

DHDC 21-8017

APPROVAL DOCUMENT – POST AT WORK LOCATION

CITY OF DETROIT
HISTORIC DISTRICT COMMISSION

2 WOODWARD, SUITE 808
DETROIT, MICHIGAN 48226

October 18, 2022

CERTIFICATE OF APPROPRIATENESS

Eamon Harnois
3956 W. Lafayette
Detroit, MI 48216

**RE: Application Number 22-8017; 3956 W Lafayette; Hubbard Farms Historic District
Project Scope: Install solar panel array**

Dear Applicant,

At the regular meeting that was held on October 12, 2022, the Detroit Historic District Commission (“DHDC”) reviewed the above-referenced application. Pursuant to Section 5(1) of the Michigan Local Historic District Act, as amended, being MCL 399.205 (1) and Sections 21-2-73/21-2-78 of the 2019 Detroit City Code; the DHDC hereby issues a Certificate of Appropriateness (“COA”) for the following work, effective on August 16, 2022, as it meets the Secretary of Interior’s Standards for Rehabilitation and the district’s Elements of Design:

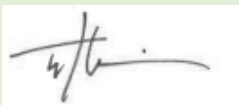
Install solar panel array per the submitted documents, drawings, and other submitted materials and specifications.

With the condition that:

- ***The equipment will be field painted an appropriate color, subject to approval by staff.***

Please retain this COA for your files and post it at the subject property until work is complete. It is important to note that approval by the DHDC does not waive the applicant's responsibility to comply with any other applicable ordinances or statutes. If you have any questions regarding the foregoing, please contact staff at 313-224-1762 or hdc@detroitmi.gov.

For the Commission:



Timothy Boscarino
Detroit Historic District Commission

Description of Project:

Harnois 6.57 kW Residential Roof-mount Solar System

Eamon Harnois

3956 W Lafayette Blvd, Detroit, MI 48216

Distributed Power, LLC

- **Description of existing conditions:**
 - Brick Exterior. Shingled roof. Two story residential home with large attic.
- **Description of project – include information on the viability of a free-standing solar array in the side/rear yard, and if less intrusive solar options were considered.**
 - 6.57 kW Residential Roof-mount Solar System.
 - Other Options were considered. The layout of the panels provided is for the optimal amount of production to the solar system. Solar panels are strategically placed where the sun can hit the panels in the most efficient way possible for the customer to save the most money on his Utility bill. The paying customer, Mr. Eamon Harnois, desires this layout for his home.
- **Current photographs – exterior photo(s) of each side of the house that clearly show the roof, and photos of the surrounding yard.**
 - See Images**
- **A brochure or other information on the selected solar panel, detailing material, color and finish.**
 - See Solar Plans associated.
- **Dimensioned roof plans and sections of the solar panels, confirming placement and how far above the roof the panels would extend.**
 - See Solar Plans associated.

Timothy Boscarino

From: Amanda Mayer <amanda@distributedpower.net>
Sent: Friday, September 9, 2022 3:09 PM
To: Timothy Boscarino
Cc: ekharnois@gmail.com; projects@distributedpower.net
Subject: [EXTERNAL] Re: 3956 W. Lafayette solar array questions
Attachments: Railing_Datasheet-E.Harnois.png

This Message Is From an External Sender

ATTENTION: This email was sent from an external source. Please be extra cautious when opening attachments or clicking links.

Hi Timothy,

To answer your questions I will list them below:

- 1) I am attaching the datasheet for the XR 10 railing highlighted as the specific railing we are using.
- 2) The panels would not be tilted, they would be the same angle as the roof slope.
- 3) The total height off the roof should be no higher than 5.5 inches off the roof with the panel and attachments.
- 4) The finish comes in black and silver. We can use the more expensive black one and that should be low vis. Would that work? We could use a specific spray paint coloring if needed.
- 5) Nothing else will be visible from the front of the house.
- 6) For the ground access point, that is a theoretical space for access and not anything installed or created. It is for firefighters to be able to navigate the roof that some jurisdictions want pointed out.

Hopefully this answers all your questions. Thank you for reaching out.

Best,



Distributedpower.net

Amanda Mayer

She/Her/They/Them

Distributed Power

NABCEP Associate PVA-012120-029944

Direct: (313) 279-8219

Distributed Power: (313) 364-1584

Service: (313) 356-0899

Email: amanda@distributedpower.net

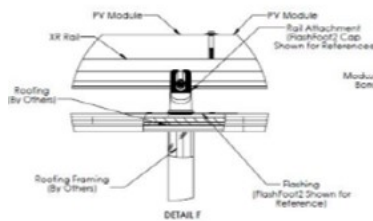
2415 Burdette St.
Ferndale, MI 48220

On Wed, Sep 7, 2022 at 1:46 AM Timothy Boscarino <Timothy.Boscarino@detroitmi.gov> wrote:

Hello,

I am assisting with the Historic District Commission review of your proposal and am looking for some additional information.

Can you give me a better sense of what these fixtures might look like in section? From the product sheets you shared, it says that the rails come in three sizes, 1.8", 2.4", and 3", but I don't see where it says which size you would select for your installation. It also says that they employ "a range of tilt leg options." Do you intend for your panels to be tilted upwards, or to be at the same angle as the roof slope? It would also be helpful to have a measurement of the total height: rail height, plus panel height, plus any gap between the rail and the roof surface. One of the images you provide shows a section drawing, but doesn't show a scale:



And finally, what color and finish will be used on the visible face? Is it possible for them to come from the factory dark brown, or could they be field painted dark brown?

Essentially, the general idea is to keep the panels to the lowest profile possible, so they are minimally visible, and also to color them in a way that helps to camouflage them. This is a particular concern on the porch roof, where they will likely be visible in profile to somebody standing in front of the house.

Other than the rails and the panels themselves, will there be any other elements that will be visible on the exterior? The site plan provided mentions a ground access point, but doesn't share any visuals on what this would look like.

With the Historic District Commission meeting on Wednesday next week, having this information by the end of this week would be helpful, so I can prepare a report for the Commission. If you have any questions, I'm happy to respond by email or do a phone call.

Thank you,

Timothy Boscarino, AICP

Historic Preservation Planner | Planning & Development | City of Detroit

Coleman A. Young Municipal Center, 2 Woodward Ave. Suite 808, Detroit, MI 48226

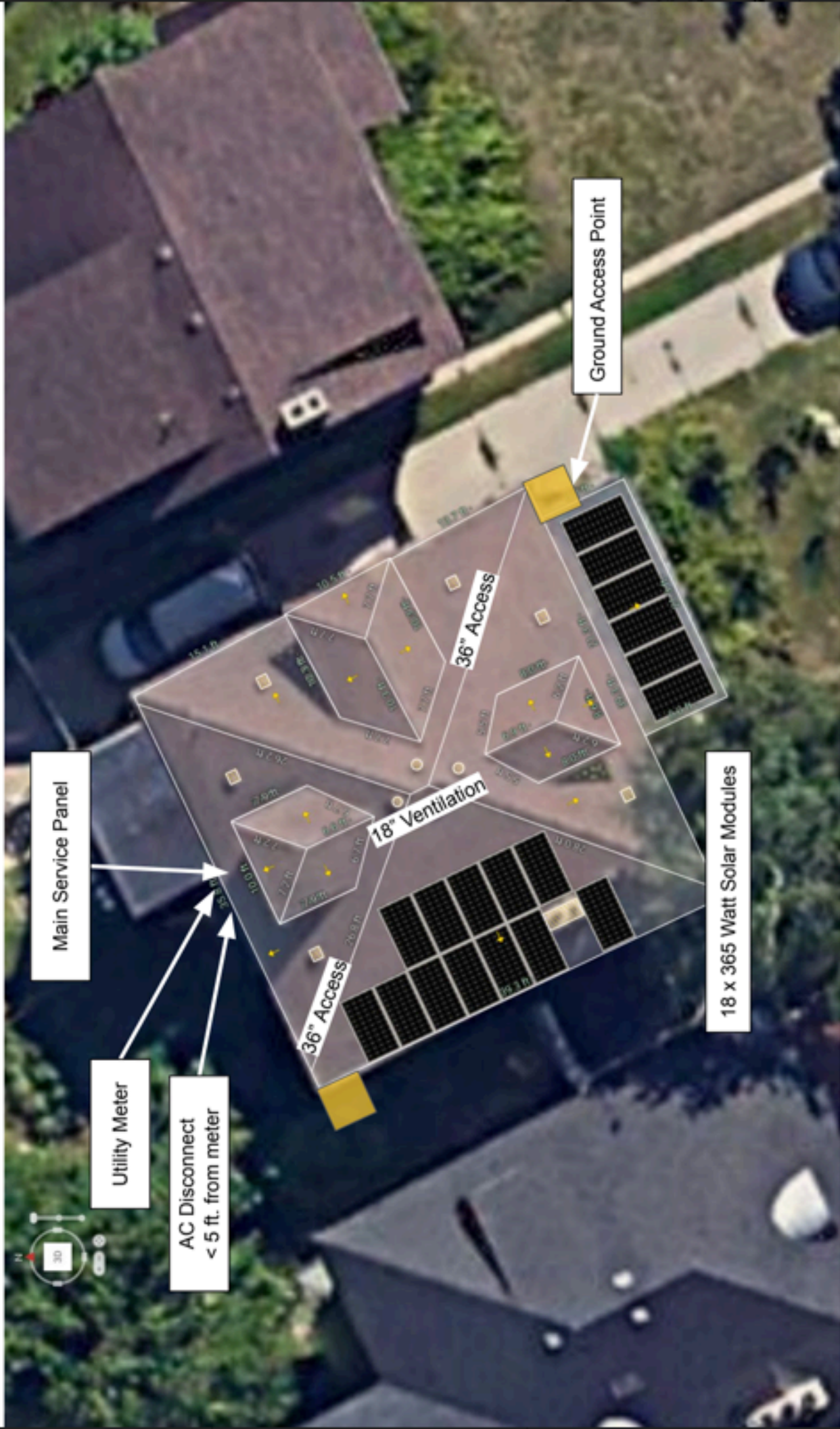
 www.detroitmi.gov/hdc

 timothy.boscarino@detroitmi.gov

Michael E. Duggan, Mayor

Site Design

3956 W Lafayette Blvd, Detroit, MI 48216



Project: Harnois 6.75 kW Residential Roof-mount Solar System

TWINPLUS MODULE SERIES

HIGH EFFICIENCY MONO-PERC M4-9B-B

350-370W

OUTSTANDING PRODUCT PERFORMANCE

- Competitive high-temperature performance with ameliorated temperature coefficient
- Minimized power loss in cell connection
- Better performance under shading effect
- Decreased nominal operating cell temperature to 43 ± 2°C
- Higher power generation with multi-busbar and half-cut technology

TRUSTWORTHY QUALITY AND RELIABILITY

- Guaranteed 0-300 positive tolerance secures reliable power output
- 3000h maximum snow load, 2000Pa maximum wind load
- Optimized electrical design lowers hot spot risk and operating current

PID RESISTANT

- Industry-leading cell processing technology and electrical design ensure solid PID resistance

MANAGEMENT SYSTEM CERTIFICATES

IEC 61215, IEC 61730
 ISO 9001-2015 / Quality management system
 ISO 14001-2015 / Standards for environmental management system
 OHSAS 18001-2007 / International standards for occupational health & safety
 IEC TS 42941-1: 2016 Terrestrial photovoltaic (PV) modules—guidelines for increased confidence in PV module design qualification and type approval

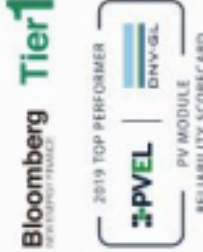


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www.phonosolar.com | info@phonosolar.com

Major Equipment continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System



ELECTRICAL TYPICAL VALUES

Model	PS350M4-201U4B	PS350M4-201U4B	PS350M4-201U4B	PS370M4H-201U4B
Testing Condition	S1C	M0CT	S1C	M0CT
Rated Power (P _{mppt})	350	359	363	370
Rated Current (I _{mppt})	18.44	8.45	18.53	8.51
Rated Voltage (V _{mppt})	33.47	38.41	33.72	38.84
Short Circuit Current (I _{sc})	18.95	8.80	11.81	8.70
Open Circuit Voltage (V _{oc})	38.98	35.44	38.33	35.98
Module Efficiency (%)	19.88	19.35	19.62	20.17

MECHANICAL CHARACTERISTICS

Cell Type: Monocrystalline Silicon x 60mm

Length: 174mm (6.85 inch)
 Width: 1042mm (40.94 inch)
 Height: 35mm (1.38 inch)
 Weight: 14.5kg (32.99 lbs)
 Front Glass: 3-Dmm Toughened Glass
 Frame: Anodized Aluminum Alloy
 Cable: 4mm BECL Length, 20mm Vertical / 120mm Horizontal or Customized Length
 Junction Box: IP 68 Rated

TEMPERATURE RATINGS

Voltage Temperature Coefficient: -0.30%/°C
 Current Temperature Coefficient: -0.05%/°C
 Power Temperature Coefficient: -0.30%/°C
 Tolerance: 0-30a
 M0CT: -13a/°C

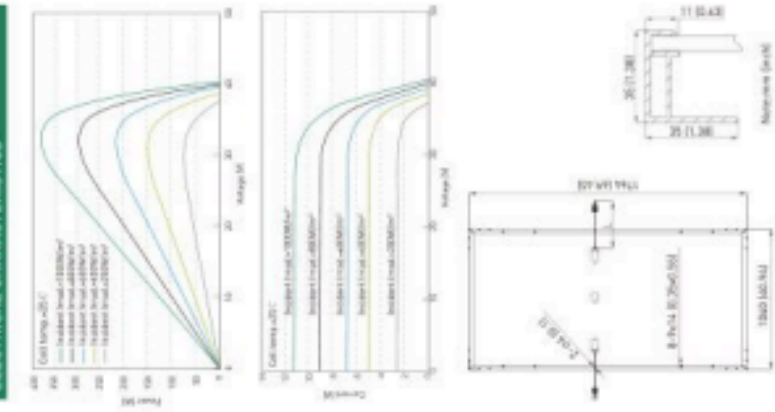
ABSOLUTE MAXIMUM RATING

Operating Temperature: From: -43 to +85°C
 Hot Diameter @ 80mm/h: Up to 25mm
 Front Side Maximum Static Loading: 5400Pa
 Rear Side Maximum Static Loading: 3400Pa
 Maximum Service Fuse Rating: 20A
 PV Module Classification: II
 Fire Rating (IEC 61730): C
 Module Fire Performance (IEC 11883): Type 4
 Maximum System Voltage: DC 1500V/1500V

PACKING CONFIGURATION

Container: 20' GP
 Pieces/Container: 384

ELECTRICAL CHARACTERISTICS



Phono Solar

PHONO SOLAR TECHNOLOGY CO., LTD reserves the right to make necessary adjustments to the information described herein at any time without further notice. The specifications and certificates contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Please be sure to use the most recent version of data.



DISTRIBUTED
POWER

Enphase IQ 7 and IQ 7+ Microinverters

The high-powered smart grid-ready **Enphase IQ 7 Micro™** and **Enphase IQ 7+ Micro™** dramatically simplify the installation process while achieving the highest system efficiency.

Part of the Enphase IQ System, the IQ 7 and IQ 7+ Microinverters integrate seamlessly with the Enphase IQ Envoy™, Enphase Q Aggregator™, Enphase IQ Battery™, and the Enphase Enlighten™ monitoring and analysis software.

IQ Series Microinverters extend the reliability standards set forth by previous generations and undergo over a million hours of power-on testing, enabling Enphase to provide an industry-leading warranty of up to 25 years.

Easy to Install

- Lightweight and simple
- Faster installation with improved, lighter two-wire cabling
- Built in rapid shutdown compliant (NEC 2014 & 2017)

Productive and Reliable

- Optimized for high-powered 60-cell and 72-cell™ modules
- More than a million hours of testing
- Class II double-insulated enclosure
- UL listed

Smart Grid Ready

- Complies with advanced grid support, voltage and frequency ride-through requirements
- Remote updates to respond to changing grid requirements
- Configurable for varying grid profiles
- Meets CA Rule 21 (UL 1741-SA)



To learn more about Enphase offerings, visit enphase.com



Enphase IQ 7 and IQ 7+ Microinverters

INPUT DATA (DC)	IQ7PLUS-72-2-US	IQ7+ Microinverter
Commonly used module ratings ¹	235 W - 350 W +	235 W - 600 W +
Module compatibility	60-cell PV modules only	60-cell and 72-cell PV modules
Maximum input DC voltage	48 V	60 V
Peak power tracking voltage	27 V - 37 V	27 V - 45 V
Operating range	16 V - 48 V	16 V - 60 V
Min Max start voltage	22 V / 43 V	22 V / 60 V
Max DC short circuit current (module Isc)	15 A	15 A
Over-voltage class DC port	II	II
DC port backfeed current	0 A	0 A
PV array configuration	1 x 1 ungrounded array. No additional DC side protection required. AC side protection requires max 20A per branch circuit	1 x 1 ungrounded array. No additional DC side protection required. AC side protection requires max 20A per branch circuit
OUTPUT DATA (AC)	IQ 7 Microinverter	IQ 7+ Microinverter
Peak output power	250 VA	295 VA
Maximum continuous output power	240 VA	290 VA
Nominal (L-L) voltage/range ²	240 V / 211-264 V	240 V / 211-264 V
Maximum continuous output current	1.0 A, 1.15 A	1.21 A, 1.39 A
Nominal frequency	60 Hz	60 Hz
Extended frequency range	47 - 68 Hz	47 - 68 Hz
AC short circuit fault current over 3 cycles	5.8 Arms	5.8 Arms
Maximum amps per 20 A (L-L) branch circuit ³	15 (240 VAC) 13 (208 VAC)	13 (240 VAC) 11 (208 VAC)
Overvoltage class AC port	II	II
AC port backfeed current	0 A	0 A
Power factor (adjustable)	1.0	1.0
Power factor setting	0.7 leading... 0.7 lagging	0.7 leading... 0.7 lagging
EFFICIENCY	@240 V	@208 V
Peak CEC efficiency	97.6 %	97.5 %
CEC weighted efficiency	97.0 %	97.0 %
MECHANICAL DATA	IQ 7 Microinverter	
Ambient temperature range	-40°C to +65°C	
Relative humidity range	4% to 100% (condensing)	
Connector type	MCA (per Amphenol HD-UTX with additional Q-CCC-5 adapter)	
Dimensions (WxHxD)	212 mm x 175 mm x 36.2 mm (without bracket)	
Weight	1.68 kg (3.88 lb)	
Cooling	Natural convection - No fans	
Approved for wet locations	Yes	
Pollution degree	P03	
Enclosure	Class II double-insulated, corrosion resistant polymeric enclosure	
Environmental category / UV exposure rating	NEMA Type 6 / outdoor	
FEATURES	Power Line Communication (PLC) Enlighten Manager and MyEnlighten monitoring options. Both options require installation of an Enphase IQ Envoy. The AC and DC connectors have been evaluated and approved by UL for use as the load break disconnect required by NEC 690.	
Compliance	CA Rule 21 (UL 1741-SA) UL 62109-1, UL1741, IEEE1547, FCC Part 15 Class B, ICES-003 Class B, CAN/CSA-C22.2 NO. 1071-01 This product is UL Listed as PV Rated Smart Device Equipment and conforms with NEC 2014 and NEC-2017 sections 690.11 and C21.7-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

1. No enforced DC/AC ratio. See the compatibility calculator at logix.enphase.com/ul-us-support/module-compatibility
2. Nominal voltage range can be extended beyond nominal if required by the utility.
3. Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

To learn more about Enphase offerings, visit enphase.com

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Major Equipment

Project: Harnois 6.75 kW Residential Roof-mount Solar System



Enphase IQ Envoy

The **Enphase IQ Envoy™** communications gateway delivers solar production and energy consumption data to Enphase Enlighten™ monitoring and analysis software for comprehensive, remote maintenance and management of the Enphase IQ System.

With integrated revenue grade production metering and optional consumption monitoring, the Envoy IQ is the platform for total energy management and integrates with the Enphase IQ Battery™.



Smart

- Enables web-based monitoring and control
- Bidirectional communications for remote upgrades
- Supports power export limiting and zero-export applications

Simple

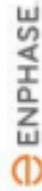
- Easy system configuration using Enphase Installer Toolkit™ mobile app
- Flexible networking with Wi-Fi, Ethernet, or cellular

Reliable

- Designed for installation indoors or outdoors
- Five-year warranty



To learn more about Enphase offerings, visit enphase.com



Enphase IQ Envoy

MODEL NUMBERS

Enphase IQ Envoy™
ENV-IQ-AMT-240

ACCESSORIES (order separately)

Enphase Mobile Connect™

CELLMODEM-03 (4G / 12-year data plan)

CELLMODEM-01 (3G / 5-year data plan)

CELLMODEM-MT (4G-based LTE-M / 3-year data plan)

Consumption Monitoring CT

CT-350-5PL-IT

Enphase IQ Envoy communications gateway with integrated revenue grade PV production metering (ANSI CT2, 20 +/- 0.5%) and optional consumption monitoring (1+/- 2.5%). Includes one 200A continuous rated production CT.

Plug and play industrial grade cellular modem with data plan for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.)

Split-core current transformers enable whole home metering.

POWER REQUIREMENTS

Power requirements

120/240 VAC split phase

Max 20A continuous production required

CAPACITY

Up to 600

MECHANICAL DATA

Dimensions (WxHxD)

21.3 x 12.6 x 4.5 in (8.4" x 5" x 1.8")

Weight

17.6 oz (498 g)

Ambient temperature range

-40° to 48° C (-40° to 118° F) if installed in an enclosure

Environmental rating

IP31. For installation indoors or in an NRTL-certified, NEMA type 3R enclosure.

Production CT

- Is limited to 200A of continuous current / 250A OCPD - 720W AC

- Internal aperture measures 18.25mm to support 250MCM THHN conductors (max)

- Internal aperture measures 8.84" x 0.16" (21.31mm x 24.38mm) to support

2.0 THHN conductor

- ET wire table rating of 450V

INTERNET CONNECTION OPTIONS

Integrated Wi-Fi

802.11b/g/n

802.3, Cat 6 UTP Ethernet cable, not included

Ethernet

Optional: CELLMODEM-01 (3G) or CELLMODEM-03 (4G), not included

Mobile

COMPLIANCE

Compliance

UL 916

CAVCOA C22.2 No. 60700-1

47 CFR Part 15, Class B, ICES 003

IECEN 60710-3:2010

EN50465-1, EN61950-4-5, EN50595-4-1, EN61050-6-2

Missing: ABS-C12-20_accuracy_d9831.0.5

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Major Equipment continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System



DISTRIBUTED
POWER

Rail:
XR100

Flush Mount System Span Table (inches)
Portrait Installation (Maximum Module Length 67.5")

Exposure B

Wind Speed (mph)	Roof Slope (deg.)	10 psf									20 psf									30 psf									40 psf									50 psf									60 psf								
		Ground Snow: 0 psf			10 psf			20 psf			30 psf			40 psf			50 psf			60 psf			70 psf			80 psf			90 psf			100 psf			110 psf			120 psf																	
		Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3																		
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	25	112	92	75	95	95	75	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	68	68	68	61	61	61	56	56	56	56	56	56	56	56	56															



Attn: Corey Geiger, COO, IronRidge Inc.
Date: September 7th, 2018

Re: Structural Certification and Span Tables for IronRidge Flush Mount System

This letter addresses the structural performance and code compliance of IronRidge's Flush Mount System. The Flush Mount System is a proprietary rooftop mounting system 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 XR Rails and secured to the rails with IronRidge mounting clamps. The XR Rails are side mounted to a selected roof attachment with 3/8" stainless steel bonding hardware and then attached directly to the roof structure or to a stanchion that is fastened to the underlying roof structure. Assembly details of a typical Flush Mount installation and its core components are shown in Exhibit EX-0015.

The IronRidge Flush Mount System is designed and certified to the structural requirements of the reference standards listed below, for the load conditions and configurations tabulated in the attached span tables.

- ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)
- 2015 International Building Code (IBC-2015)
- 2015 Michigan Building Code
- 2015 Aluminum Design Manual (ADM-2015)

The tables included in this letter provide the maximum allowable spans of XR Rails in the Flush Mount System for the respective loads and configurations listed, covering wind exposure categories B, C, D, roof zones 1, 2 & 3, and roof slopes from 0° to 45°. The span tables are applicable provided that the following conditions are met:

1. Span is the distance between two adjacent roof attachment points (measured at the center of the attachment fastener)
2. The underlying roof pitch, measured between roof surface and horizontal plane, is 45° or less.
3. The mean roof height, defined as the average of the roof eave height and the roof ridge height measured from grade, does not exceed 30 feet.
4. Module length shall not exceed the listed maximum dimension provided for the respective span table and module width shall not exceed 48".
5. All Flush Mount components shall be installed in a professional workmanlike manner per IronRidge's Flush Mount installation manual and other applicable standards for general roof construction practice.

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MI Flush Mount System Certification Letter - 1

The parameters and adjustments allowed in the span tables are defined as follows:

1. The Flush Mount System is designed as a Risk Category II structure as defined by ASCE 7-10 Chart 1.5-1.
2. When designing with a roof slope not listed in the span tables, but no greater than 45°, the lesser of the two span values listed immediately below and above the desired slope shall be used. For instance, if one is designing to a roof slope of 12°, use the lesser of the two span values associated with 10° and 15°.
3. The wind speed selection shall conform to ASCE 7-10 Fig. 26.5-1A (Risk Category II wind) and any state & local county/city amendments to the IBC. No special wind topographic features are included in the span tables and the topographic coefficient (Kzt) is taken as 1.0.
4. The snow load used in the span tables is the ground snow and shall conform to ASCE 7-10 Fig. 7-1. If a more restrictive snow load is imposed by a local building code/amendment to the IBC, such snow load requirement shall also be complied with. If the local jurisdiction specified snow load is in the format of a flat roof snow load, it shall first be converted to a ground snow following the local building code/amendment before the application of the attached span tables. No special snow conditions are considered including unbalanced, drifting, sliding or ponding snow. Snow load conditions presented in the span tables do not include buildings which are intentionally kept below freezing, kept just above freezing, or unheated.
5. The span tables reflect the ASCE 7 prescribed earthquake loads with the maximum magnitudes being:
 - 1) For ground snow no greater than 42psf: $S_s \pm 2.0g$ for Site Class A, B, C, or D.
 - 2) For ground snow greater than 42psf: $S_s \pm 1.0g$ for Site Class A, B, C, or D.
 - 3) For ground snow between 42 and 60psf: $S_s \pm 1.5g$ for Site Class A, B, C, or D.
6. Roof zone size and definition conforms to ASCE 7-10 Fig. 30.4-2A.
7. Allowable span length in the charts may be multiplied by a factor of 1.08 if the rails are continuous over a minimum of three spans.
8. An array to roof clearance of 2" minimum must be provided.
9. The maximum cantilever length measured from the rail end to the nearest attachment point shall not exceed 40% of the allowable span provided for the respective load & configuration condition from the span tables.
10. No rail splices are allowed in the cantilever, outer 2/3 of end spans, or middle 1/3 of interior spans.
11. For shaded cells of the span tables, UFO Mid Clamps shall not be installed closer than 20" to the shaded cell's associated Roof Zone.
12. When a roof attachment listed in IronRidge's Flush Mount installation manual is considered, the span values provided in this letter can be adjusted using IronRidge's online Design Assistant by checking the capacity of the selected roof attachment against the reaction forces provided in Design Assistant.

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MI Flush Mount System Certification Letter - 2

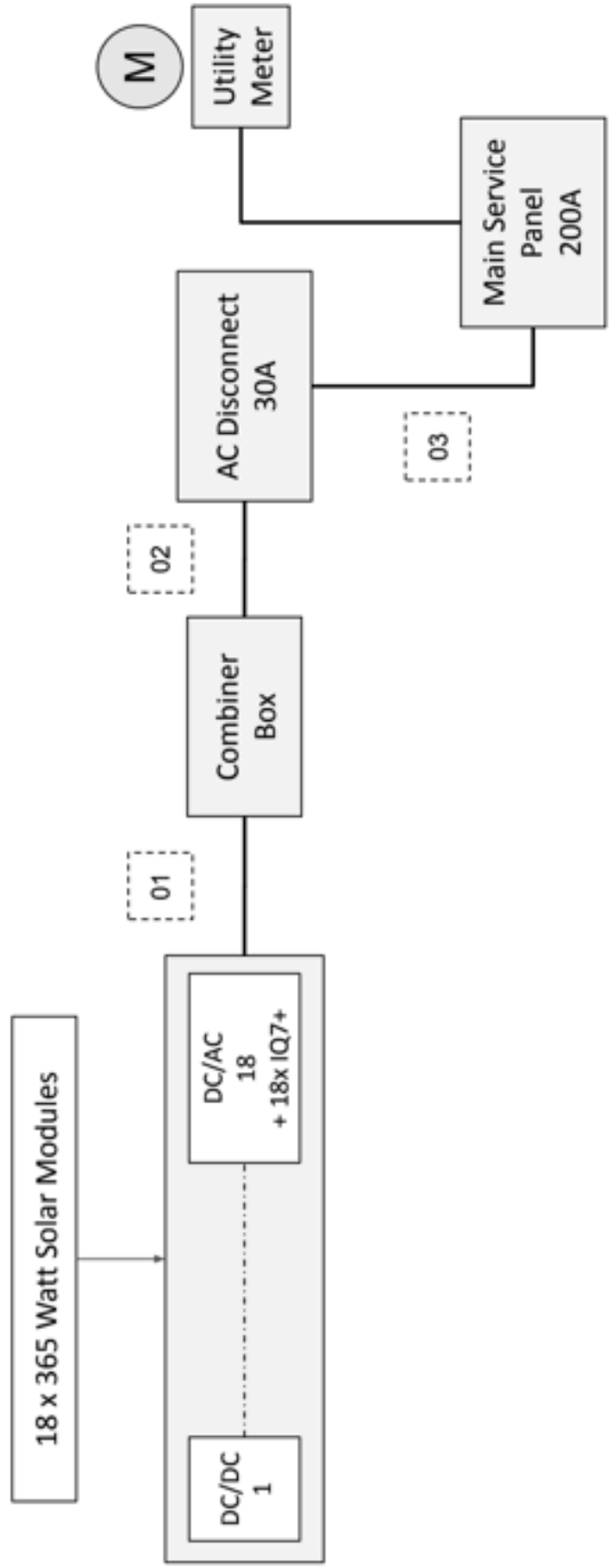
System Mount Overview continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System



Electrical Diagram

3956 W Lafayette Blvd, Detroit, MI 48216



#	Conductor	Conduit	OCPD
01	(2) #10 THHN (1)#10 Cu Ground	3/4" DIA EMT	N/A
02	(3) #10 THHN (1)#10 Ground	3/4" DIA EMT	30A
03	(3) #10 THHN (1)#10 Ground	3/4" DIA EMT	N/A



Installed Weight of PV System on Asphalt Shingle Roof

PV Module 60 Cell Framed Solar Module

Weight = 44lbs

Area = 39" x 65" nominal (17.6 Sq. Ft.)

Mounting Rail (Extruded Aluminum) Weight = 1.03/lf

There are 80" of rail per module = 6.87 Lbs

Module + Rail = 50.87 lbs over 17.6 Sq. Ft. = ***2.89 lbs/ Sq. Ft.**

Foot Spacing is 32" O.C. Across Panel Width with 2 rows per module.

Typical layout provides 13 feet on one rail for each 10 modules in a row.

This provides for an average of 1.3 feet/ Module/rail x 2 rails = 2.6 feet/module

Module + Rail weight distributed per mounting foot = 58.87 lbs /2.6 feet = 19.56 lbs / mtg foot.

Composite Shingle Roofing = 3.8 PSF

½" Ext Ply Sheathing = 1 PSF

Installed Solar Array = **2.89 #/ Sf ***

Total Load = 7.69#/sf

IRC-Table R802.5.1(3) Rafter Spans for Common Lumber Species.

System Mount Overview continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System



13. Systems using CAMO module clamps shall be installed with the following guidance:

- 1) For single module installations ("orphan modules") using modules with a length greater than 67.5", CAMO clamps shall not be installed in regions that experience ground snow loads of 70psf and greater; such scenarios are shown by asterisks in the applicable span table.
- 2) CAMO will function within a module's design load ratings. Be sure the specific module being used with CAMO is listed in IronRidge's installation manual. Is suitable for the environmental conditions of a particular project, and meets the dimensional requirements shown in the figure below.

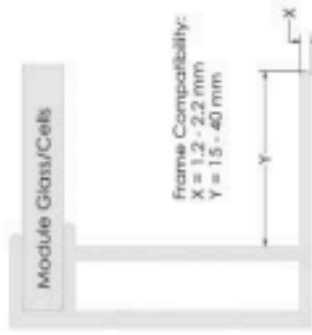


Figure 1: CAMO Module Frame Dimensional Requirements

The span tables provided in this letter are certified based on the structural performance of IronRidge XR Rails only with no consideration of the structural adequacy of the chosen roof attachments, PV modules, or the underlying roof supporting members. It is the responsibility of the installer or system designer to verify the structural capacity and adequacy of the aforementioned system components in regards to the applied or resultant loads of any chosen array configuration.

Sincerely,



Date:

2018.09.18

09:52:26 -07'00'

Gang Xuan, PE, LEED AP
Senior Structural Engineer

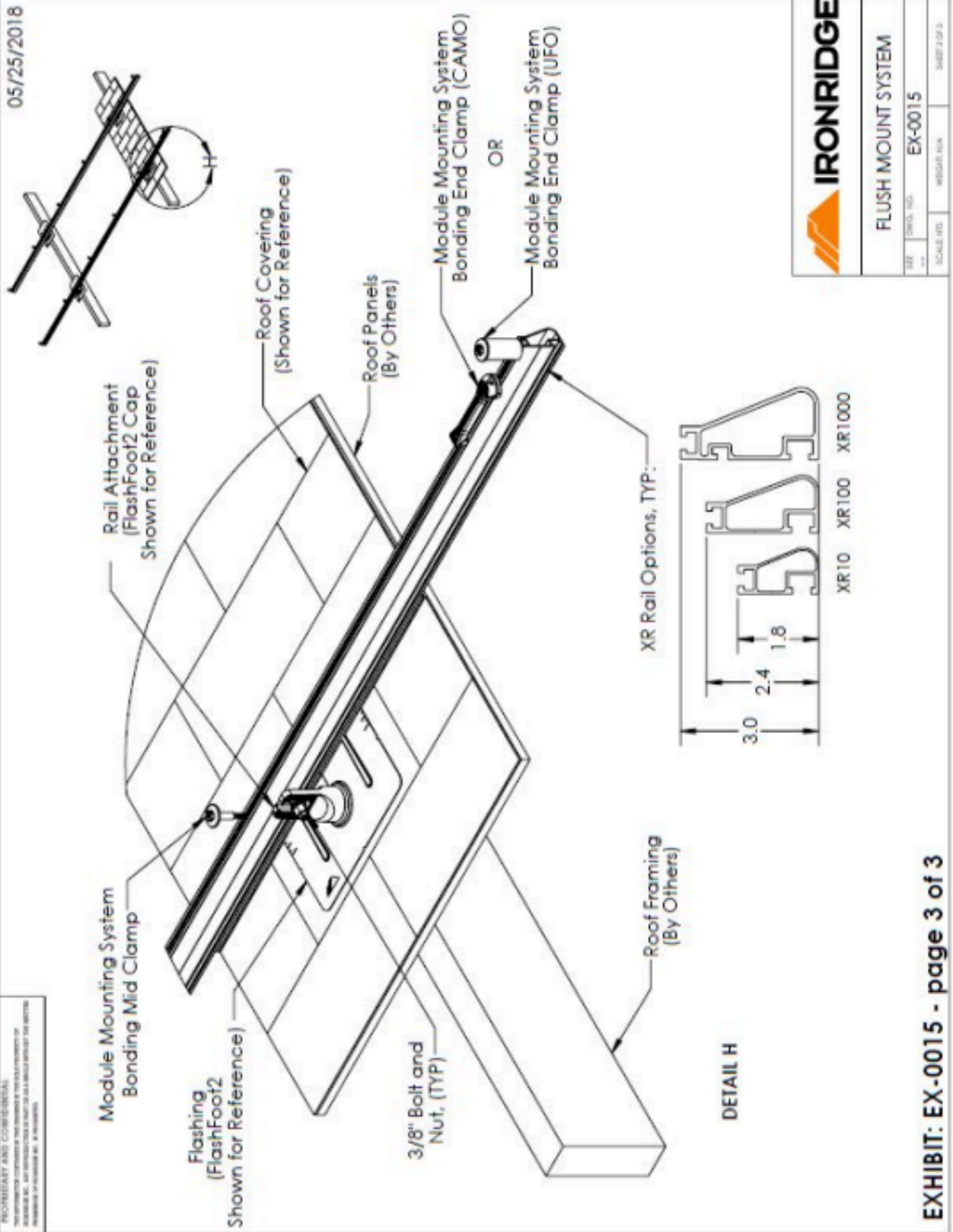
System Mount Overview continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System



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05/25/2018



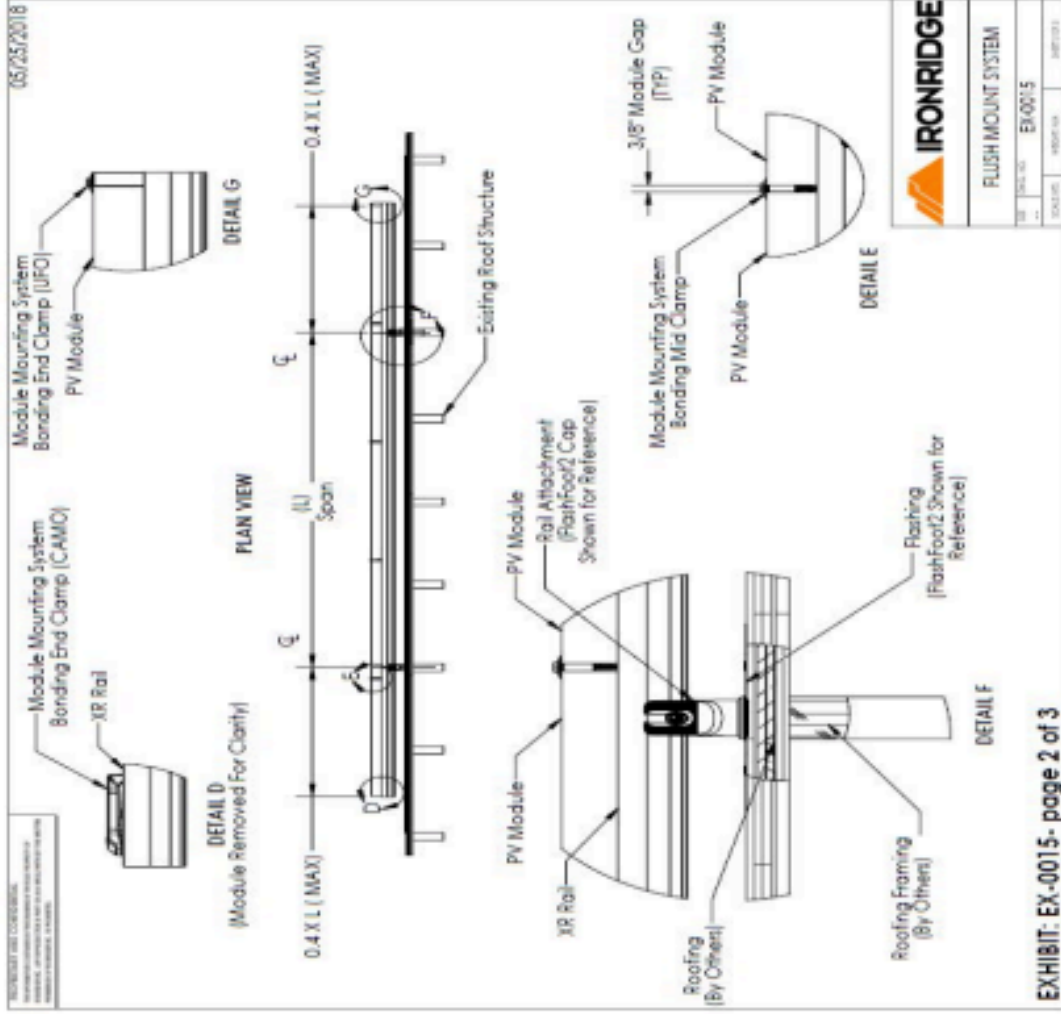
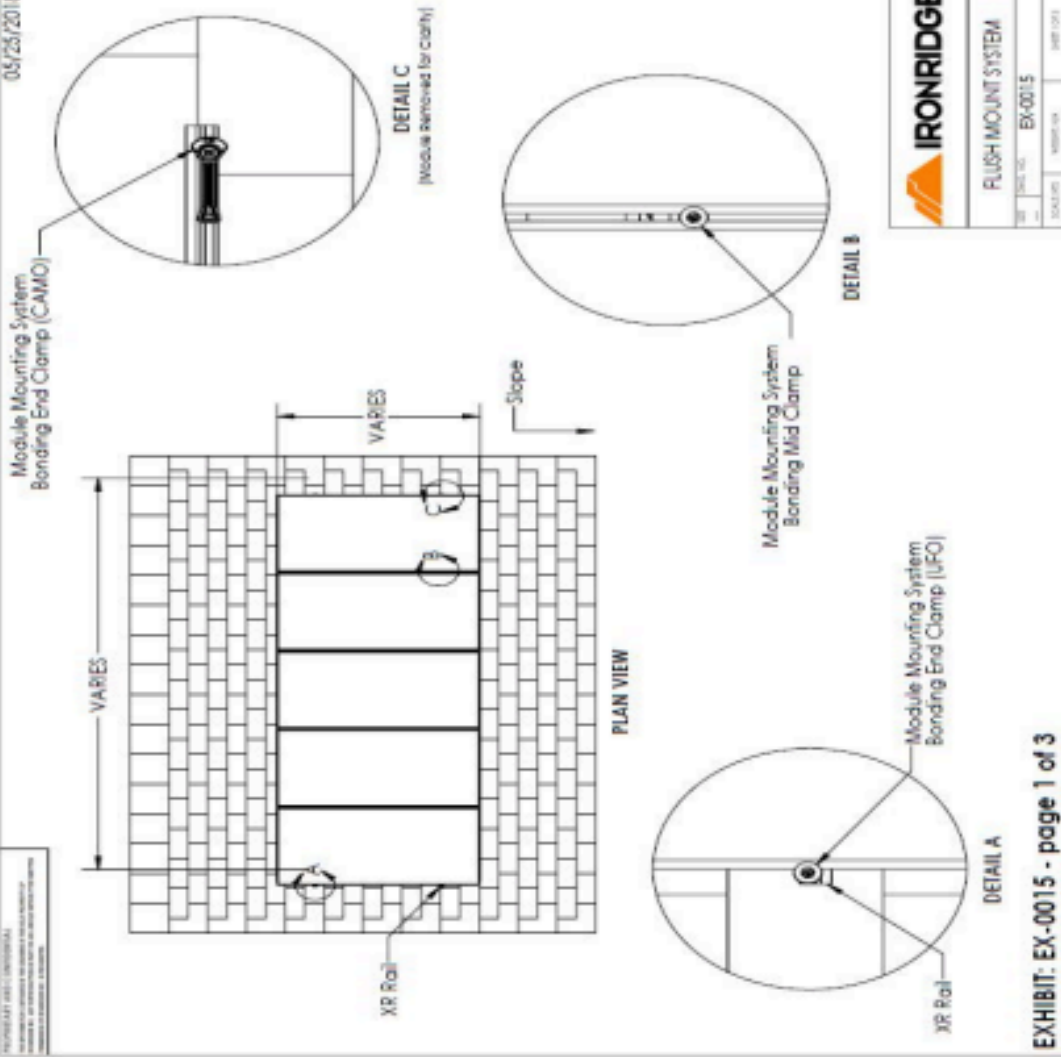
IRONRIDGE	
FLUSH MOUNT SYSTEM	
REV	DRWG. NO. EX-0015
SCALE: N/A	ISSUE: N/A
SHEET 3 OF 3	

EXHIBIT: EX-0015 - page 3 of 3

System Mount Overview continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System

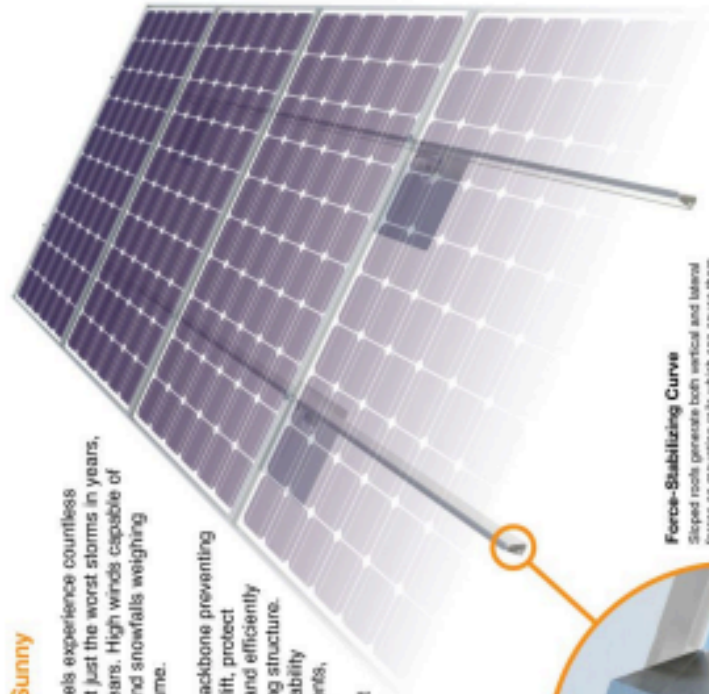




Solar Is Not Always Sunny

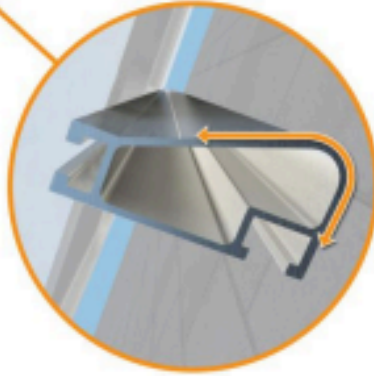
Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



Force-Stabilizing Curve

Steep roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.



Compatible with Flat & Pitched Roofs



XR Rails are compatible with Flat-Foot and other pitched roof attachments.



IronRidge offers a range of fit leg options for flat roof mounting applications.

Corrosion-Resistant Materials



All XR Rails are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



XR10

XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves 8 foot spans, while retaining light and economical.

- 8' spanning capability
- Moderate load capability
- Clear & black anodized finish
- Internal splices available



XR100

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 8 feet.

- 8' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



XR1000

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme conditions and spans up to 12 feet for commercial applications.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish
- Internal splices available

Rail Selection

The following table was prepared in compliance with applicable engineering codes and standards. Values are based on the following criteria: ASCE 7-10, Roof Zone 1, Exposure B, Roof Slope of 7 to 27 degrees and Mean Building Height of 30 ft. Visit IronRidge.com for detailed span tables and certifications.

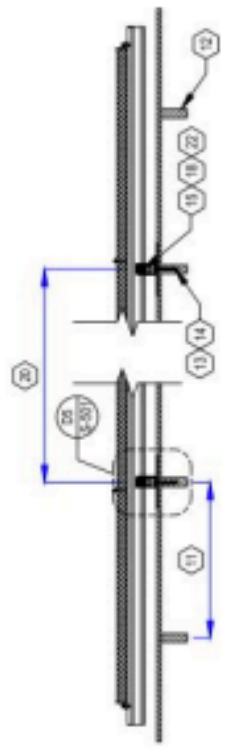
Load		Rail Span					
		4'	5' 5"	6'	8'	10'	12'
Snow (PSF)	100						
	120						
	140						
	160						
None	100						
	120						
	140						
	160						
10-20	100						
	120						
	140						
	160						
30	100						
	120						
	140						
	160						
40	100						
	120						
	140						
	160						
50-70	100						
	120						
	140						
	160						
80-90	100						
	120						
	140						
	160						

GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS

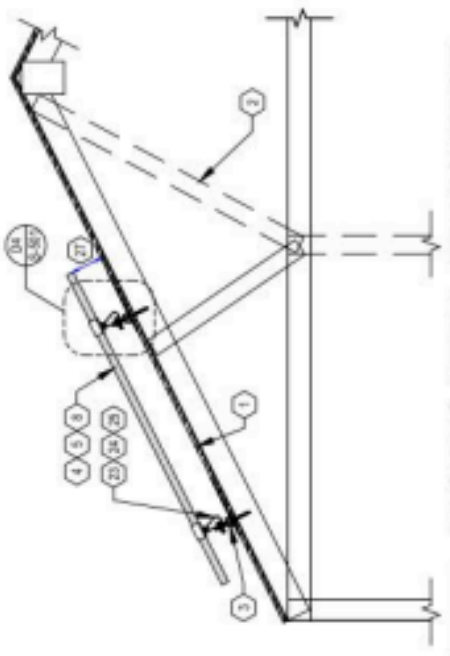
SHEET KEYNOTES

1. ROOF MATERIAL: ASPHALT SHINGLE
2. ROOF STRUCTURE: TRUSS
3. ATTACHMENT TYPE: IRONRIDGE FLASHFOOTZ
4. MODULE MANUFACTURER: SLAFB
5. MODULE MODEL: SLA110M
6. MODULE LENGTH: 64.96"
7. MODULE WIDTH: 38.96"
8. MODULE WEIGHT: 41.89 LBS
9. SEE SHEET A-103 FOR DIMENSIONS
10. MIN. FIRE OFFSET: NO FIRE CODE ENFORCED
11. TRUSS SPACING: 24 IN. O.C.
12. TRUSS SIZE: 2M4 NOMINAL
13. LAG BOLT DIAMETER: BOLT/SCREW SUPPLIED WITH RACKING
14. LAG BOLT EMBEDMENT: PER RACKING MFG SPECIFICATIONS
15. TOTAL # OF ATTACHMENTS: 56
16. TOTAL AREA: 962.7 SQ. FT.
17. TOTAL WEIGHT: 538.25 LBS
18. WEIGHT PER ATTACHMENT: 28.49 LBS
19. DISTRIBUTED LOAD: 2.73 PSF
20. MAX. HORIZONTAL STANDOFF: 48 IN.
21. MAX. VERTICAL STANDOFF: LANDSCAPE: 28 IN., PORTRAIT: 33 IN.
22. STANDOFF STAGGERING: YES
23. RAIL MANUFACTURER (OR EQUIV.): IRONRIDGE
24. RAIL MODEL (OR EQUIVALENT): XR100
25. RAIL WEIGHT: 0.88 PLF
26. MAX. TRUSS SPAN: 8 FT.
27. MODULE CLEARANCE: 3 IN. MIN., 6 IN. MAX.



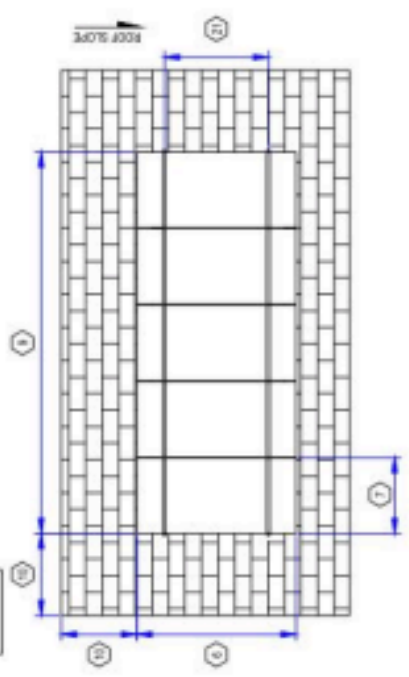
RACKING DETAIL (LONGITUDINAL)
NOT TO SCALE

D2



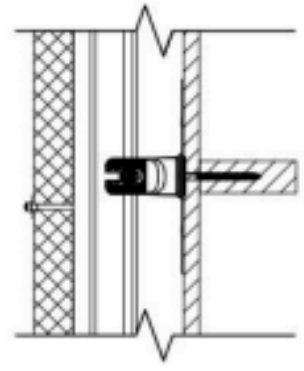
RACKING DETAIL (TRANSVERSE)
NOT TO SCALE

D1



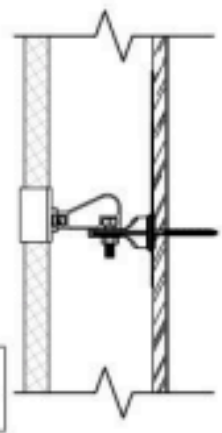
RACKING DETAIL (TOP)
NOT TO SCALE

D3



DETAIL (LONGITUDINAL)
NOT TO SCALE

D5



DETAIL (TRANSVERSE)
NOT TO SCALE

D4

System Mount Overview continued

The Strongest Attachment in Solar

IronRidge FlashFoot2 raises the bar in solar roof protection. The unique water seal design is both elevated and encapsulated, delivering redundant layers of protection against water intrusion. In addition, the twist-on Cap perfectly aligns the rail attachment with the lag bolt to maximize mechanical strength.

Twist-On Cap

FlashFoot2's unique Cap design encapsulates the lag bolt and locks into place with a simple twist. The Cap helps FlashFoot2 deliver superior structural strength, by aligning the rail and lag bolt in a concentric load path.

Three-Tier Water Seal

FlashFoot2's seal architecture utilizes three layers of protection. An elevated platform diverts water away, while a stack of rugged components raises the seal an entire inch. The seal is then fully-encapsulated by the Cap. FlashFoot2 is the first solar attachment to pass the TAS-100 Wind-Driven Rain Test.

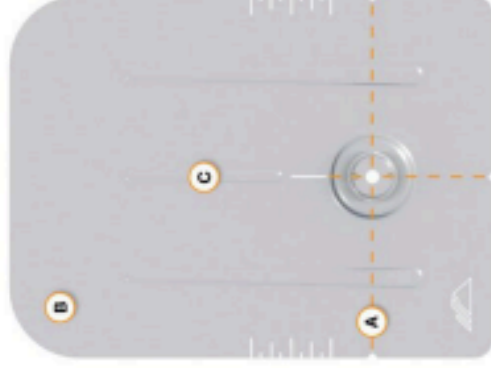
Single Socket Size

A custom-design lag bolt allows you to install FlashFoot2 with the same 3/16" socket size used on other Flush Mount System components.

Water-Shedding Design

An elevated platform diverts water away from the water seal.

Installation Features



A Alignment Markers

Quickly align the flashing with chalk lines to find pilot holes.

B Rounded Corners

Makes it easier to handle and insert under the roof shingles.

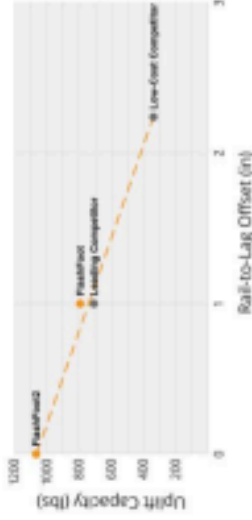
C Reinforcement Ribbs

Help to stiffen the flashing and prevent any bending or cracking during installation.

Benefits of Concentric Loading

Traditional solar attachments have a horizontal offset between the rail and lag bolt, which introduces leverage on the lag bolt and decreases uplift capacity.

FlashFoot2 is the only product to align the rail and lag bolt. This concentric loading design results in a stronger attachment for the system.



Testing & Certification

Structural Certification

Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings

Water Sealing Tested to UL 441 Section 27 "Rain Test" and TAS 100-95 "Wind Driven Rain Test" by Intertek. Ratings applicable for composition shingle roofs having slopes between 2:12 and 12:12.

UL 2703

Conforms to UL 2703 Mechanical and Bonding Requirements. See Flush Mount Install Manual for full ratings.

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System Mount Overview continued

Project: Harnois 6.75 kW Residential Roof-mount Solar System