Professional Engineer Letterhead

8/13/2020

RE: Structural Certification for Installation of Residential Solar
Installer Name: Street Address, City, State, Zip Code

Attn: To Whom It May Concern

This Letter is for the existing roof framing which supports the new flush mount PV modules as well as the attachment of the PV system to existing roof framing. From the field observation report, the roof is made of composite shingle roofing supported by 2x6 timber rafters. The slope of the roof was approximated to be 20 degrees.

Contractor shall verify that existing framing is consistent with the described above before install. Should they find any discrepancies, a written approval from SEOR is mandatory before proceeding with install. Capacity calculations were done in accordance with applicable building codes.

Design Criteria	2019 California Building Code (ASCE 7-16)				
Risk category		II	Wind Load	(component and Cladding)	
Roof Dead Load	Dr	10 psf		V	96 mph
PV Dead Load	DPV	3 psf		Exposure	B
Roof Live Load	Lr	20 psf			
Ground Snow	S	0 psf			

If you have any questions on the above, please do not hesitate to call.

Sincerely,

Professional Engineer

Professional Structural
Engineer of Record,
Phone Number
Email Address

peemail@pewebsite.com
http://www.pewebsite.com

Professional Engineer Letterhead

Structural Letter for PV Installation

Date: 8/13/2020
Job Address: **Street Address**
City, State, Zip
Job Name: **PV Job**
Job Number: **2008133**

Scope of Work

This Letter is for the existing roof framing which supports the new PV modules as well as the attachment of the PV system to existing roof framing. All PV mounting equipment shall be designed and installed per manufacturer's approved installation specifications.

Table of Content

Engineering Calculations Summary

Code	2019 California Building Code (ASCE 7-16)		
Risk category		II	
Roof Dead Load	Dr	10	psf
PV Dead Load	DPV	3	psf
Roof Live Load	Lr	20	psf
Ground Snow	S	0	psf
Wind Load	(component and Cladding)		
	V	96	mph
	Exposure	B	

References

2 AISI

Sincerely,

Professional Engineer

Professional Structural
Engineer of Record,
Phone Number
Email Address

peemail@pewebsite.com
http://www.pewebsite.com

Professional Engineer
Letterhead

Wind Load Cont.

Risk Category =	II		
V=	**96**	**mph**	**ASCE 7-16 Figure 26.5-1B**
Exposure =	**B**		
K_{zt} =	1.0		ASCE 7-16 Sec 26.8.2
K_z =	0.65		ASCE 7-16 Table 26.10-1
K_d =	0.85		ASCE 7-16 Table 26.6-1
K_e =	0.98		ASCE 7-16 Table 26.9-1
$q_h = 0.00256K_zK_{zt}K_dK_eV^2$ =	12.73	psf	
Pitch =	20	Degrees	
γ_E =	1.5	Conservatively assuming all exposed	
γ_a =	0.8	conservatively assuming 10 ft^2 effective area	

Uplift (W)		**Zone(1')**	**Zone(1)**	**Zone(2)**	**Zone(3)**
Fig. 30-3-2	GC_p=	-0.9	-1.4	-1.9	-2.4
Eq. 29.4-7	$P=q_h(GC_p)(\gamma_E)(\gamma_a)$=	-13.75	-21.39	-29.03	-36.67

GC_p=	0.3	Figure 30.3-2
$P=q_h(GC_p)(\gamma_E)(\gamma_a)$=	3.44	Equation 29.4-7

Rafter Attachments: 0.6D+0.6W (CD=1.6)

ProteaBracket Connection

Attachement max. spacing=	24	ft	
Ultimate Withdrawl Value=	1098	lbs	Manufacturer Test
Safety Factor=	3	in	24ga Assumed

Allowable Capacity with = 366 lb

Zone	**Trib Width**	**Area (ft)**	**Uplift (lbs)**	**Down (lbs)**	
Zone(1')	4	11.0	99.5	70.8	
Zone(1)	4	11.0	144.9	70.8	
Zone(2)	4	11.0	190.3	70.8	
Zone(3)	4	11.0	235.7	70.8	
	Conservative Max=		235.7	<	366
			CONNECTION IS OK		

1. Pv seismic dead weight is negligible to result in significant seismic uplift, therefore the wind uplift governs
2. Embedment is measured from the top of the framing member to the tapered tip of a lag screw. Embedment in sheading or other material does not count.

peemail@pewebsite.com
http://www.pewebsite.com

Professional Engineer
Letterhead

Load Resisting System_Pitched Roof

Roof Framing	**Rafters**								
		Lr =	**20**	psf					
		Dr =	**10**	psf					
	(New)	PvDL =	3	psf					
		Dr+PvDL=	13.0	psf	<	Dr+Lr=	30	psf	**OK**

Note: Proposed loading will add less than 5% of the existing loads.
Infact, It will result in less loading for the framing given that area occupied by solar will not carry live load.

Siesmic Loads Check

Roof Dead Load	10	psf
% or Roof with Pv	50%	
Dpv and Racking	3	psf
Averarage Total Dead Load	11.5	psf
Increase in Dead Load	7.5%	**OK**

The increase in seismic Dead weight as a result of the solar system is less than 10% of the existing structure and therefore no further seismic analysis is required.

peemail@pewebsite.com
http://www.pewebsite.com

STRUCTURAL NOTES:

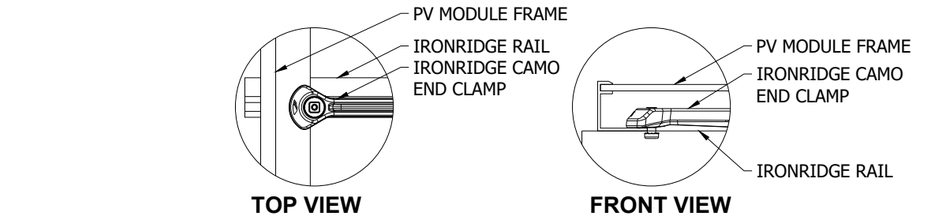
SNO.	MOUNTING SYSTEM	
1	MOUNTING TYPE	IRONRIDGE FLASHFOOT 2
2	MOUNTING WEIGHT PER MODULE (LBS.)	7.89
3	TOTAL MOUNTING WEIGHT (LBS.)	126
4	MAX. ATTACHMENT POINT SPACING	48 IN.
5	MAX RAIL OVERHANG	24 IN.

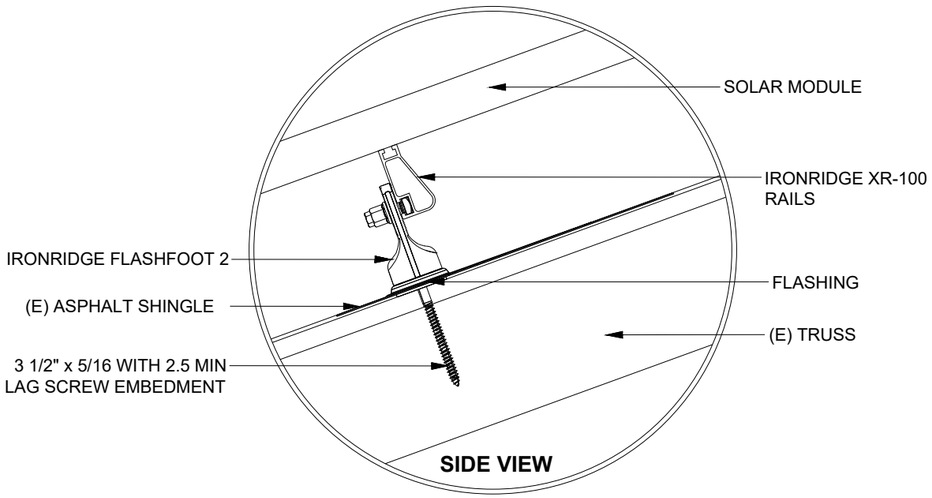
SNO.	SITE DETAILS	
1	FRAMING TYPE	SITE BUILT
2	FRAMING SIZE	2X6
3	FRAMING SPACING	24 IN. O.C
4	ROOF SLOPE	36°
5	FASTENERS PER ATTACHMENT	1
6	FASTENER SIZE	5/16"
7	EMBEDMENT DEPTH	2.5" IN. (MIN.)

SNO.	WEIGHT CALCULATIONS	
1	TOTAL SYSTEM WEIGHT (LBS)	862
2	TOTAL # OF ATTACHMENTS	34
3	WEIGHT PER ATTACHMENT (LBS)	25.36
4	UNDER 45 LBS	YES
5	WEIGHT PER SQUARE FOOT (LBS/SQ.FT.)	2.77
6	UNDER 5 LBS/SQ.FT	YES

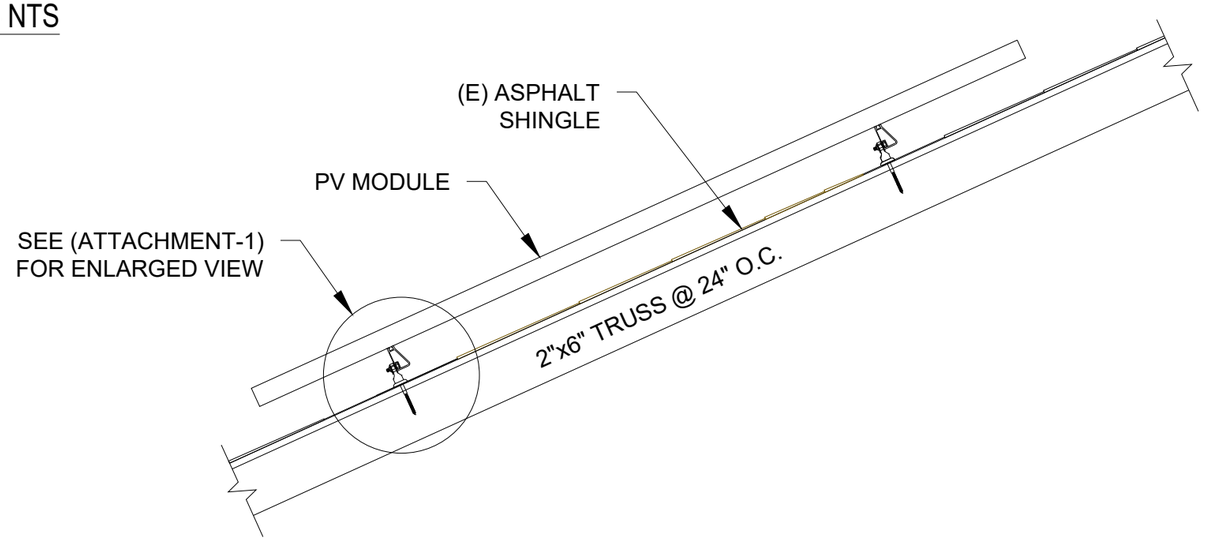
SNO.	SOLAR MODULE SPECS	
1	MODULE TYPE	SOLARIA POWER XT-370R-PD
2	MODULE WEIGHT (LBS.)	46
3	MODULE AREA (SQ.FT)	19.46
4	MODULE IN ARRAY	16
5	TOTAL MODULE WEIGHT (LBS.)	736
6	TOTAL MODULE AREA (SQ.FT.)	311

ATTACHMENT DETAILS - 1: SCALE - NTS





ATTACHMENT DETAILS - 2: SCALE - NTS



REGISTERED PROFESSIONAL ENGINEER
YOUR NAME HERE
No. XXXXX
Exp:
CIVIL
STATE OF CALIFORNIA
Professional Engineer

SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

IRONRIDGE

PROJECT NAME:

PROJECT ADDRESS:

TEL. #:

JOB NUMBER:

DRAFTER:

REVISION HISTORY

REV	DESCRIPTION	DRW	DATE
0	DRAFT REVIEW	DG	09-28-20
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STRUCTURAL DETAILS

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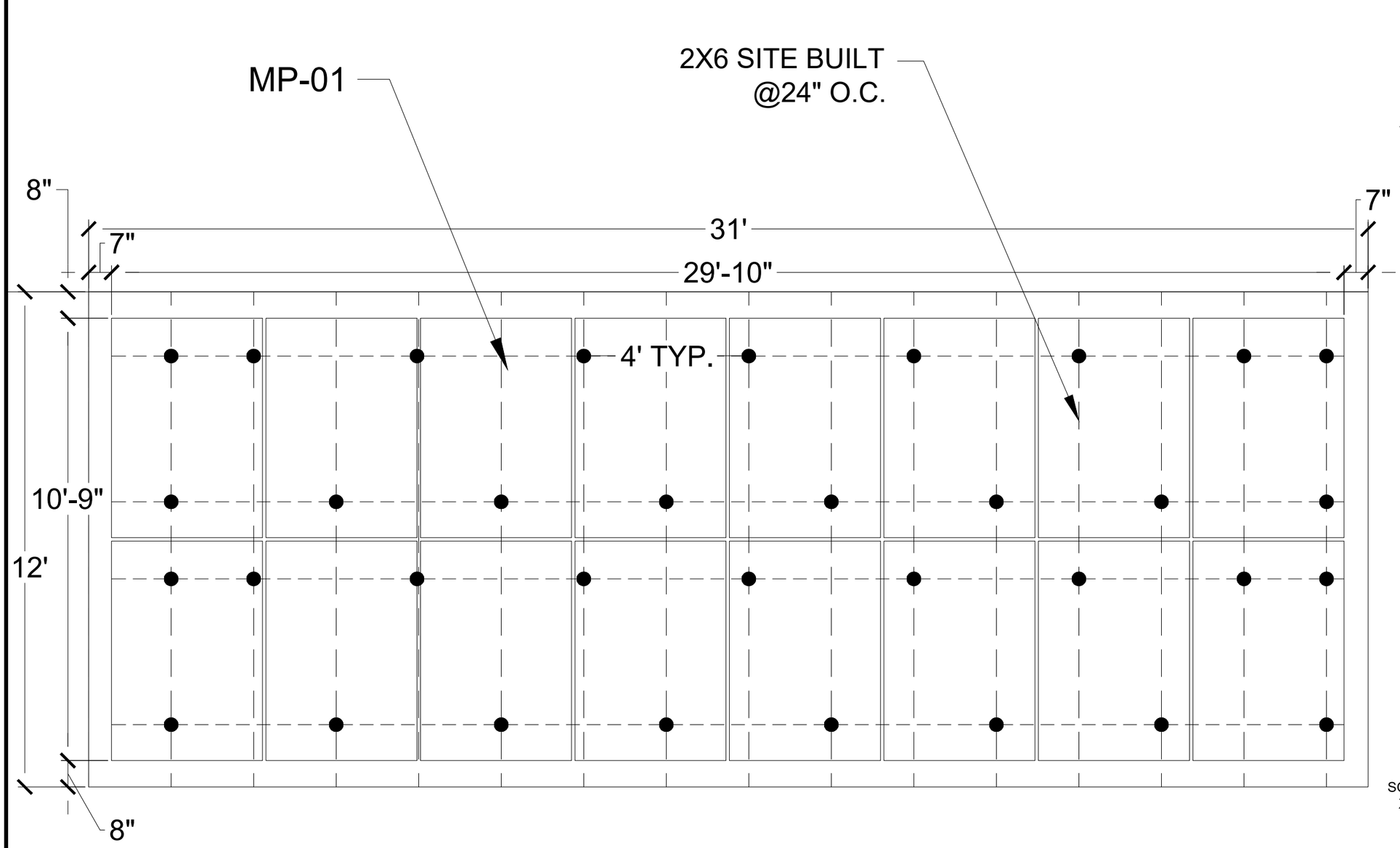
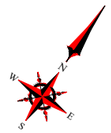
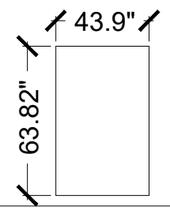




ARRAY AZIMUTH
145 DEGREE



SOLARIA POWER
XT-360 (360W)
MODULES

LEGEND

- ○ ▭ - VENT, ATTIC FAN (ROOF OBSTRUCTION)
- ● - ROOF ATTACHMENT
- ---- - RAFTERS

MOUNTING PLANE : SCALE - 3/16" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
YOUR NAME HERE
No. XXXXX
Exp:
CIVIL
STATE OF CALIFORNIA
Professional Engineer

SYSTEM SIZE: 5920W

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SHEET MOUNTING PLANE DETAILS

REV: 0

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CERTIFICATE OF COMPLIANCE

Certificate Number 20161220-E341165
Report Reference E341165-20161210
Issue Date 2016-DECEMBER-20

Issued to: ENPHASE ENERGY INC
1420 N McDowell Blvd
Petaluma CA 94954-6515

This is to certify that representative samples of STATIC INVERTERS, CONVERTERS AND ACCESSORIES FOR USE IN INDEPENDENT POWER SYSTEMS, PHOTOVOLTAIC RAPID SHUTDOWN SYSTEM EQUIPMENT

Permanently-connected, utility Interactive, single-phase, distributed resource power system, Models IQ6PLUS-72-2-US, IQ6PLUS-72-5-US, IQ6-60-2-US, IQ6-60-5-US, IQ6PLUS-72-ACM-US and IQ6-60-ACM-US. Photovoltaic Rapid Shutdown Equipment, Models IQ6PLUS-72-2-US, IQ6PLUS-72-5-US, IQ6-60-2-US, IQ6-60-5-US, IQ6PLUS-72-ACM-US and IQ6-60-ACM-US

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: See addendum page
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program
UL LLC

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CERTIFICATE OF COMPLIANCE

Certificate Number 20161220-E341165
Report Reference E341165-20161210
Issue Date 2016-DECEMBER-20

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Standard(s) for Safety:
UL1741, INVERTERS, CONVERTERS, CONTROLLERS AND INTERCONNECTION SYSTEM EQUIPMENT FOR USE WITH DISTRIBUTED ENERGY RESOURCES
IEEE1547, IEEE STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS
IEEE1547.1, IEEE STANDARD FOR CONFORMANCE TEST PROCEDURES FOR EQUIPMENT INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS

Bruce Mahrenholz, Director North American Certification Program
UL LLC

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SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

IRONRIDGE

PROJECT NAME:

PROJECT ADDRESS:

TEL. #:

JOB NUMBER:

DRAFTER:

REVISION HISTORY

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SHEET RAPID SHUTDOWN CERTIFICATE

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Datasheet

IRONRIDGE

Roof Mount System

Built for solar's toughest roofs.

Anchored by the strongest rails in solar, the IronRidge Roof Mount System provides the durability and versatility to handle virtually any residential or commercial rooftop.

The unique curved profile of the XRS Rail increases its strength while also giving it an attractive look, making it very customer-friendly. In addition, IronRidge Rails are certified for integrated grounding, which eliminates separate module grounding components and procedures, making it very installer-friendly.

Strongest Rails
Longer spans between attachments, fewer roof penetrations.

PE Certified
Pre-stamped engineering letters available in most states.

Simple Assembly
Versatile and adjustable components simplify any array design.

Design Software
Online tool generates a complete bill of materials in minutes.

Integrated Grounding
UL 2703 system eliminates separate module grounding components.

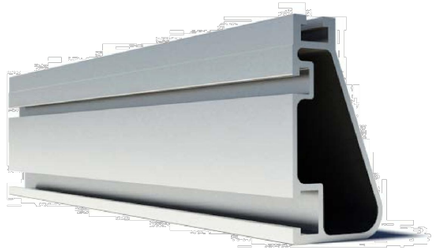
20 Year Warranty
Twice the protection offered by competitors.

IRONRIDGE

Engineering Design Guide | System Parts

XR1000 Rail

XR1000 is a heavyweight among solar mounting rails, built to handle extreme climates and spans 12 feet or more for commercial applications.



Property	Value
Material	6000 Series Aluminum
Finish	Clear Anodized
Beam Height	3.00"
Weight / Linear Foot	0.945 Lbs
Total Cross-Sectional Area	0.807 In^2
Section Modulus (X-axis)	0.530 In^3
Moment of Inertia (X-axis)	0.843 In^4
Moment of Inertia (Y-axis)	0.182 In^4
Torsional Constant	0.436 In^3
Polar Moment of Inertia	0.3299 In^4

XR100 Rail

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans.

Property	Value
Material	6000 Series Aluminum
Finish	Clear & Black Anodized
Beam Height	2.44"
Weight / Linear Foot	0.68 Lbs
Total Cross-Sectional Area	0.582 In^2
Section Modulus (X-axis)	0.297 In^3
Moment of Inertia (X-axis)	0.390 In^4
Moment of Inertia (Y-axis)	0.085 In^4
Torsional Constant	0.214 In^3
Polar Moment of Inertia	0.126 In^4

XR10 Rail

XR10 is a low-profile mounting rail, perfectly matched to regions with light snow. It achieves 6 foot spans, while staying light and economical.

Property	Value
Material	6000 Series Aluminum
Finish	Clear Anodized
Beam Height	1.75"
Weight / Linear Foot	0.436 Lbs
Total Cross-Sectional Area	0.363 In^2
Section Modulus (X-axis)	0.136 In^3
Moment of Inertia (X-axis)	0.124 In^4
Moment of Inertia (Y-axis)	0.032 In^4
Torsional Constant	0.076 In^3
Polar Moment of Inertia	0.033 In^4

SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

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Tech Brief

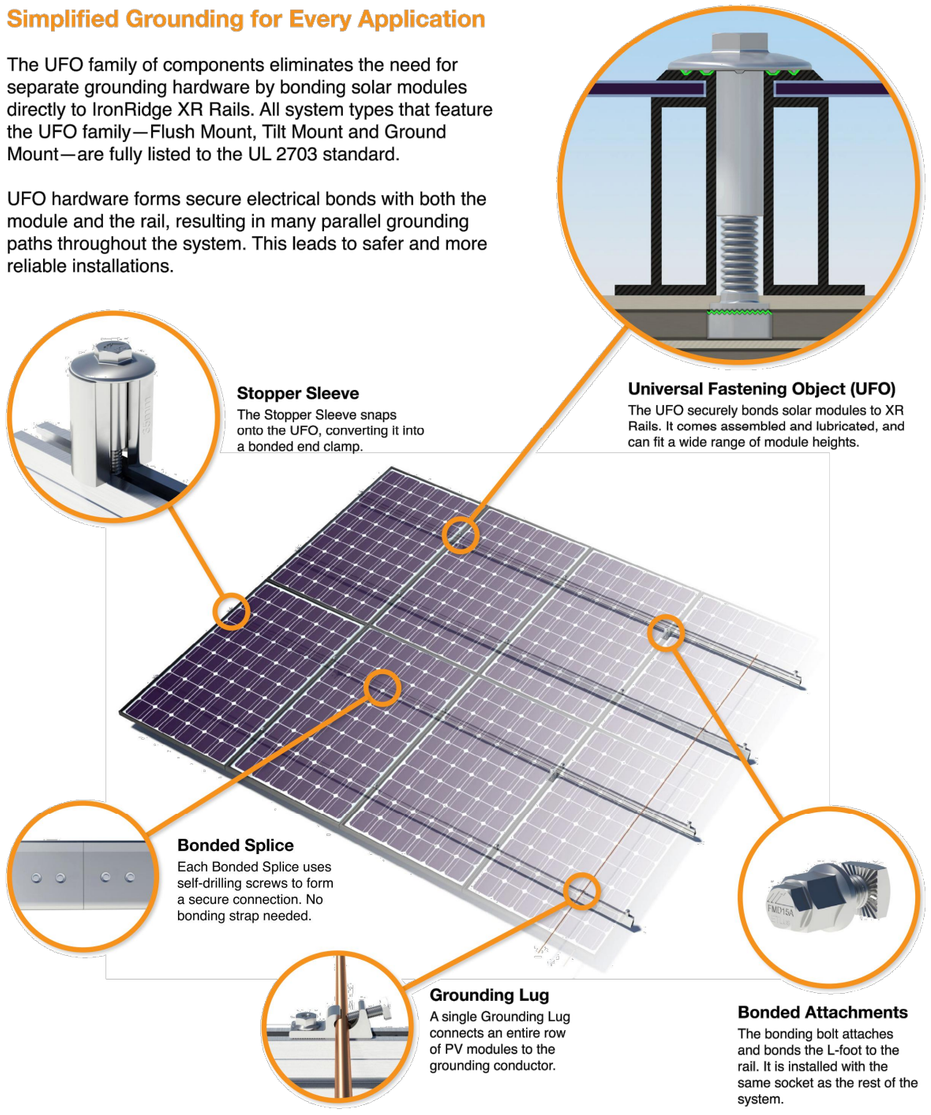
IRONRIDGE

UFO Family of Components

Simplified Grounding for Every Application

The UFO family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge XR Rails. All system types that feature the UFO family—Flush Mount, Tilt Mount and Ground Mount—are fully listed to the UL 2703 standard.

UFO hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.



Stopper Sleeve
The Stopper Sleeve snaps onto the UFO, converting it into a bonded end clamp.

Universal Fastening Object (UFO)
The UFO securely bonds solar modules to XR Rails. It comes assembled and lubricated, and can fit a wide range of module heights.

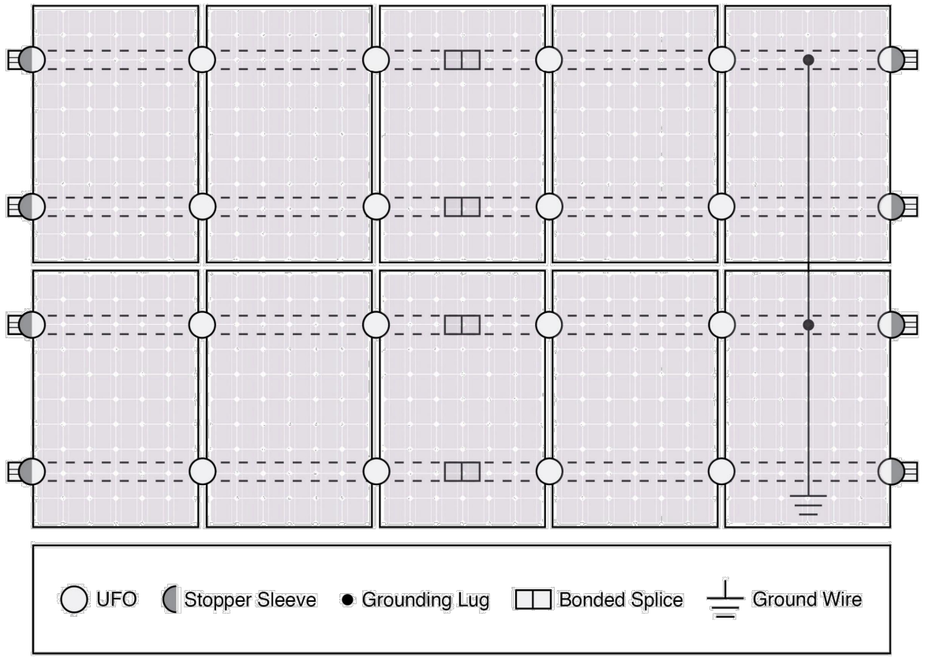
Bonded Splice
Each Bonded Splice uses self-drilling screws to form a secure connection. No bonding strap needed.

Grounding Lug
A single Grounding Lug connects an entire row of PV modules to the grounding conductor.

Bonded Attachments
The bonding bolt attaches and bonds the L-foot to the rail. It is installed with the same socket as the rest of the system.

Tech Brief

System Diagram



Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

UL Certification

The IronRidge Flush Mount, Tilt Mount, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

Go to IronRidge.com/UFO

Cross-System Compatibility

Feature	Flush Mount	Tilt Mount	Ground Mount
XR Rails	✔	✔	XR1000 Only
UFO/Stopper	✔	✔	✔
Bonded Splice	✔	✔	N/A
Grounding Lugs	1 per Row	1 per Row	1 per Array
Microinverters & Power Optimizers	Enphase - M250-72, M250-60, M215-60, C250-72 Darfon - MIG240, MIG300, G320, G640 SolarEdge - P300, P320, P400, P405, P600, P700, P730		
Fire Rating	Class A	Class A	N/A
Modules	Tested or Evaluated with over 400 Framed Modules Refer to installation manuals for a detailed list.		

SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

IRONRIDGE

PROJECT NAME:

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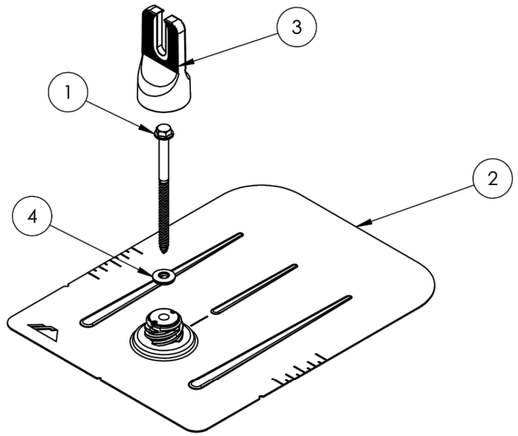
Cut Sheet

IRONRIDGE

FlashFoot2

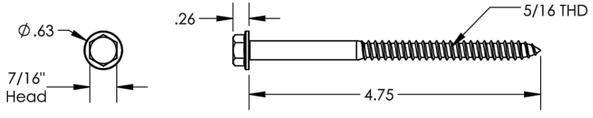


ITEM NO.	DESCRIPTION	Qty in Kit
1	BOLT LAG 5/16 X 4.75"	4
2	ASSY, FLASHING	4
3	ASSY, CAPFOOT	4
4	WASHER, EPDM BACKED	4

FLASHFOOT2

Part Number	Description
FM-FF2-001	Kit, 4pcs, FlashFoot2 (Mill)
FM-FF2-001-B	Kit, 4pcs, FlashFoot2 (Black)

1) Bolt, Lag 5/16 x 4.75



Property	Value
Material	300 Series Stainless Steel
Finish	Clear

v1.0

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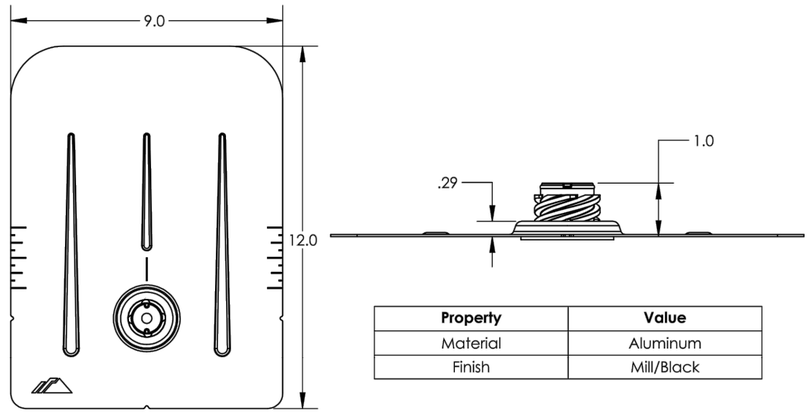
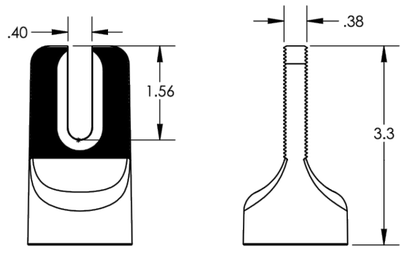
2) Assy, Flashing



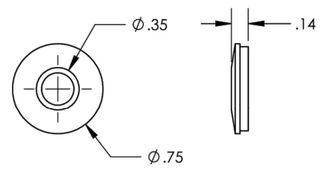
Property	Value
Material	Aluminum
Finish	Mill/Black

3) Assy, Capfoot



Property	Value
Material	Aluminum
Finish	Mill/Black

4) Washer, EPDM Backed



Property	Value
Material	300 Series Stainless Steel
Finish	Clear

v1.0

SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

IRONRIDGE

PROJECT NAME:

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ATTACHMENT DATASHEET

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Tech Brief

IRONRIDGE

Hidden End Cam

Solar, Sleeker Than Ever

Most solar installations use mounting rails and fasteners to secure modules to the building structure, but these critical components often protrude from the sides of the modules, giving arrays a coarse look.

CAMO is an invisible fastener that secures solar modules flush to rail ends, creating a clean, sleek appearance. CAMO works with nearly all solar modules and installs without tools or torque specifications. It simply rotates into place to structurally secure and electrically bond with the module.

Cam-Locking Design
CAMO's unique design allows for a completely tool-less installation. Simply slide CAMO into the rail track and rotate the ergonomic handle 90 degrees to lock onto the module frame. It's that easy.

Certified to comply with International Building Code, ASCE/SEI-7, and UL 2703 Mechanical and Bonding Requirements.

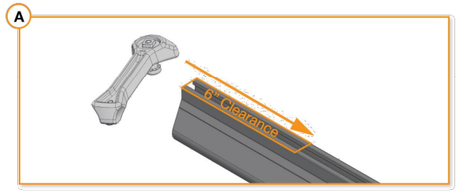
Intertek

Tech Brief

Easy, Tool-Less Installation

A. PLACE CAMO

Slide CAMO into rail track far enough to clear the module frame. CAMO requires 6" of clearance from end of rail.

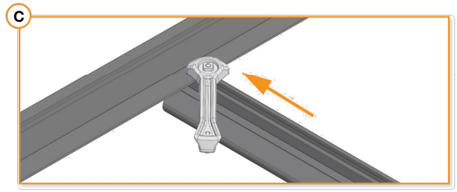


B. PLACE MODULE

Place module on rails and align flush with rail ends (module cells not shown in image to provide clarity). The module can overhang the rail no more than 1/4".

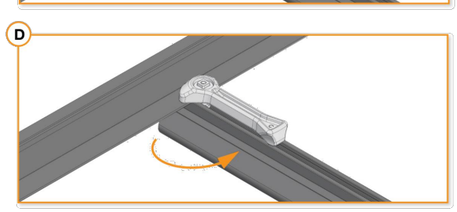
C. SLIDE CAMO

Pull CAMO towards rail end, at a 45 degree angle, so linear bonding pin contacts the module flange edge.

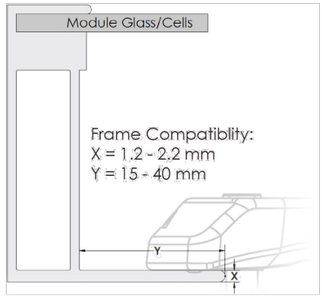


D. SECURE CAMO

Rotate handle with an upwards motion until CAMO snaps into rail track. Ensure CAMO bonding pins are fully seated on top of module frame.



Tested & Certified



UL 2703

CAMO conforms to STD UL 2703 (2015) requirements and fits modules with bottom flanges that meet specifications shown in the frame compatibility diagram on the left.

See IronRidge Installation Manuals for full ratings and a list of certified compatible modules.

Intertek

SYSTEM SIZE: 5920W

MODULES:
(16) SOLARIA POWER XT-370R-PD

INVERTER:
ENPHASE IQ7PLUS-72-2-US

SURFACE TYPE: ROOF

AHJ: CITY OF GLOUCESTER

CONTRACTOR:

IRONRIDGE

PROJECT NAME:

PROJECT ADDRESS:

TEL. #:

JOB NUMBER:

DRAFTER:

REVISION HISTORY

REV	DESCRIPTION	DRW	DATE
0	DRAFT REVIEW	DG	09-28-20
1			
2			
3			
4			
5			
6			
7			

SHEET HIDDEN END CLAMP DATASHEET

REV: 0

PAGE PV- 7.8