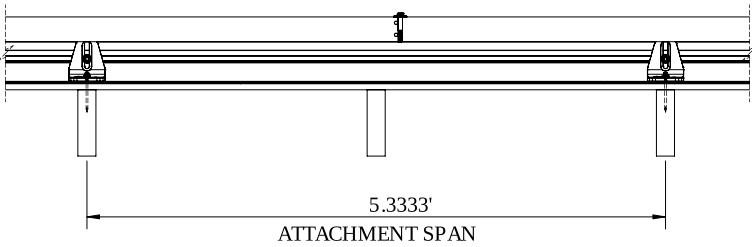
*Optional - Attachment Span Details Halo UltraGrip (Deck attached) [Global] [US] - Portrait	
Zone	Max attachment span
1	5' 6"
2	2' 8"
3	1' 8"

* Based on minimum 7/16" sheathing thickness

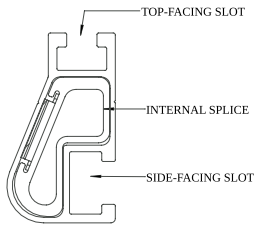
Side View (portrait)



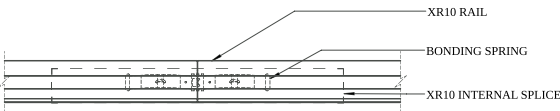
Front View (portrait)



Splice Details

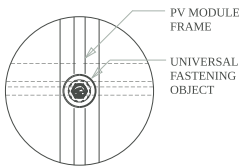


XR10

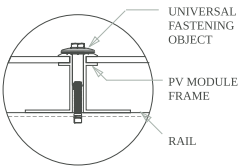


Splice Connection

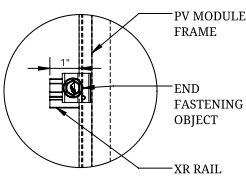
Clamp Detail



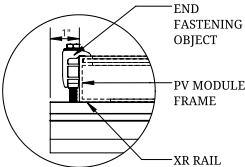
Mid Clamp, Plan



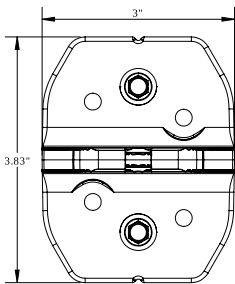
Mid Clamp, Front



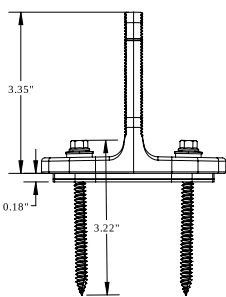
End Clamp, Plan



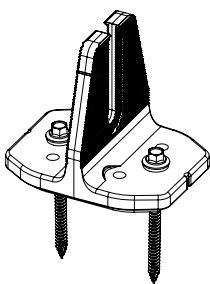
End Clamp, Front



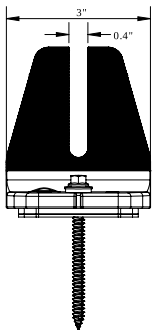
Plan View



Side View

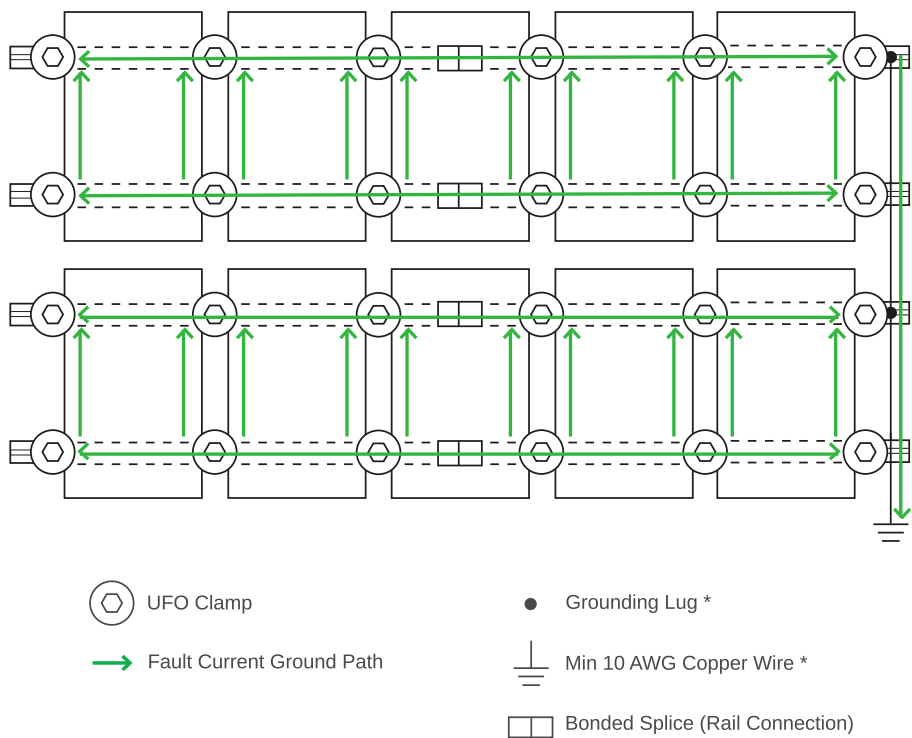


Perspective View



Front View

Grounding Diagram



* Grounding Lugs and Wire are not required in systems using Enphase microinverters.

Bill of Materials		
Part	Spares	Qty
Rails & Splices		
XR-10-168A XR-10, 168" (14') Clear	0	12
XR10-BOSS-01-M1 Bonded Splice, XR10	0	8
Clamps & Grounding		
UFO-CL-01-A1 Universal Module Clamp, Clear	0	32
UFO-END-01-A1 End Fastening Object (End Clamp, 30-40mm), Mill	0	8
XR-LUG-03-A1 Grounding Lug, Low Profile	0	2
Attachments		
QM-HUG-01-M1 Halo UltraGrip, Mill	0	30
HW-RD1430-01-M1 RD Structural Screw, 3.0L	0	60
* Add desired additional screws by adjusting spares column.		
BHW-TB-03-A1 T-Bolt, Bonding Hardware	0	30

ATTACHMENTS

PRE-INSTALLATION

- ❑ Verify module compatibility. See [Page 21](#) for info.

TOOLS REQUIRED

- | | |
|---------------------------------|-----------------------|
| ❑ Cordless Drill (non-impact) | ❑ 3/8" Socket |
| ❑ Impact Driver (for lag bolts) | ❑ 1/8" Drill Bit |
| ❑ Torque Wrench (0-250 in-lbs) | ❑ 1/4" Drill Bit |
| ❑ 7/16" Socket | ❑ T30 Bit |
| ❑ 1/2" Socket | ❑ Channel Lock Pliers |
| ❑ 9/16" Socket | ❑ #3 Phillips Bit |
| ❑ 7/32" Drill Bit | ❑ 3/16" Hex Bit |

BONDING HARDWARE TORQUE VALUES

Please refer to each attachment's individual section for full details on all torque values and instructions.

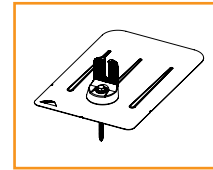
- ❑ 3/8" Bonding Hardware Nuts (7/16" Socket): 250 in-lbs
- ❑ All Tile Hook Carriage Bolts (7/16" Socket): 132 in-lbs
- ❑ Flat Roof Attachment Nuts (9/16" Socket): 250 in-lbs
- ❑ Lynx Set Screw (3/16" Hex Drive): 150 in-lbs
- ❑ Lynx Flange Nut (1/2" Socket): 150 in-lbs

ATTACHMENTS

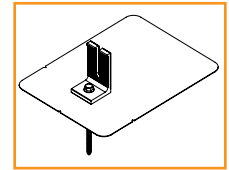
COMPOSITION SHINGLE



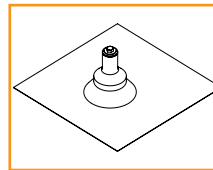
FlashFoot2



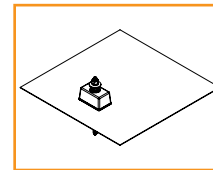
FlashVue



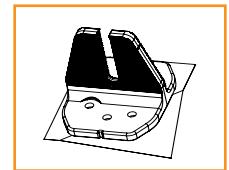
QM L-Mount



QM QBase

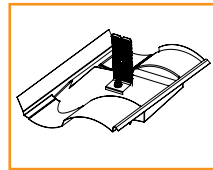


QM Classic Comp Mount

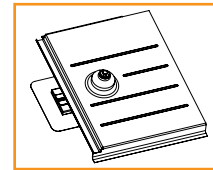


HUG (Halo UltraGrip)

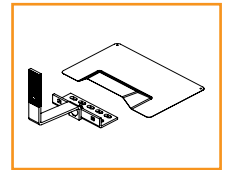
TILE



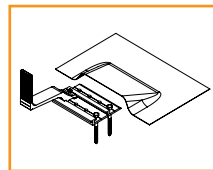
Knockout Tile



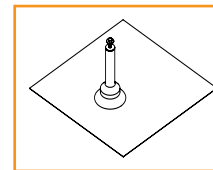
QM Tile Replacement



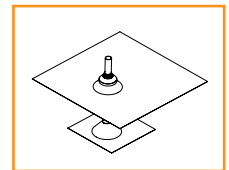
All Tile Hook and Flashing (optional)



QM Quick Hook and Flashing (optional)

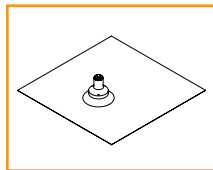


QM QBase Tile

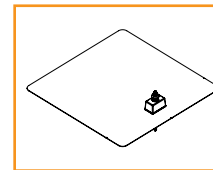


QM Tile Conduit Penetration

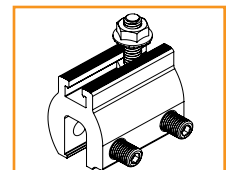
ADDITIONAL ROOF TYPES



QM Qbase Shake - Slate - Metal Shingle

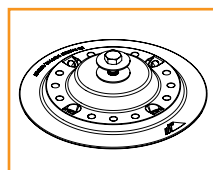


QM Classic Mount Shake

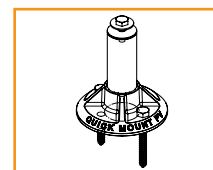


QM Lynx Metal Roof Attachment

LOW SLOPE ROOF



Flat Roof Attachment



QM QBase Mount

- If using previous version of Integrated Grounding Mid Clamps, End Clamps, Expansion Joints and for a list of approved 3rd party components please refer to Alternate Components Addendum (Version 1.9)

PRE-INSTALLATION

- ❑ Verify module compatibility. See [Page 21](#) for info.

TOOLS REQUIRED

- | | |
|---------------------------------|-----------------------|
| ❑ Cordless Drill (non-impact) | ❑ 1/8" Drill bit |
| ❑ Impact Driver (for lag bolts) | ❑ 1/4" Drill bit |
| ❑ Torque Wrench (0-250 in-lbs) | ❑ T30 Torx Bit |
| ❑ 7/16" Socket | ❑ Channel Lock Pliers |
| ❑ 1/2" Socket | ❑ #3 Phillips Bit |
| ❑ 9/16" Socket | ❑ Paddle Bit |
| ❑ 7/32" Drill bit | |

BONDING HARDWARE TORQUE VALUES

Please refer to each attachment's individual section for full details on all torque values and instructions.

- ❑ Universal Fastening Object (7/16" Socket): 80 in-lbs
- ❑ Rail Grounding Lug Nut (7/16" Socket): 80 in-lbs
- ❑ Module Grounding Lug
 - ❑ Grounding Nut (7/16" Socket): 60 in-lbs
 - ❑ Grounding Lug Terminal Screws (7/16" Socket): 20 in-lbs
- ❑ Microinverter Kit Nuts (7/16" Socket): 80 in-lbs
- ❑ Frameless Module Kit Nuts (7/16" Socket): 80 in-lbs
- ❑ 3/8" Bonding Hardware Nuts (7/16" Socket): 250 in-lbs
- ❑ Contour Clamp (T-30 Torx Bit): 80 in-lbs

➤ Unless otherwise noted, all components have been evaluated for multiple use. They can be uninstalled and reinstalled in the same or new location.

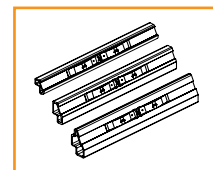
COMPONENTS



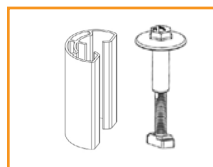
XR Rail



Wire Clip



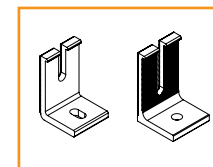
BOSS



UFO and Stopper Sleeve (30-46MM)



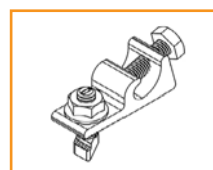
CAMO



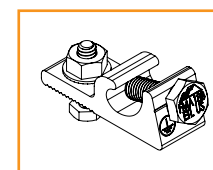
Ironridge L-Foot and QM L-Foot



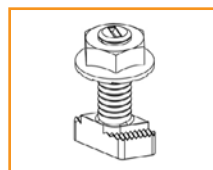
End Cap



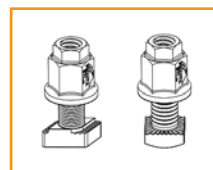
Rail Grounding Lug



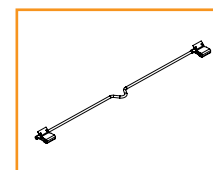
Module Grounding Lug



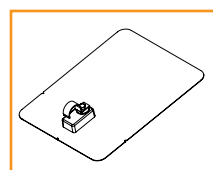
Microinverter Kit



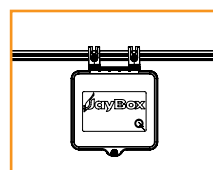
3/8" Bonding Hardware



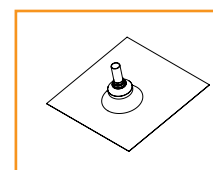
8" Bonding Jumper Single Use Only



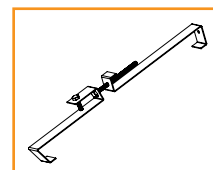
QM Classic Conduit Comp Mount



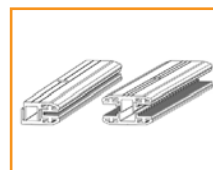
JAYBOX



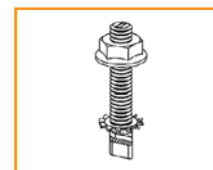
QM Composition Conduit Penetration



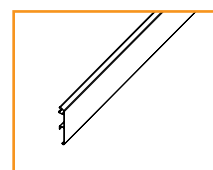
QM Tile Conduit Mount



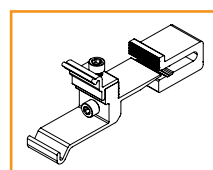
Frameless End/Mid Clamp



Frameless Module Kit



Contour Trim



Contour Clamp