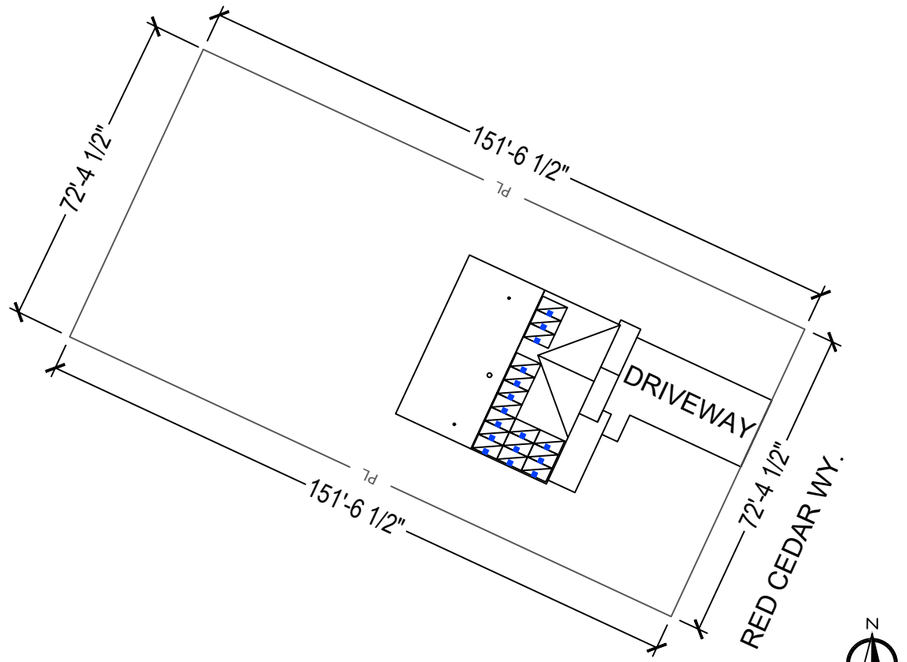
SCOPE OF WORK

NEW GRID-INTERACTIVE PHOTOVOLTAIC SYSTEM WITH NO BATTERY STORAGE

DC STC (KW):	6.40
AC RATING (KW):	4.64
MODULE:	(16) Q.PEAK DUO BLK ML-G10+ 400
MICROINVERTER:	(16) IQ8PLUS-72-2-US
COMBINER BOX:	X-1Q-AM1-240-4

SHEET INDEX



A PLOT PLAN
NOT TO SCALE

SITE DETAILS

ASHRAE EXTREME LOW: -11°C
ASHRAE 2% HIGH: 34°C
CLIMATE DATA SOURCE: FSEC
WIND SPEED: 117 MPH
RISK CATEGORY: II
WIND EXPOSURE CATEGORY: B
GROUND SNOW LOAD: 15 PSF

INTERCONNECTION DETAILS

POINT OF INTERCONNECTION: NEW LINE SIDE TAP
CONNECTION PER NEC 705.12 (A)

UTILITY SERVICE: 120/240V

LOCATION: LINE SIDE TAP WITHIN THE MAIN SERVICE PANEL

PROJECT DETAILS

PROPERTY OWNER: ASHIM GHIMIRE
PROPERTY ADDRESS: 195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

BUILDING INFORMATION: TWO STORY HOUSE
OCCUPANCY: RESIDENTIAL GROUP R-3

ELECTRICAL INFORMATION
UTILITY COMPANY: DUKE ENERGY
MAIN SERVICE AMPERAGE: 200A

AHJ: COUNTY OF HARNETT

APPLICABLE CODES:

ELECTRICAL	2017 NC ELECTRICAL CODE	(2017 NEC)
FIRE	2018 NC FIRE CODE	(2018 IFC)
BUILDING	2018 NC BUILDING CODE	(2018 IBC)
PLUMBING	2018 NC PLUMBING CODE	(2018 IPC)
DWELLING	2018 NC RESIDENTIAL CODE	(2018 IRC)

CONTRACTOR INFORMATION

COMPANY: EMPWR SOLAR

ADDRESS: 1007 JOHNNIE DODDS BLVD
SUITE 111
MT. PLEASANT, SC 29464

PHONE NUMBER: (866) 337-1104
www.empwrsolar.com/

B AERIAL VIEW
NOT TO SCALE

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM
ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526
6.4KW DC 4.64KW AC

NORTH CAROLINA PROFESSIONAL SEAL 027575 ENGINEER PETER J HAZEL
9/23/2022

PROJECT SUMMARY

DOC ID	
DATE: 9/23/2022	
CREATED BY: JPL	
REVIEWED BY:	

REVISIONS

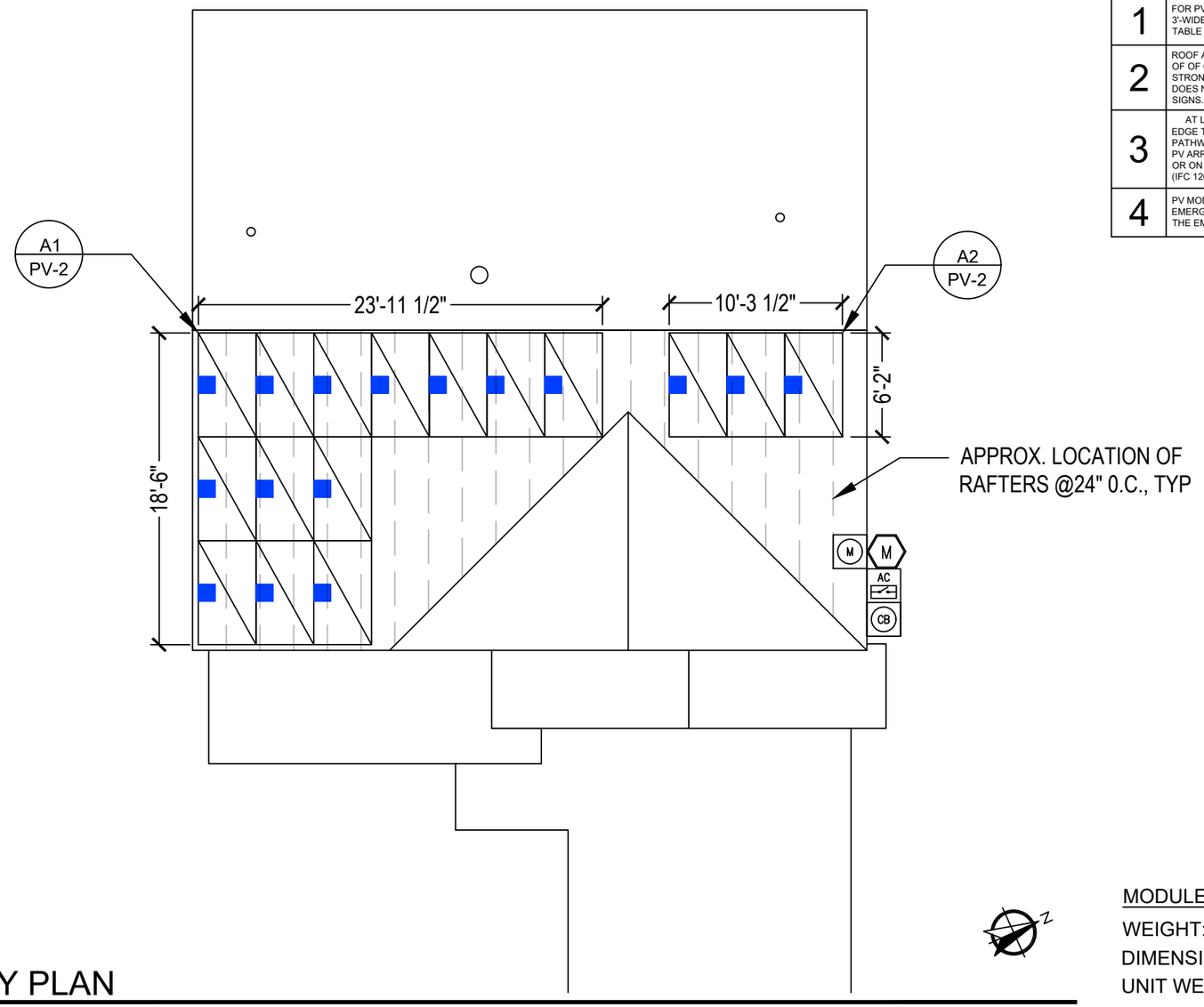
PV-1

ROOF PROPERTIES

ROOF MATERIAL	COMP SHINGLE
SLOPE	34°
MEAN ROOF HEIGHT	50FT
DECK SHEATHING	15 / 32" OSB
CONSTRUCTION	2X4@24"O.C.

ARRAY AREA

ARRAY	# OF MODULES	ARRAY AREA (SQFT)	ROOF TILT	AZIMUTH
A1	13	319.55	34°	114°
A2	3	63.30	34°	114°



ARRAY PLAN

1/8" = 1'-0"

GENERAL NOTES

1	EQUIPMENT LIKELY TO BE WORKED UPON WHILE ENERGIZED SHALL BE INSTALLED IN LOCATIONS THAT SATISFY MINIMUM WORKING CLEARANCES PER NEC 110.26.
2	CONTRACTORS SHALL USE ONLY COMPONENTS LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY FOR THE INTENDED USE.
3	CONTRACTOR IS RESPONSIBLE FOR FURNISHING ALL EQUIPMENT, CABLES, ADDITIONAL CONDUITS, RACEWAYS, AND OTHER ACCESSORIES NECESSARY FOR A COMPLETE AND OPERATIONAL PV SYSTEM.
4	WHERE DC PV SOURCE OR DC PV OUTPUT CIRCUITS ARE RUN INSIDE THE BUILDING, THEY SHALL BE CONTAINED IN METAL RACEWAYS, TYPE MC METAL-CLAD CABLE, OR METAL ENCLOSURES FROM THE POINT OF PENETRATION INTO THE BUILDING TO THE FIRST READILY ACCESSIBLE DISCONNECTING MEANS, PER NEC 690.31 (G).
5	RAFTER LOCATIONS ARE APPROXIMATE. ACTUAL LOCATIONS MAY DIFFER AND CONTRACTOR MAY NEED TO ADJUST MOUNT LOCATIONS. IN NO CASE SHALL THE MOUNT SPACING EXCEED "MAX. MOUNT SPACING"

SETBACK NOTES

1	FOR PV ARRAYS OCCUPYING MORE THAN 1/3 OF THE PLAN VIEW TOTAL ROOF AREA, A MIN. 3'-WIDE SETBACK IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE.(IFC 1204.2.1.2) (SEE TABLE ON SHEET PV-2)
2	ROOF ACCESS POINT SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES OR SIGNS.
3	AT LEAST TWO 36"-WIDE PATHWAYS ON SEPARATE ROOF PLANES, FROM LOWEST ROOF EDGE TO RIDGE, SHALL BE PROVIDED ON ALL BUILDINGS. THERE SHALL BE AT LEAST ONE PATHWAY ON THE STREET OR DRIVEWAY SIDE OF THE ROOF. FOR EACH ROOF PLANE WITH A PV ARRAY, AT LEAST ONE SUCH PATHWAY SHALL BE PROVIDED ON THE SAME ROOF PLANE, OR ON AN ADJACENT ROOF PLANE, OR STRADDLING THE SAME AND ADJACENT ROOF PLANES. (IFC 1204.2.1.1)
4	PV MODULES SHALL NOT BE INSTALLED ON THE PORTION OF A ROOF THAT IS BELOW AN EMERGENCY ESCAPE AND RESCUE OPENING. A 36"-WIDE PATHWAY SHALL BE PROVIDED TO THE EMERGENCY ESCAPE AND RESCUE OPENING. (IFC 1204.2.2)

SITE PLAN LEGEND

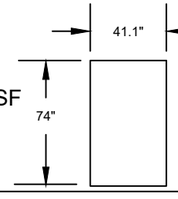
- M — SERVICE ENTRANCE AND 200A MAIN PANEL
- Inv — INVERTER
- LC — PV LOAD CENTER
- M — METER
- J — JUNCTION BOX
- P — PULLBOX
- DC — DC DISCONNECT
- AC — AC DISCONNECT
- S — FACILITY SUBPANEL
- B — BATTERY
- ESS — ENERGY STORAGE SYSTEM
- ATS — AUTO TRANSFER SWITCH
- CB — COMBINER BOX
- – – – RAFTERS

MODULE DIMENSIONS & WEIGHT

WEIGHT: 48.5 LBS/22 KG

DIMENSIONS: 74 IN X 41.1 IN=21.1 SF

UNIT WEIGHT OF ARRAY: 2.6 PSF



195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

NORTH CAROLINA PROFESSIONAL SEAL 027575 ENGINEER PETER J HAZEL

9/23/2022

ROOF PLAN

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

PV-2

GENERAL ELECTRICAL NOTES

1	UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
2	MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
3	CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICL 310.10 (D)
4	CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).

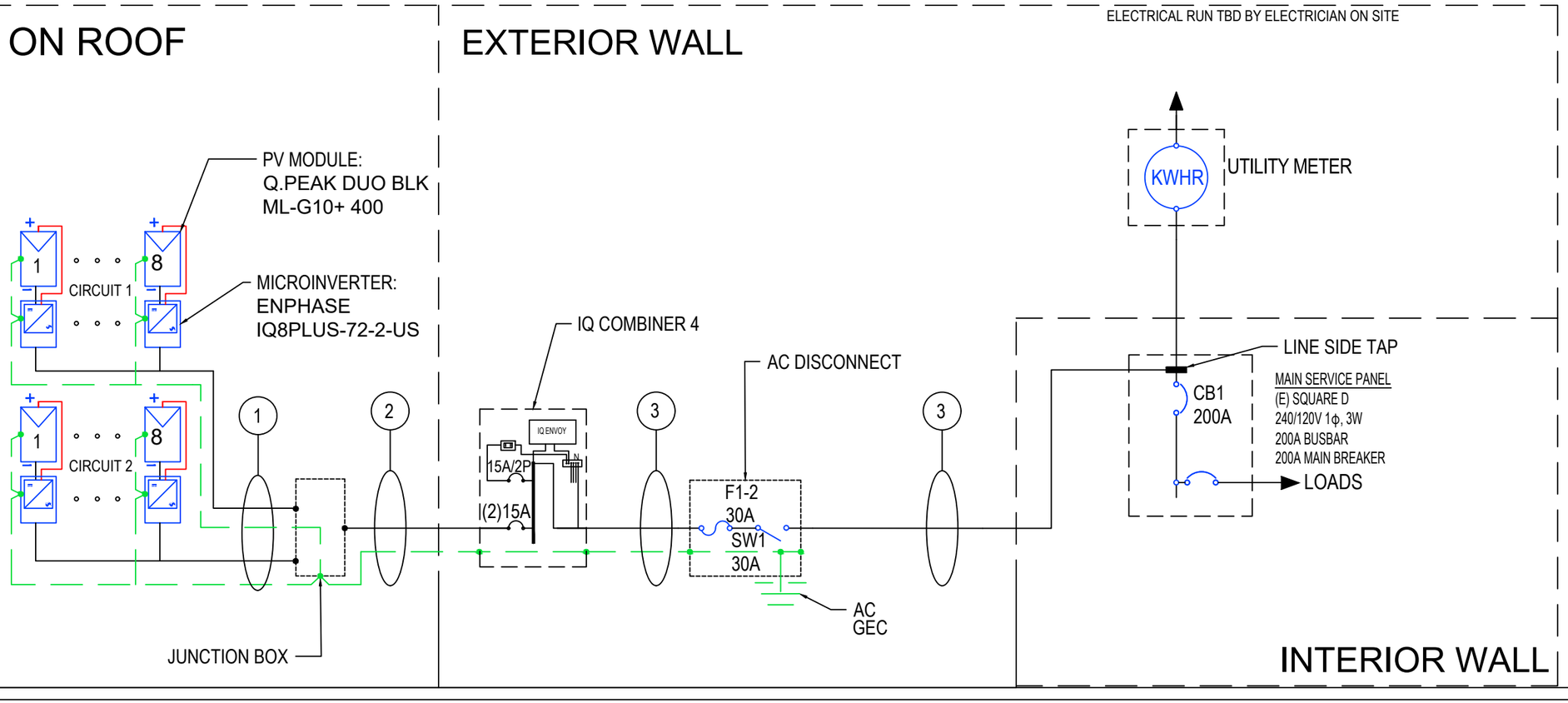
SERVICE INFORMATION
UTILITY COMPANY: DUKE ENERGY
MAIN SERVICE VOLTAGE: 240V
MSP MANUFACTURER: SQUARE D
MAIN SERVICE PANEL: 200A
MAIN CIRCUIT RATING: 200A

NOTES

1	MATING CONNECTORS SHALL COMPLY WITH NEC 690.33.
2	PHOTOVOLTAIC MOUNTED SYSTEM MEETS REQUIREMENTS FOR PHOTOVOLTAIC RAPID SHUTDOWN SYSTEM (PVRSS), AS PER NEC 690.12(B).
3	DC PV CONDUCTORS ARE NOT SOLIDLY-GROUNDED. NO DC PV CONDUCTOR SHALL BE WHITE- OR- GRAY COLORED
4	ALL METAL ENCLOSURES, RACEWAYS, CABLES AND EXPOSED NONCURRENT-CARRYING METAL PARTS OF EQUIPMENT SHALL BE GROUNDED TO EARTH AS REQUIRED BY NEC 250.4(A) AND PART III OF ARTICLE 250 AND EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO NEC 690.45. THE GROUNDING ELECTRODE SYSTEM SHALL ADHERE TO NEC 690.47(A) AND NEC 250.169. THE DC GROUNDING ELECTRODE SHALL BE SIZED ACCORDING TO NEC 250.166 AND INSTALLED IN COMPLIANCE WITH NEC 250.64.
5	MAX DC VOLTAGE OF ARRAY FIXED BY THE INVERTER AT 400V REGARDLESS OF TEMPERATURE. THE MAX DC VOLTAGE OF THE MODULE AT -17°C IS 45.3V (-17°C - 25°C) X -0.11V/C + 40.66V = 45.3V).
6	POINT-OF-INTERCONNECTION IS ON LINE SIDE OF SERVICE DISCONNECT, IN COMPLIANCE WITH NEC 705.12(A)
7	PV SYSTEM DISCONNECT SHALL BE A VISIBLE KNIFE-BLADE TYPE DISCONNECT THAT IS ACCESSIBLE AND LOCKABLE BY THE UTILITY IN ACCORDANCE WITH NEC 690.13(E). THE DISCONNECT SHALL BE LOCATED WITHIN 10 FT OF UTILITY METER AND INSTALLED IN COMPLIANCE WITH NEC 705.20 AND GROUPED AS REQUIRED BY NEC 230.72.

GROUNDING NOTES

1	ALL EQUIPMENT SHALL BE PROPERLY GROUNDED PER THE REQUIREMENTS OF NEC ARTICLES 250 & 690
2	PV MODULES SHALL BE GROUNDED TO MOUNTING RAILS USING MODULE LUGS OR RACKING INTEGRATED GROUNDED CLAMPS AS ALLOWED BY LOCAL JURISDICTION. ALL OTHER EXPOSED METAL PARTS SHALL BE GROUNDED USING UL-LISTED LAY-IN LUGS.
3	INSTALLER SHALL CONFIRM THAT MOUNTING SYSTEM HAS BEEN EVALUATED FOR COMPLIANCE WITH UL 2703 "GROUNDING AND BONDING" WHEN USED WITH PROPOSED PV MODULE.
4	ALL GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE
5	IF THE EXISTING MAIN SERVICE PANEL DOES NOT HAVE A VERIFIABLE GROUNDING ELECTRODE, IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL A SUPPLEMENTAL GROUNDING ELECTRODE.
6	AC SYSTEM GROUNDING ELECTRODE CONDUCTOR (GEC) SHALL BE A MINIMUM SIZE #8AWG WHEN INSULATED, #6AWG IF BARE WIRE.
7	EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO NEC ARTICLE 690.45, AND BE A MINIMUM OF #10AWG WHEN NOT EXPOSED TO DAMAGE, AND #6AWG SHALL BE USED WHEN EXPOSED TO DAMAGE
8	GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLOR CODED GREEN, OR MARKED GREEN IF #4AWG OR LARGER



195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

SINGLE LINE DIAGRAM 1-2

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

PV-3

MODULES										
REF.	QTY	MAKE AND MODEL	PMAX	PTC	ISC	IMP	VOC	VMP	TEMP. COEFF. OF VOC	FUSE RATING
PV MODULE	16	HANHWA Q.PEAK DUO BLK ML-G10+ 400	400W	318W	11.14	10.77	45.30	37.13	-0.27%/C°	20A

MICROINVERTERS									
REF.	QTY.	MAKE AND MODEL	AC VOLTAGE	GROUND	RATED POWER	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX INPUT VOLTAGE	CEC WEIGHTED EFFICIENCY
MINV	16	ENPHASE IQ8PLUS-72-2-US	240V	NOT SOLIDLY GROUNDED	290W	1.21A	15A	60V	97%

COMBINER BOX							
REF.	QTY.	MODEL	AC VOTLAGE	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX BRANCH RATING	BUSBAR RATING
CB	1	ENPHASE X-IQ-AM1-240-4	240V	65A	64A	80A	125A

DISCONNECTS				
REF.	QTY.	MAKE AND MODEL	RATED CURRENT	MAX RATED VOLTAGE
ACD	1	EATON DG221NRB OR EQUIV.	30A	240VAC

OCPDS			
REF.	QTY.	RATED CURRENT	MAX VOLTAGE
CB1	1	200A	240VAC
F1-2	1	30A	240VAC

EQUIPMENT SCHEDULE

AC WIRE AND CONDUIT SCHEDULE

ID	CIRCUIT DESCRIPTION	ORIGIN	DESINATION	CONDUIT TYPE	CONDUIT SIZE	CONDUIT FILL %	CONDUCTOR QTY PER CONDUIT	CONDUCTOR SIZE	CONDUCTOR MATERIAL	CONDUCTOR INSULATION	NEUTRAL & EQUIP. GROUND SIZE
1	MICROINVERTER TO JBOX	MINV	JBOX	Q CABLE	N/A	N/A	2	#12	CU	PV WIRE	--
2	JBOX TO COMBINER BOX (ATTIC)	JBOX	CB	LFMC	3/4"	35.35%	4	#10	CU	THWN-2	#10
3	COMBINER BOX TO ACD TO MAIN SERVICE PANEL	CB	MSP	EMT	3/4"	26.94%	2	#6	CU	THWN-2	#8

AC AMPACITY CALCULATIONS

ID	AMBIENT TEMP.	AMBIENT TEMP. CORRECTION FACTOR	# CONDUIT ADJUSTMENT FACTOR	MAX. CIRCUIT CURRENT (AMPS)	MIN. CONDUCTOR AMPACITY	DERATED AMPACITY	CONDUCTOR AMAPCITY	OCPD RATING	VOLTAGE DROP PERCENTAGE
1	34	0.94	1.00	9.67	12.08	23.50	25	20	0.00
2	34	0.94	0.80	9.67	12.08	26.32	35	20	0.12
3	34	0.94	1.00	19.33	24.17	61.10	65	25	0.15

WIRE AND CONDUIT CALCULATIONS

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

WIRING CALCS 2-2

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

PV-4

DC- DISCONNECT

2 5 7

DC RACEWAYS

6

JBOX - TRANSITION BOX
(SOLADECK 0783-3R-4ER6)

2

ACD - DISCONNECT
(EATON DG221NRB)

2 3 4 9

INV - MICROINVERTER
(ENPHASE IQ8PLUS-72-2-US)

2 3

MSP - MAIN SERVICE PANEL
(SQUARE D)

1 4 8 9

10

8

⚠ WARNING

DUAL POWER SUPPLY

SOURCES: UTILITY GRID AND
PV SOLAR ELECTRIC SYSTEM

VINYL LABEL, ORANGE W/ WHITE, BLACK LETTERS
PLACEMENT: MAIN SERVICE PANEL; NEC705.12(D)(3)

9

**PHOTOVOLTAIC SYSTEM
AC DISCONNECT**

OPERATING VOLTAGE:	240 VOLTS
RATED CURRENT:	19.3 AMPS

VINYL LABEL, BLACK W/ WHITE LETTERS; NEC 690.54
PLACEMENT: AC DISCONNECT, MAIN SERVICE PANEL

10

⚠ WARNING

POWER SOURCE OUTPUT
CONNECTION DO NOT RELOCATE
THIS OVERCURRENT DEVICE

VINYL LABEL, ORANGE W/ WHITE, BLACK LETTERS
PLACEMENT: NEAR PV BREAKER; NEC705.12(D)(2)(3)(b)

⚠ CAUTION: ⚠

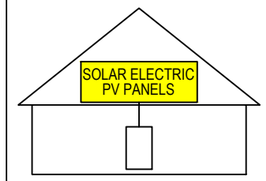
MULTIPLE SOURCES OF POWER

VINYL LABEL, YELLOW W/ BLACK LETTERS,
PLACEMENT: MAIN SERVICE PANEL; NEC 705.10
WILL BE CUSTOMIZED WITH DIRECTORY OF DISCONNECTING MEANS PROPERLY

1

**SOLAR PV SYSTEM EQUIPPED
WITH RAPID SHUTDOWN**

TURN RAPID SHUTDOWN
SWITCH TO THE
"OFF" POSITION TO
SHUT DOWN PV SYSTEM
AND REDUCE
SHOCK HAZARD
IN THE ARRAY



VINYL LABEL, YELLOW W/ WHITE, BLACK LETTERS
PLACEMENT: MAIN SERVICE PANEL; NEC 690.56(C)(1)(a)

2

⚠ WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON THE
LINE AND LOAD SIDES MAY
BE ENERGIZED IN THE
OPEN POSITION

VINYL LABEL, ORANGE W/ WHITE, BLACK LETTERS
PLACEMENT: AC DISC, DC COMBINER BOX, DC DISCONNECT; NEC 690.13(B)

3

**RAPID SHUTDOWN SWITCH
FOR SOLAR PV SYSTEM**

VINYL LABEL, RED W/ WHITE LETTERS
PLACEMENT: AC DISCONNECT, INVERTER; NEC 690.56(C)(3)

4

**PHOTOVOLTAIC AC
DISCONNECT**

VINYL LABEL, WHITE W/ BLACK LETTERS
PLACEMENT: AC DISCONNECT, MAIN SERVICE PANEL; NEC 690.13(B)

WARNING LABELS

NTS

195-2022

EMPWR SOLAR

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

WARNING
LABELS

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

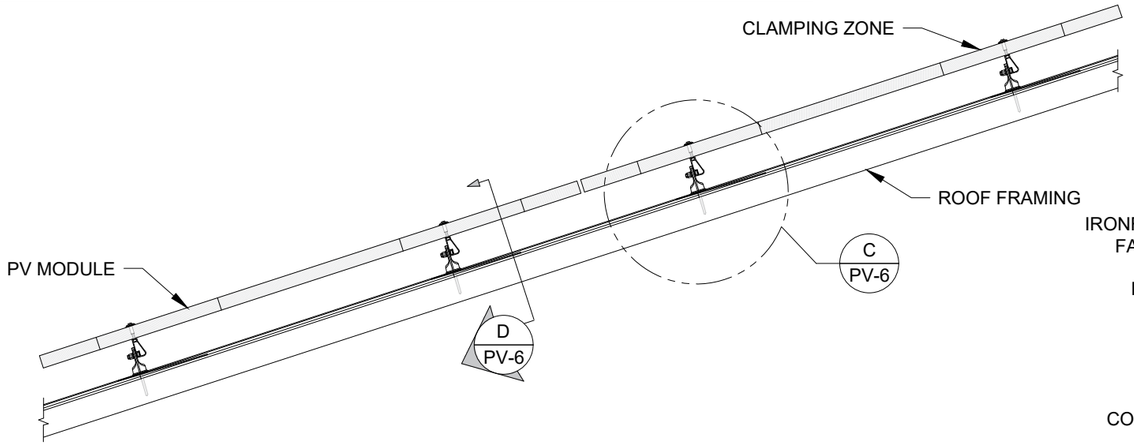
PV-5

MOUNTING SYSTEM PROPERTIES

MAX. MOUNT SPACING	72IN (ZONES 1,2, AND 3)
MAX. ALLOW. CANTILEVER	18IN (ZONES 1,2, AND 3)
GROUNDING AND BONDING	INTEGRAL GROUNDING CERTIFIED TO UL 2703 REQUIREMENTS

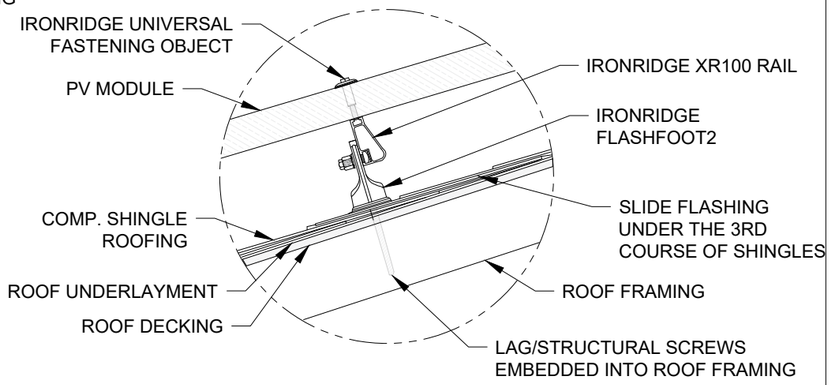
MOUNTING SYSTEM NOTES

1	FLASHING SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS.
2	IF THERE IS ANY CONFLICT BETWEEN WHAT IS DEPICTED HERE AND INSTRUCTIONS PROVIDED BE A MANUFACTURER, THE MANUFACTURER'S INSTRUCTIONS SHALL SUPERCEDE.

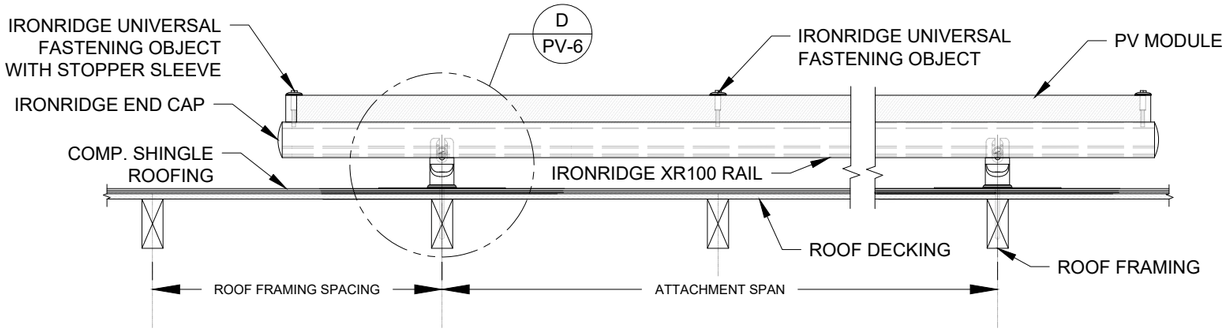


LAGSCREW DIAMETER: 5/16"
MINIMUM EMBEDMENT: 2-1/2"

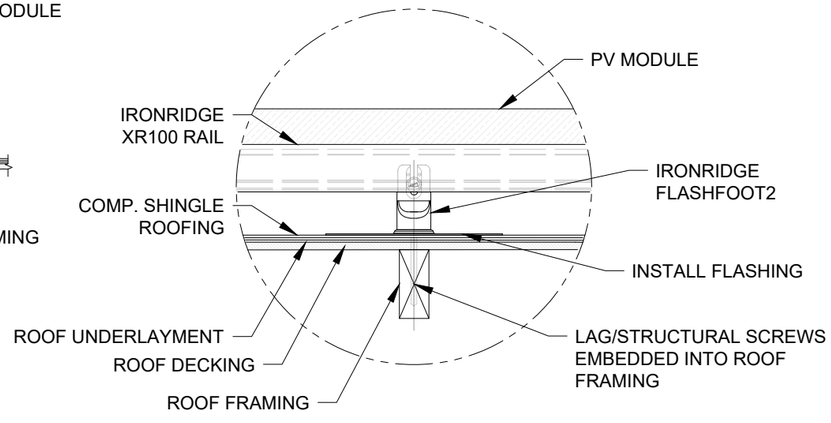
A PV-6 RACKING ELEVATION (TRANSVERSE VIEW)
SCALE: NTS



C PV-6 ATTACHMENT DETAIL (TRANSVERSE VIEW)
SCALE: NTS



B PV-6 RACKING ELEVATION (LONGITUDINAL VIEW)
SCALE: NTS



D PV-6 ATTACHMENT DETAIL (LONGITUDINAL VIEW)
SCALE: NTS

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

NORTH CAROLINA PROFESSIONAL SEAL 027575 ENGINEER PETER J HAZEL

9/23/2022

ATTACHMENT DETAILS

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

PV-6

Project Details

Name	195 Red Cedar Way	**Date**	09/23/2022
Location	195 Red Cedar Way, Fuquay-Varina, NC 27526	**Total modules**	16
Module	Hanwha Q.Cells: Q.PEAK DUO BLK ML-G10+ 400 (32mm)	**Total watts**	6,400
Dimensions	Dimensions: 73.98" x 41.14" x 1.26" (1879.0mm x 1045.0mm x 32.0mm)	**Attachments**	28
ASCE	7-16	**Rails per row**	2

System Weight

Total system weight	902.6 lbs
Weight/attachment	41.0 lbs
Racking weight	126.6 lbs
Distributed weight	2.6 psf

Load Assumptions

Wind exposure	B
Wind speed	117 mph
Ground snow load	15 psf
Attachment spacing portrait	6.0'
Site Elevation	333.0 ft
S_{DS}	0.134

Roof Information

Roof Material Family	Comp Shingle	**Roof material**	Comp Shingle
Building height	30 ft	**Roof attachment**	Flashfoot2
Roof slope	34 °	**Attachment hardware**	Square
Risk category	II		
Roof shape	Gable		

Span Details XR100 - Portrait

Zone	Module Position	Max span	Max cantilever
Zone 1/2e/2r	Normal	7' 7"	3'
Zone 2n/3r	Normal	7' 7"	3'
Zone 3e	Normal	7' 7"	3'

Reaction Forces XR100 - Portrait

Zone	Module Position	Down (lbs)	Uplift (lbs)	Lateral (lbs)
Zone 1/2e/2r	Normal	262	206	104
Zone 2n/3r	Normal	262	246	104
Zone 3e	Normal	262	313	104

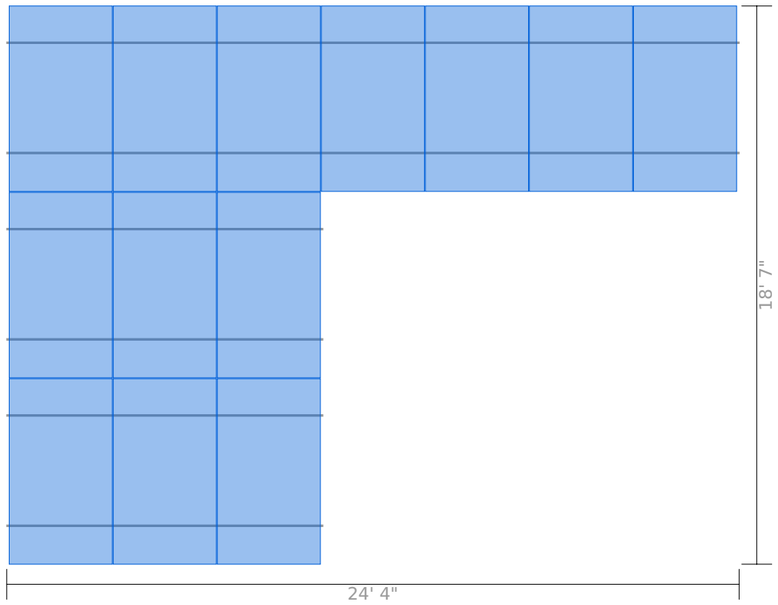
Bill of Materials

Part	Spares	Total Qty
Rails & Splices		
XR-100-168A XR100, Rail 168" (14 Feet) Clear	0	10
XR100-BOSS-01-M1 Bonded Splice, XR100	0	2
Clamps & Grounding		
UFO-CL-01-A1 Universal Module Clamp, Clear	0	40
UFO-STP-32MM-M1 Stopper Sleeve, 32MM, Mill	0	16
XR-LUG-03-A1 Grounding Lug, Low Profile	0	4
Attachments		
FF2-01-M2 FlashFoot2, Mill	0	28
BHW-SQ-02-A1 Square-Bolt Bonding Hardware	0	28

Roof Section 1

Details		Weights
Panels: 13	Provided rail: 112' [8 x 168"]	Total weight: 732.4 lbs
Rail orientation: East-West	Attachments: 22	Weight/attachment: 40.7 lbs
Panel orientation: Portrait	Splices: 2	Total Area: 280.1 sq ft
Entry type: Graphical	Clamps: 32	Distributed weight: 2.6 psf

Diagram



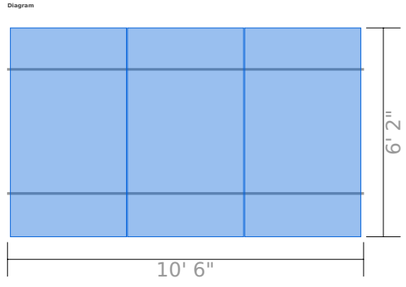
Segments

Identifier	Columns	Row length	Rail length	Cantilever	Rail	Attachments	Splices	Clamps
A	7	24' 4"	24' 4"	2"	**56' [4 x 168"]**	**10**	**2**	**16**
B	3	10' 6"	10' 6"	3"	28' [2 x 168"]	6	0	8
			Row segment totals (x 2) →		**56' [4 x 168"]**	**12**	**0**	**16**

Roof Section 1

Details		Weights
Panels: 3	Provided rail: 28' [2 x 168"]	Total weight: 170.2 lbs
Rail orientation: East-West	Attachments: 6	Weight/attachment: 42.6 lbs
Panel orientation: Portrait	Splices: 0	Total Area: 64.8 sq ft
Entry type: Graphical	Clamps: 8	Distributed weight: 2.6 psf

Diagram



Segments

Identifier	Columns	Row length	Rail length	Cantilever	Rail	Attachments	Splices	Clamps
A	3	10' 6"	10' 6"	3"	**28' [2 x 168"]**	**6**	**0**	**8**

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

NORTH CAROLINA PROFESSIONAL SEAL 027575 ENGINEER PETER J HAZEL
9/23/2022

IRONRIDGE REPORTS

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

PV-7

powered by Q.ANTUM DUO Z

Q.PEAK DUO BLK ML-G10+

385-405

ENDURING HIGH PERFORMANCE

25 YR Warranty Product & Performance

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2021

Q CELLS Yield Security

BREAKING THE 20% EFFICIENCY BARRIER
Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.

THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY
Q CELLS is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.

INNOVATIVE ALL-WEATHER TECHNOLOGY
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

ENDURING HIGH PERFORMANCE
Long-term yield security with Anti LID Technology, Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

EXTREME WEATHER RATING
High-tech aluminum alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa).

A RELIABLE INVESTMENT
Inclusive 25-year product warranty and 25-year linear performance warranty[2].

[1] APT test conditions according to IEC/TS 62804-1:2015, method A (–1500 V, 96 h)
[2] See data sheet on rear for further information.

THE IDEAL SOLUTION FOR:

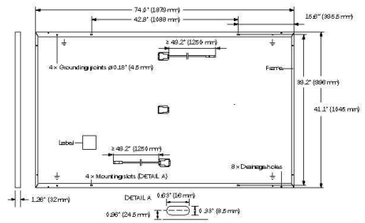
Rooftop arrays on residential buildings

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09–3.98 in × 1.26–2.36 in × 0.59–0.71 in (53–101 mm × 32–60 mm × 15–18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 49.2 in (1250 mm), (–) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

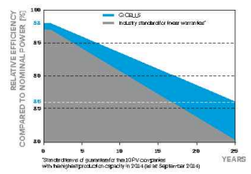


ELECTRICAL CHARACTERISTICS

POWER CLASS			385	390	395	400	405
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / –0 W)							
Minimum	Power at MPP[1]	P_{MPP} [W]	385	390	395	400	405
	Short Circuit Current[1]	I_{SC} [A]	11.04	11.07	11.10	11.14	11.17
	Open Circuit Voltage[1]	V_{OC} [V]	45.19	45.23	45.27	45.30	45.34
	Current at MPP	I_{MPP} [A]	10.59	10.65	10.71	10.77	10.83
	Voltage at MPP	V_{MPP} [V]	36.36	36.62	36.88	37.13	37.39
	Efficiency[1]	η [%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]							
Minimum	Power at MPP	P_{MPP} [W]	288.8	292.6	296.3	300.1	303.8
	Short Circuit Current	I_{SC} [A]	8.90	8.92	8.95	8.97	9.00
	Open Circuit Voltage	V_{OC} [V]	42.62	42.65	42.69	42.72	42.76
	Current at MPP	I_{MPP} [A]	8.35	8.41	8.46	8.51	8.57
	Voltage at MPP	V_{MPP} [V]	34.59	34.81	35.03	35.25	35.46

[1] Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2] 800 W/m², NMOT, spectrum AM 1.5

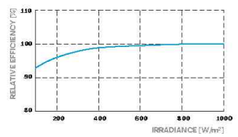
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	–0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	–0.34	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull[3]	[lbs/ft²]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	–40 °F up to +185 °F (–40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs/ft²]	113 (5400 Pa) / 84 (4000 Pa)		

[3] See Installation Manual

QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells), QCPV Certification ongoing.

PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

MODULE CUTSHEET

DOC ID

DATE: 9/23/2022

CREATED BY: JPL

REVIEWED BY:

REVISIONS

E-1

Data Sheet
Enphase Networking

Enphase IQ Combiner 4/4C

X-IQ-AM1-240-4
X-IQ-AM1-240-4C

X-IQ-AM1-240-4C

X-IQ-AM1-240-4

The **Enphase IQ Combiner 4/4C** with Enphase IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure and streamlines IQ microinverters and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

Smart

- Includes IQ Gateway for communication and control
- Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), included only with IQ Combiner 4C
- Includes solar shield to match Enphase IQ Battery aesthetics and deflect heat
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

Simple

- Centered mounting brackets support single stud mounting
- Supports bottom, back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80A total PV or storage branch circuits

Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the IQ Combiner SKU's
- UL listed

UL LISTED

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE

Enphase IQ Combiner 4/4C

MODEL NUMBER	
IQ Combiner 4 (X-IQ-AM1-240-4)	IQ Combiner 4 with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery system and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C (X-IQ-AM1-240-4C)	IQ Combiner 4C with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem 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.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.
ACCESSORIES AND REPLACEMENT PARTS	(not included, order separately)
Ensemble Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support
EPLC-01	Power line carrier (communication bridge pair), quantity - one pair
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 4/4C
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01)
XA-ENV-PCBA-3	Replacement IQ Gateway printed circuit board (PCB) for Combiner 4/4C
X-IQ-NA-HD-125A	Hold down kit for Eaton circuit breaker with screws.
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating	65 A
Max. continuous current rating (input from PV/storage)	64 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation / 95A with IQ Gateway breaker included
Envoy breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-SPLIT)	A pair of 200 A split core current transformers
MECHANICAL DATA	
Dimensions (WxHxD)	37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"). Height is 21.06" (53.5 cm) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing.
Altitude	To 2000 meters (6,560 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)
COMPLIANCE	
Compliance, IQ Combiner	UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

COMBINER CUTSHEET

DOC ID
DATE: 9/23/2022
CREATED BY: JPL
REVIEWED BY:

REVISIONS

E-2

ENPHASE

DATA SHEET

IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.

Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.

Enphase 25 year limited warranty

IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.

Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.

UL CERTIFIED SAFETY

IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer's instructions.

IQ8SP-DS-0002-01-EN-US-2021-10-19

Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produce power even when the grid is down
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings[1]	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current[2] [module Isc]	A	15	
Overvoltage class DC port		II	
DC port backfeed current	mA	0	
PV array configuration		1x1 Ungrounded array; No acditional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)		**IQ8-60-2-US**	**IQ8PLUS-72-2-US**
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range[3]	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
Max units per 20 A (L-L) branch circuit[4]		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.5	97.6
CEC weighted efficiency	%	97	97
Night-time power consumption	mW	60	
MECHANICAL DATA			
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)	
Relative humidity range		4% to 100% (condensing)	
DC Connector type		MC4	
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight		1.08 kg (2.38 lbs)	
Cooling		Natural convection – no fans	
Approved for wet locations		Yes	
Acoustic noise at 1 m		<60 dBA	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 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 https://link.enphase.com/module-compatibility (2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8SP-DS-0002-01-EN-US-2021-10-19

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

INVERTER CUTSHEET

DOC ID

DATE: 9/23/2022

CREATED BY: JPL

REVIEWED BY:

REVISIONS

E-3

Powering Business Worldwide

pe.eaton.com

General Duty Cartridge Fuse Safety Switch

DG221NRB

UPC:782113120317

Dimensions:

- **Height:** 6.25 IN
- **Length:** 5.73 IN
- **Width:** 6.1 IN

Weight:5 LB

Notes: Maximum hp ratings apply only when dual element fuses are used. 3-Phase hp rating shown is a grounded B phase rating, UL listed.

Warranties:

- Eaton Selling Policy 25-000, one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

Specifications:

- **Type:** General Duty/Cartridge Fuse
- **Amperage Rating:** 30A
- **Enclosure:** NEMA 3R
- **Enclosure Material:** Painted galvanized steel
- **Fuse Class Provision:** Class H fuses
- **Fuse Configuration:** Fusible with neutral
- **Number Of Poles:** Two-pole
- **Number Of Wires:** Three-wire
- **Product Category:** General Duty Safety Switch
- **Voltage Rating:** 240V

Supporting documents:

- Eatons Volume 2-Commercial Distribution
- Eaton Specification Sheet - DG221NRB

Certifications:

- UL Listed

195-2022

EMPWR SOLAR

GRID-TIED SOLAR POWER SYSTEM

ASHIM GHIMIRE
195 RED CEDAR WY.
FUQUAY-VARINA, NC 27526

6.4KW DC 4.64KW AC

DISCONNECT CUTSHEET

DOC ID

DATE: 9/23/2022

CREATED BY: JPL

REVIEWED BY:

REVISIONS

E-4

SolaDeck

FLASHED PV ROOF-MOUNT COMBINER/ENCLOSURE

Basic Features

- Stamped Seamless Construction
- 18 Gauge Galvanized Steel
- Powder Coated Surfaces
- Flashes into the roof deck
- 3 Roof deck knockouts .5", .75", 1"
- 5 Centering dimples for entry/exit fittings or conduit
- 2 Position Ground lug installed
- Mounting Hardware Included

SolaDeck Model SD 0783

SolaDeck UL50 Type 3R Enclosures

Available Models:
Model SD 0783 - (3” fixed Din Rail)
Model SD 0786 - (6” slotted Din Rail)

SolaDeck UL 1741 Combiner/Enclosures

Models SD 0783-41 and SD 0786-41 are labeled and ETL listed UL STD 1741 according to the UL STD 1741 for photovoltaic combiner enclosures.

Max Rated - 600VDC, 120AMPS

Model SD 0783-41 3” Fixed Din Rail fastened using Norlock System

****Typical System Configuration**

4- Din Rail Mounted Fuse Holders 600VDC 30 AMP
1- Power Distribution Block 600VDC 175AMP
1- Bus Bar with UL lug

Model SD 0786-41 6” Slotted Din Rail fastened using steel studs

****Typical System Configuration**

4- Din Rail Mounted Fuse Holders 600VDC 30 AMP
4- Din Rail Mounted Terminal Blocks
Bus Bars with UL lug

**Fuse holders and terminal blocks added in the field must be UL listed or recognized and meet 600 VDC 30 AMP 110C for fuse holders, 600V 50 AMP 90C for rail mounted terminal blocks and 600 V 175 AMP 90C for Power Distribution Blocks. Use Copper Wire Conductors.

Cover is trimmed to allow conduit or fittings, base is center dimpled for fitting locations.

Model SD 0783-41, wired with Din Rail mounted fuse holders, bus bar and power distribution block.

Model SD 0786-41, wired with Din Rail mounted fuse holders, terminal blocks and bus bars.

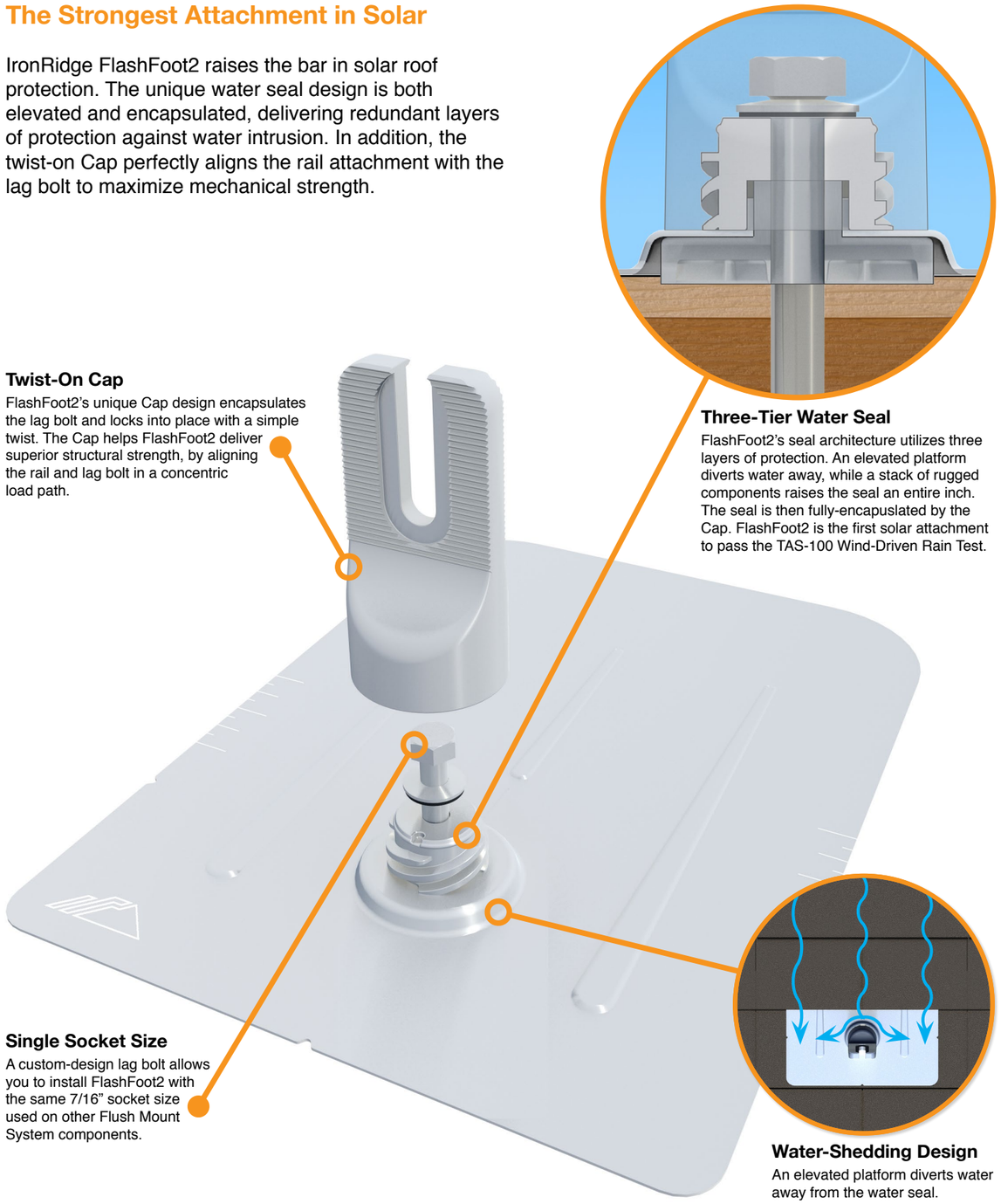
RSTC Enterprises, Inc • 2219 Heimstead Road • Eau Cliare, WI 54703
For product information call 1(866) 367-7782

Tech Brief

FlashFoot2

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-encapuslated by the Cap. FlashFoot2 is the first solar attachment to pass the TAS-100 Wind-Driven Rain Test.

Single Socket Size

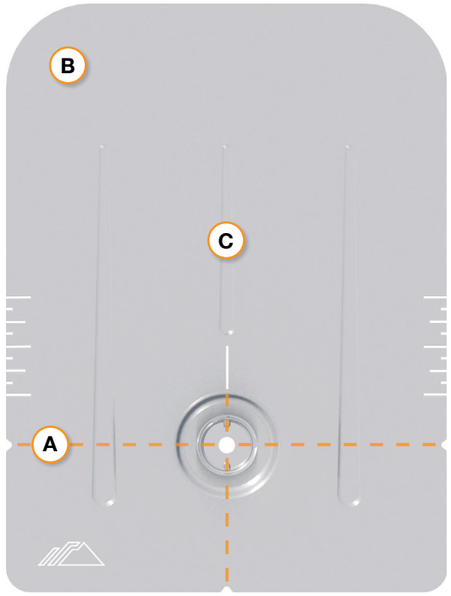
A custom-design lag bolt allows you to install FlashFoot2 with the same 7/16" socket size used on other Flush Mount System components.

Water-Shedding Design

An elevated platform diverts water away from the water seal.

Tech Brief

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.

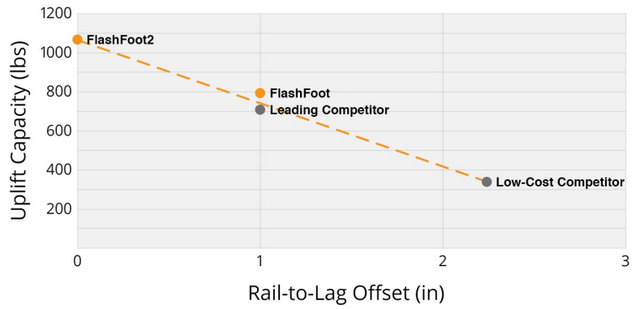
C Reinforcement Ribs

Help to stiffen the flashing and prevent any bending or crinkling 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.

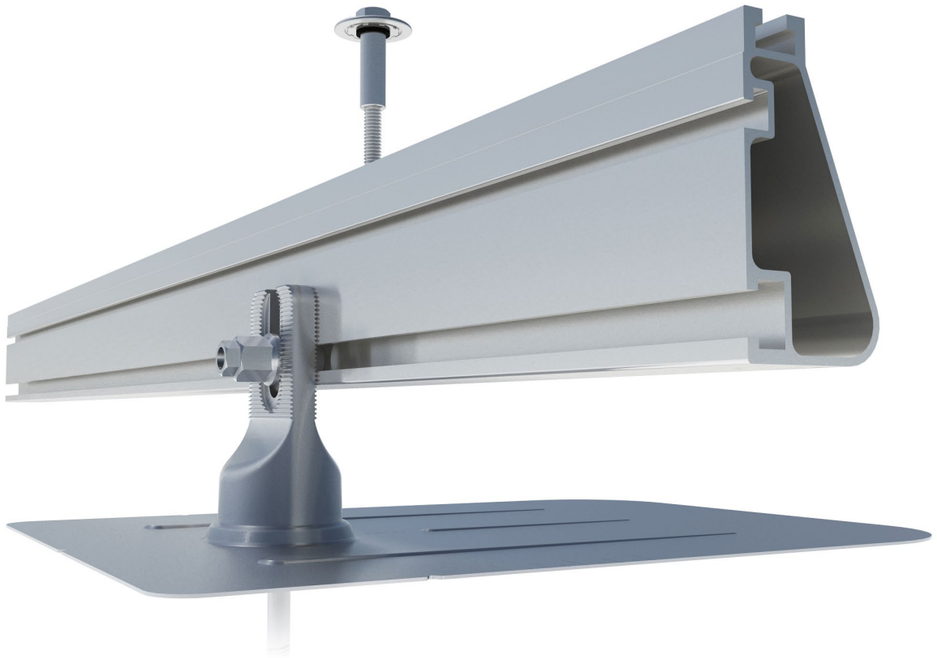
UL 2703

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

Datasheet

IRONRIDGE

Flush Mount System



Built for solar's toughest roofs.

IronRidge builds the strongest mounting system for pitched roofs in solar. Every component has been tested to the limit and proven in extreme environments.

Our rigorous approach has led to unique structural features, such as curved rails and reinforced flashings, and is also why our products are fully certified, code compliant and backed by a 25-year warranty.

Strength Tested

All components evaluated for superior structural performance.

PE Certified

Pre-stamped engineering letters available in most states.

Class A Fire Rating

Certified to maintain the fire resistance rating of the existing roof.

Design Assistant

Online software makes it simple to create, share, and price projects.

UL 2703 Listed System

Entire system and components meet newest effective UL 2703 standard.

25-Year Warranty

Products guaranteed to be free of impairing defects.

Datasheet

XR Rails

XR10 Rail

A low-profile mounting rail for regions with light snow.

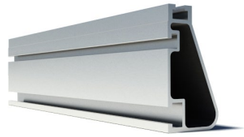
- 6' spanning capability
- Moderate load capability
- Clear and black finish

XR100 Rail

The ultimate residential solar mounting rail.

- 8' spanning capability
- Heavy load capability
- Clear and black finish

XR1000 Rail



A heavyweight mounting rail for commercial projects.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish

Bonded Splices

All rails use internal splices for seamless connections.

- Self-drilling screws
- Varying versions for rails
- Forms secure bonding

Clamps & Grounding

UFOs

Universal Fastening Objects bond modules to rails.

- Fully assembled & lubed
- Single, universal size
- Clear and black finish

Stopper Sleeves

Snap onto the UFO to turn into a bonded end clamp.

- Bonds modules to rails
- Sized to match modules
- Clear and black finish

CAMO

Bond modules to rails while staying completely hidden.

- Universal end-cam clamp
- Tool-less installation
- Fully assembled

Grounding Lugs

Connect arrays to equipment ground.

- Low profile
- Single tool installation
- Mounts in any direction

Attachments

FlashFoot2

Flash and mount XR Rails with superior waterproofing.

- Twist-on Cap eases install
- Wind-driven rain tested
- Mill and black finish

Conduit Mount

Flash and mount conduit, strut, or junction boxes.

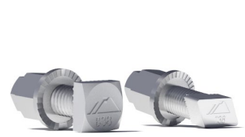
- Twist-on Cap eases install
- Wind-driven rain tested
- Secures ¾" or 1" conduit

Slotted L-Feet

Drop-in design for rapid rail attachment.

- Secure rail connections
- Slot for vertical adjusting
- Clear and black finish

Bonding Hardware



Bond and attach XR Rails to roof attachments.

- T & Square Bolt options
- Nut uses 7/16" socket
- Assembled and lubricated

Resources

Design Assistant

Go from rough layout to fully engineered system. For free.

Go to IronRidge.com/design

NABCEP Certified Training

Earn free continuing education credits, while learning more about our systems.

Go to IronRidge.com/training

28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

Attn: Corey Geiger, COO, IronRidge Inc.
Date: August 31st, 2021

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 contents of the letter shall be read in its entirety before being applied to any project design. 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)
- 2018 North Carolina State 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 8º to 45º. 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 slope, measured between roof surface and horizontal plane, is 8º to 45º.

3. Each module shall be supported by 2 rails (2 rail system) or 3 rails (3 rail system). Spans are calculated based on 2 rail systems, and conservatively deemed acceptable for 3 rail systems.

4. 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.

5. Module length and area shall not exceed the maximum values listed on the respective span tables.

6. 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.

28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

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

1. The Flush Mount System is designed as a Risk Category II structure as defined by ASCE 7-10 Chart 1.5-1.

2. 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.

3. The snow load used in the span tables is the *ground snow* and shall conform to ASCE 7-10 Fig. 7-1 and applicable state & local county/city amendments to the IBC. 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, retention, or ponding snow. The span tables do not include buildings which are intentionally kept below freezing, kept just above freezing, or unheated.

4. The span tables reflect the ASCE 7 prescribed earthquake loads with the maximum magnitudes being:

    1) For ground snow no greater than 42psf: $S_s \leq 2.0g$ for Site Class A, B, C, or D.
    2) For ground snow greater than 65psf: $S_s \leq 1.0g$ for Site Class A, B, C, or D.
    3) For ground snow between 42 and 65psf: $S_s \leq 1.5g$ for Site Class A, B, C, or D.

5. Roof zone size and definition conforms to ASCE 7-10 Fig. 30.4-2A to 30.4-2C.

6. 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.

7. The maximum rail cantilever length, measured from the rail end to the nearest attachment point, shall be the lesser of the following two conditions: 40% of the allowable span provided for the respective load & configuration condition from the span tables, or 36”.

8. An array to roof clearance of 2” minimum must be provided.

9. No splices are allowed in the rail cantilever. For each XR splice type install per the following requirements:

    a) XR Bonded Splice cannot be installed in the center 1/3 of interior spans, or the outer 2/3 of end spans.
    b) BOSS Splice can be installed at any location within a span.

10. Shaded cells of the span tables indicate conditions in which UFO Mid Clamp connection capacity is exceeded. If such conditions are encountered contact support@ironridge.com.

11. 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.

28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

12. 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 meets the dimensional requirements shown in the figure below and that the module selected is suitable for the environmental conditions of a particular project.

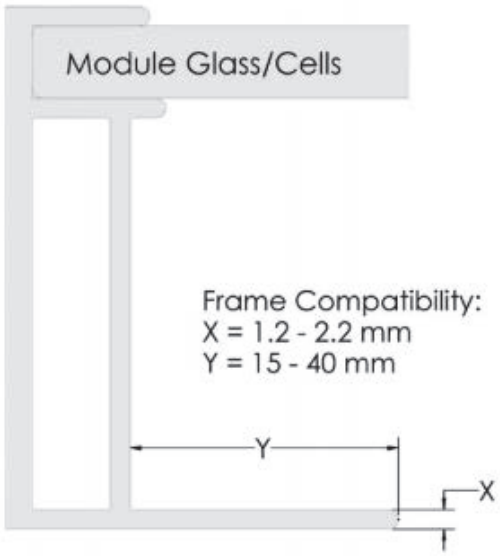


Figure 1: CAMO Module Frame Dimensional Requirements

28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

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,

2021.08.31
18:04:27
-07'00'

Gang Xuan, PE
Senior Structural Engineer