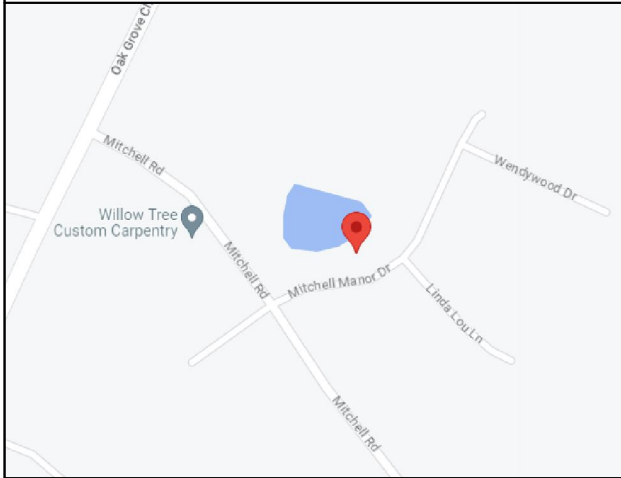
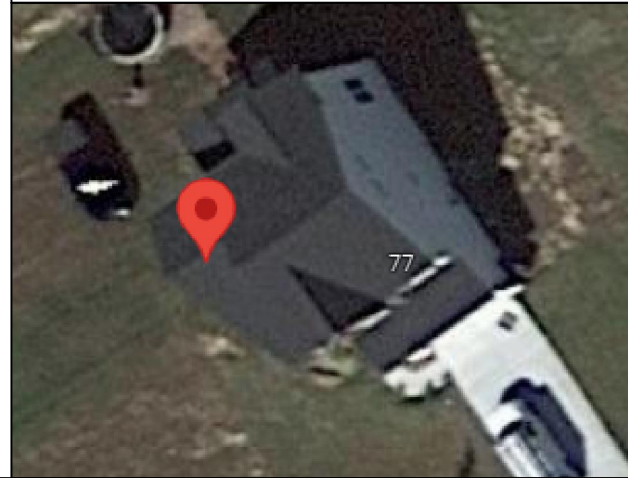


RICHARD WESTMORELAND - 8.400kW DC, 6.000kW AC

VICINITY MAP



AERIAL MAP



SHEET CATALOG

CS-01	B	COVER SHEET
CS-02	B	GENERAL NOTES
E-01	B	SITE PLAN
E-01.1	B	SITE PLAN(ADDITIONAL)
S-01	B	MOUNTING DETAILS
S-02	B	STRUCTURAL DETAILS
E-02	B	SINGLE LINE DIAGRAM
E-03	B	ELECTRICAL CALCULATIONS
PL-01	B	PLACARDS
SS	B	SPECSHEET(S)

ROOF AREA CALCULATION

TOTAL ARRAY AREA = 441.28 sq.ft
 TOTAL ROOF AREA = 1813 sq.ft
 % ARRAY AREA IN ROOF = 24.34 %

DESIGN CRITERIA

BASIC WIND SPEED = 118 MPH @ 3-SEC GUST
 GROUND SNOW LOAD = 15 PSF
 RISK CATEGORY- II
 PROJECT WINDSPEED DETERMINED USING THE
 ASCE 7 STANDARD UNLESS DIRECTED OTHERWISE
 BY LOCAL JURISDICTION AMENDMENTS

SCOPE OF WORK

SYSTEM SIZE:
 8400W DC, 6000W AC
MODULES:
 (21)URECO FBM400MFG-BB (400W)
INVERTER:
 (1)SOLAREEDGE TECHNOLOGIES SE6000H-US
 (240V)
OPTIMIZER:
 (21)SOLAREEDGE S440 POWER OPTIMIZERS

HOUSE VIEW



GENERAL NOTES

1. MODULES ARE LISTED UNDER UL 1703 / 61730 AND CONFORM TO THE STANDARDS.
2. INVERTERS ARE LISTED UNDER UL 1741 AND CONFORM TO THE STANDARDS.
3. DRAWINGS ARE DIAGRAMMATIC, INDICATING GENERAL ARRANGEMENT OF THE PV SYSTEM AND THE ACTUAL SITE CONDITION MIGHT VARY.
4. WORKING CLEARANCES AROUND THE NEW PV ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26.
5. ALL GROUND WIRING CONNECTED TO THE MAIN SERVICE GROUNDING IN MAIN SERVICE PANEL/ SERVICE EQUIPMENT.
6. ALL CONDUCTORS SHALL BE 600V, 90°C STANDARD COPPER UNLESS OTHERWISE NOTED.
7. WHEN REQUIRED, A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
8. THE SYSTEM WILL NOT BE INTERCONNECTED BY THE CONTRACTOR UNTIL APPROVAL FROM THE LOCAL JURISDICTION AND/OR THE UTILITY.
9. ROOF ACCESS POINT SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREES, WIRES OR SIGNS.
10. PV ARRAY COMBINER/JUNCTION BOX PROVIDES TRANSITION FROM ARRAY WIRING TO CONDUIT WIRING.

APPLICABLE CODES

- ELECTRIC CODE:NEC 2020
- FIRE CODE:IFC 2018
- BUILDING CODE:IBC 2018
- RESIDENTIAL CODE:IRC 2018

CUSTOMER INFORMATION

NAME: RICHARD WESTMORELAND
 ADDRESS: 77 MITCHELL MANOR DR,
 ANGIER, NC 27501

 35.449392, -78.713391
 APN: 0406820328
 UTILITY: DUKE ENERGY

 AHJ: NC- COUNTY HARNETT

CONTRACTOR INFORMATION

WIRING SOLUTIONS PLUS
OWNER: JOE LANDU
CSLB #: L25181
ADDRESS: 4724 HARGROVE ROAD
SUITE # 192 NORTH CAROLINA
27616

DRAWING INFORMATION

PRN NUMBER: CSN-83027 REV: B

SCALE: AS NOTED
 PAPER SIZE: 17"X11"

COVER SHEET
 DATE: 08/08/2023 SHEET: CS-01

INSTALLATION NOTES:

1. STRUCTURAL ROOF MEMBER LOCATIONS ARE ESTIMATED AND SHOULD BE LOCATED AND VERIFIED BY THE CONTRACTOR WHEN LAG BOLT PENETRATION OR MECHANICAL ATTACHMENT TO THE STRUCTURE IS REQUIRED.
2. ROOFTOP PENETRATIONS FOR SOLAR RACKING WILL BE COMPLETED AND SEALED WITH APPROVED SEALANT PER CODE BY A LICENSED CONTRACTOR.
3. LAGS MUST HAVE A MINIMUM 2.5" THREAD EMBEDMENT INTO THE STRUCTURAL MEMBER.
4. ALL PV RACKING ATTACHMENTS SHALL BE STAGGERED BY ROW BETWEEN THE ROOF FRAMING MEMBERS AS NECESSARY.
5. ROOF MOUNTED STANDARD RAIL REQUIRES ONE THERMAL EXPANSION GAP FOR EVERY RUN OF RAIL GREATER THAN 40'.
6. ALL CONDUCTORS AND CONDUITS ON THE ROOF SHALL BE MINIMUM 7/8" ABOVE THE ROOF SURFACE (INCLUDING CABLES UNDERNEATH MODULES AND RACKING).
7. THE PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL OR BUILDING ROOF VENTS.
8. ALL SOLAR PANEL ARRAY COMPONENTS SHALL BE INSTALLED PER THE MANUFACTURER'S APPROVED INSTALLATION SPECIFICATIONS.
9. THE EXISTING BUILDINGS STRUCTURE SHALL BE VERIFIED AS PROPERLY CONSTRUCTED AND MAINTAINED IN GOOD CONDITION. NO ALLOWANCE HAS BEEN MADE IN THESE DRAWINGS FOR ANY EXISTING DEFICIENCY IN DESIGN, MATERIAL, CONSTRUCTION, OR LACK OF MAINTENANCE FOR THE EXISTING STRUCTURE OR PROPOSED EQUIPMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFYING EXISTING CONDITIONS, PROPER FIT, AND CLEARANCES IN THE FIELD.
10. WATERPROOFING AROUND THE ROOF PENETRATIONS IS THE RESPONSIBILITY OF CONTRACTOR/INSTALLER.
11. MISCELLANEOUS ITEMS NOT EXPLICITLY LISTED OR IDENTIFIED IN THESE DRAWINGS HAVE NOT BEEN DESIGNED. IT IS RECOMMENDED THAT MATERIAL OF SUITABLE SIZE STRENGTH TO BE OBTAINED FROM A REPUTABLE MANUFACTURER FOR MISCELLANEOUS ITEMS.
12. IF ANY CONDITION THROUGHOUT THE ASSOCIATED REPORT OR PERMIT DRAWINGS IS NOT ALSO REPRESENTED ON-SITE, CONTRACTOR SHALL NOTIFY THE ENGINEER OF RECORD OF ANY DISCREPANCIES AND RECEIVE WRITTEN APPROVAL FROM THE ENGINEER OF RECORD BEFORE PROCEEDING WITH INSTALLATION.
13. CONTRACTOR TO PROVIDE MINIMUM 1/4" GAP BETWEEN ALL SOLAR PANELS.

ROOF ACCESS PATHWAYS AND SETBACKS:

1204.2.1 SOLAR PHOTOVOLTAIC SYSTEMS FOR GROUP R-3 BUILDINGS:

SOLAR PHOTOVOLTAIC SYSTEMS FOR GROUP R-3 BUILDINGS SHALL COMPLY WITH SECTIONS 1204.2.1.1 THROUGH 1204.2.1.3.

EXCEPTIONS:

1. THESE REQUIREMENTS SHALL NOT APPLY TO STRUCTURES DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE INTERNATIONAL RESIDENTIAL CODE.
2. THESE REQUIREMENTS SHALL NOT APPLY TO ROOFS WITH SLOPES OF 2 UNITS VERTICAL IN 12 UNITS HORIZONTAL OR LESS.

1204.2.1.1 PATHWAYS TO RIDGE:

NOT FEWER THAN TWO 36-INCH-WIDE (914 MM) PATHWAYS ON SEPARATE ROOF PLANES, FROM LOWEST ROOF EDGE TO RIDGE, SHALL BE PROVIDED ON ALL BUILDINGS. NOT FEWER THAN ONE PATHWAY SHALL BE PROVIDED ON THE STREET OR DRIVEWAY SIDE OF THE ROOF. FOR EACH ROOF PLANE WITH A PHOTOVOLTAIC ARRAY, NOT FEWER THAN ONE 36-INCH-WIDE (914 MM) PATHWAY FROM LOWEST ROOF EDGE TO RIDGE SHALL BE PROVIDED ON THE SAME ROOF PLANE AS THE PHOTOVOLTAIC ARRAY, ON AN ADJACENT ROOF PLANE OR STRADDLING THE SAME AND ADJACENT ROOF PLANES.

1204.2.1.2 SETBACKS AT RIDGE:

FOR PHOTOVOLTAIC ARRAYS OCCUPYING 33 PERCENT OR LESS OF THE PLAN VIEW TOTAL ROOF AREA, A SETBACK OF NOT LESS THAN 18 INCHES (457 MM) WIDE IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE. FOR PHOTOVOLTAIC ARRAYS OCCUPYING MORE THAN 33 PERCENT OF THE PLAN VIEW TOTAL ROOF AREA, A SETBACK OF NOT LESS THAN 36 INCHES (457 MM) WIDE IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE.

1204.2.1.3 ALTERNATIVE SETBACKS AT RIDGE:

WHERE AN AUTOMATIC SPRINKLER SYSTEM IS INSTALLED WITHIN THE DWELLING IN ACCORDANCE WITH SECTION 903.3.1.3, SETBACKS AT THE RIDGE SHALL CONFORM TO ONE OF THE FOLLOWING:

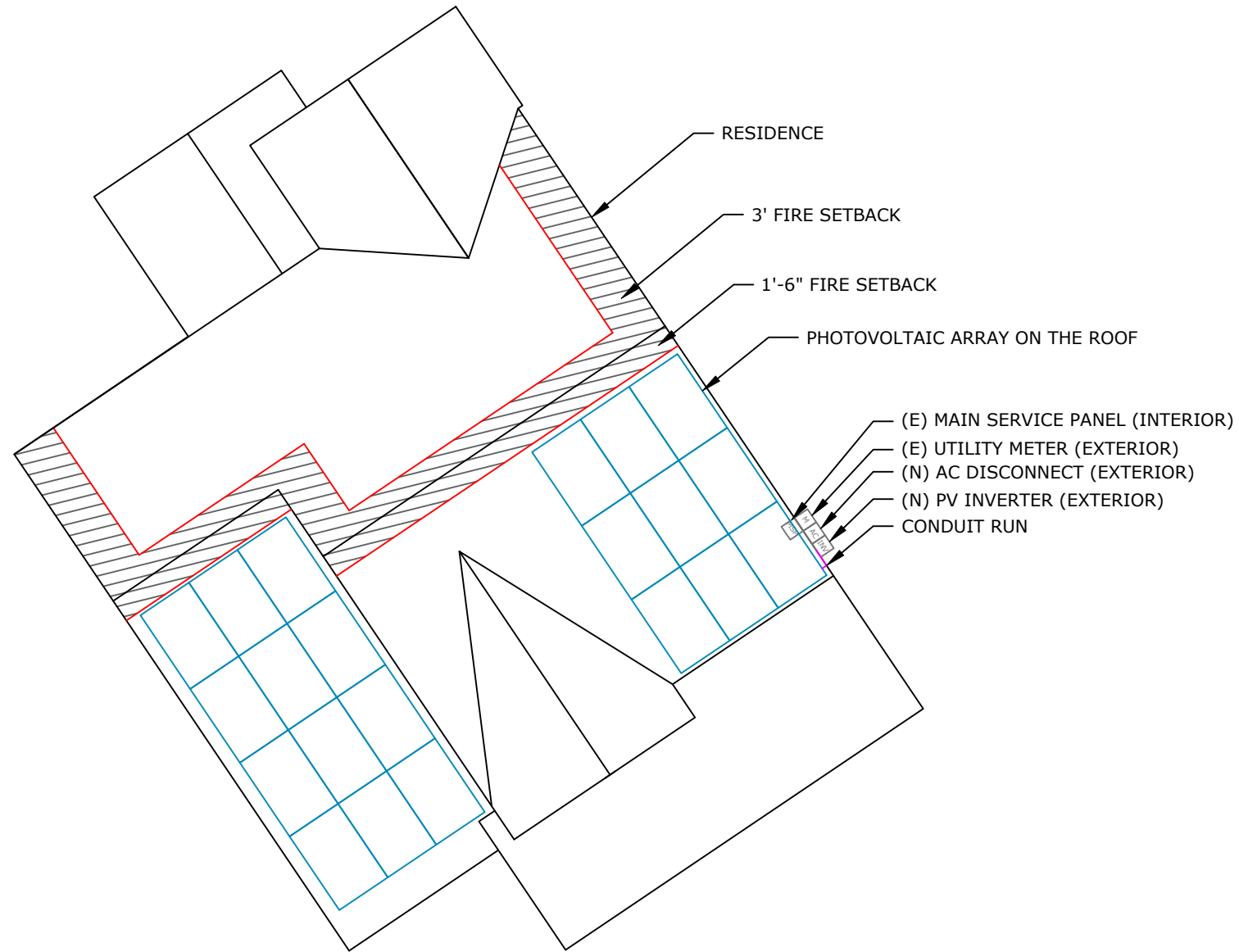
1. FOR PHOTOVOLTAIC ARRAYS OCCUPYING 66 PERCENT OR LESS OF THE PLAN VIEW TOTAL ROOF AREA, A SETBACK OF NOT LESS THAN 18 INCHES (457 MM) WIDE IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE.
2. FOR PHOTOVOLTAIC ARRAYS OCCUPYING MORE THAN 66 PERCENT OF THE PLAN VIEW TOTAL ROOF AREA, A SETBACK OF NOT LESS THAN 36 INCHES (914 MM) WIDE IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE.

1204.2.2 EMERGENCY ESCAPE AND RESCUE OPENINGS. PANELS AND MODULES INSTALLED ON GROUP R-3 BUILDINGS SHALL NOT BE PLACED ON THE PORTION OF A ROOF THAT IS BELOW AN EMERGENCY ESCAPE AND RESCUE OPENING. A PATHWAY OF NOT LESS THAN 36 INCHES (914 MM) WIDE SHALL BE PROVIDED TO THE EMERGENCY ESCAPE AND RESCUE OPENING.

CUSTOMER INFORMATION	CONTRACTOR INFORMATION
NAME: RICHARD WESTMORELAND ADDRESS: 77 MITCHELL MANOR DR, ANGIER, NC 27501 35.449392, -78.713391 APN: 0406820328 UTILITY: DUKE ENERGY AHJ: NC- COUNTY HARNETT	<p style="text-align: center;">WIRING SOLUTIONS PLUS OWNER: JOE LANDU CSLB #: L25181 ADDRESS: 4724 HARGROVE ROAD SUITE # 192 NORTH CAROLINA 27616</p>
DRAWING INFORMATION	
PRN NUMBER: CSN-83027 REV: B	
SCALE: AS NOTED PAPER SIZE: 17"X11"	<p style="text-align: center;">GENERAL NOTES DATE: 08/08/2023 SHEET: CS-02</p>

RICHARD WESTMORELAND - 8.400kW DC, 6.000kW AC

NOTE: NO GATE AND FENCE



ROOF AREA CALCULATION	
TOTAL ARRAY AREA	= 441.28 sq.ft
TOTAL ROOF AREA	= 1813 sq.ft
% ARRAY AREA IN ROOF	= 24.34 %

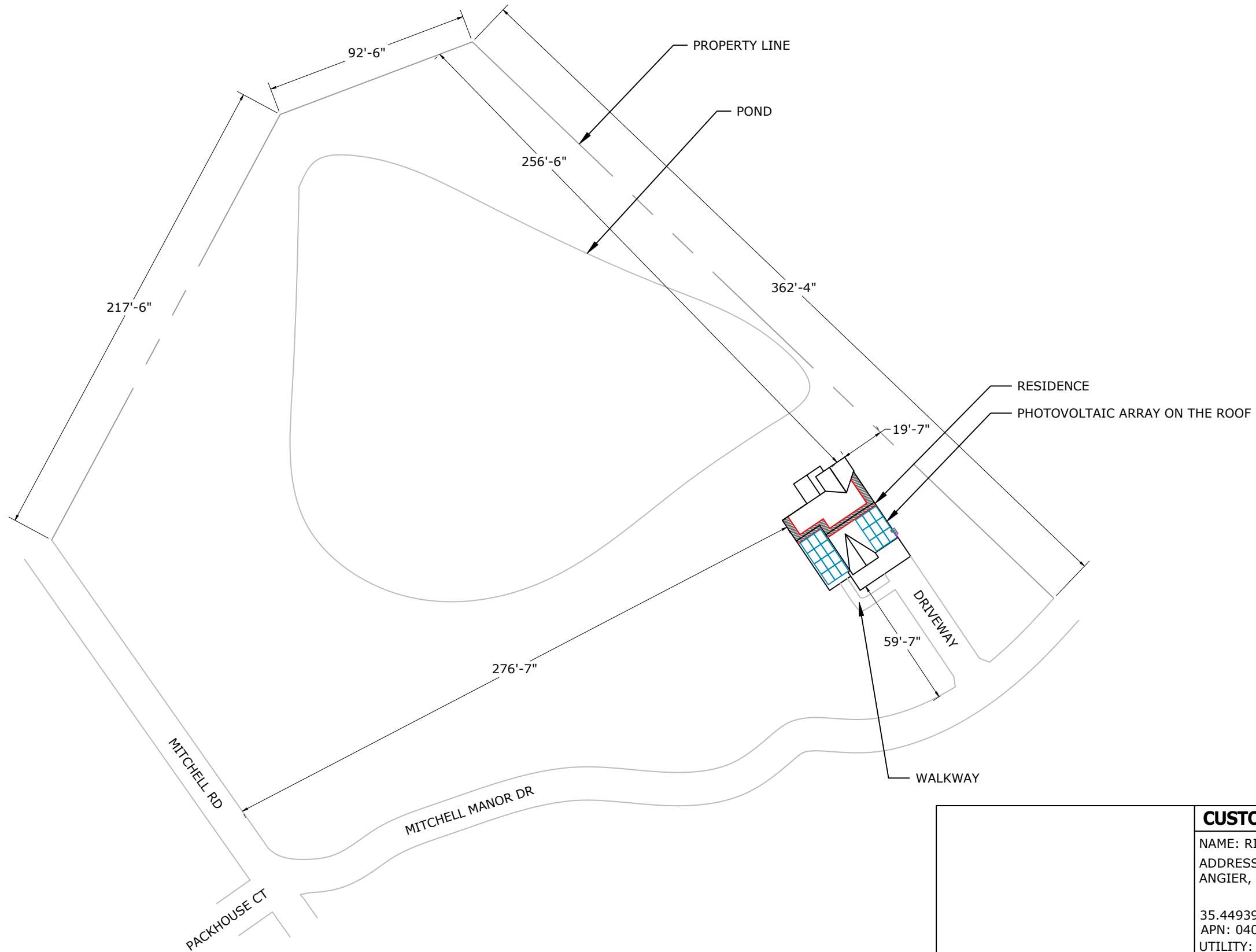
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DRAWING INFORMATION	
PRN NUMBER: CSN-83027 REV: B	
SCALE: AS NOTED PAPER SIZE: 17"X11"	SITE PLAN DATE: 08/08/2023 SHEET: E-01



SCALE: 1"=10'-0"

RICHARD WESTMORELAND - 8.400kW DC, 6.000kW AC

NOTE: NO GATE AND FENCE



ROOF AREA CALCULATION

TOTAL ARRAY AREA	= 441.28 sq.ft
TOTAL ROOF AREA	= 1813 sq.ft
% ARRAY AREA IN ROOF	= 24.34 %

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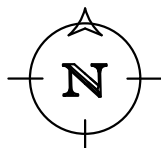
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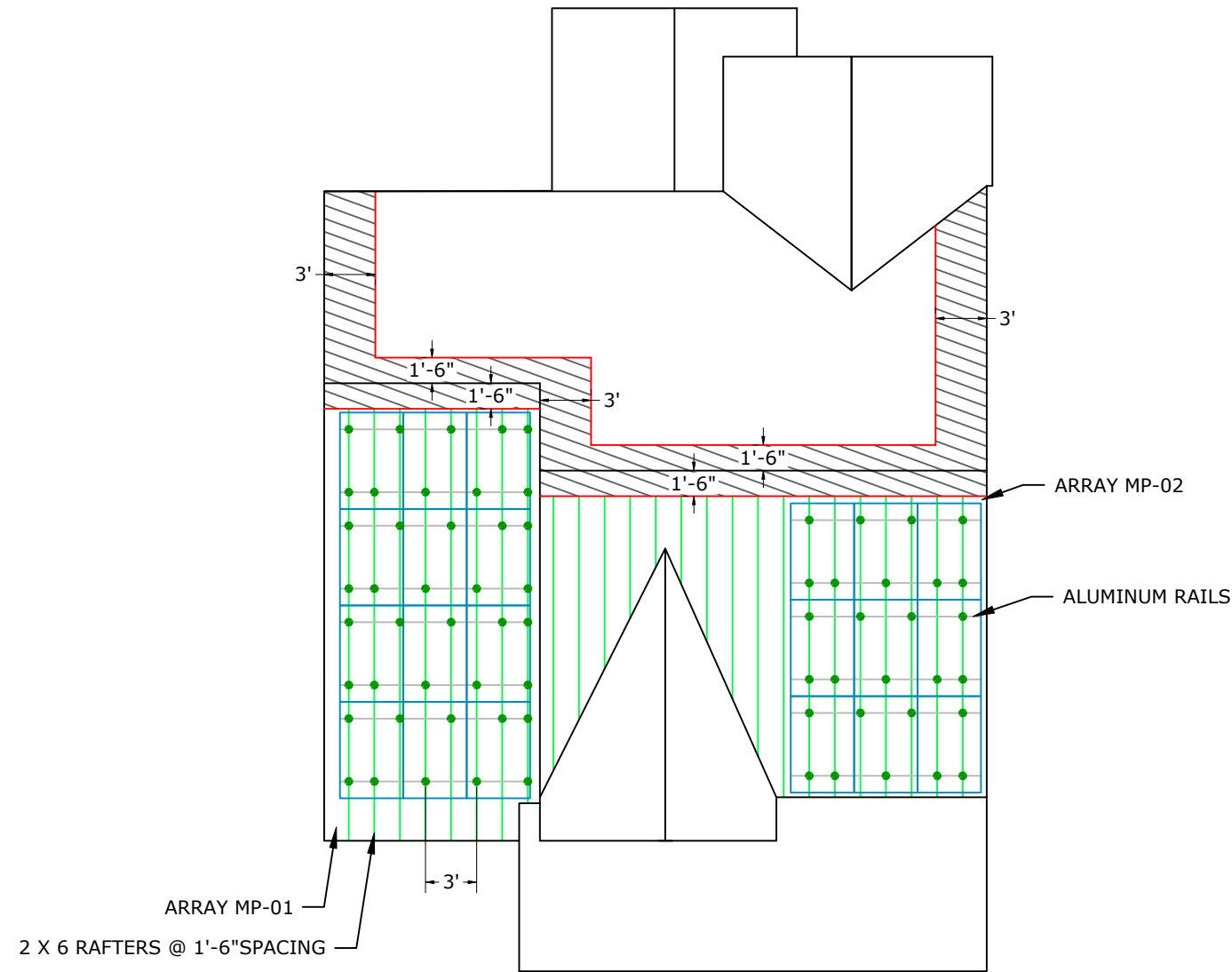
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 PAPER SIZE: 17"X11"

SITE PLAN(ADDITIONAL)
 DATE: 08/08/2023 SHEET: E-01.1



SCALE: 1"=50'-0"

NOTE: PENETRATIONS ARE STAGGERED



SCALE: 1" = 10'-0"

ROOF AREA CALCULATION

TOTAL ARRAY AREA	= 441.28 sq.ft
TOTAL ROOF AREA	= 1813 sq.ft
% ARRAY AREA IN ROOF	= 24.34 %

SITE INFORMATION

S.NO	AZIMUTH	PITCH	NO. OF MODULES	ARRAY AREA (SQ. FT.)	ROOF TYPE	ATTACHMENT	ROOF EXPOSURE	FRAME TYPE	FRAME SIZE	FRAME SPACING	MAX RAIL SPAN	OVER HANG
MP-01	146°	42°	12	252.16	COMPOSITION SHINGLE	FLASHKIT PRO	ATTIC	RAFTERS	2 X 6	1'-6"	3'-0"	1'-6"
MP-02	146°	32°	9	189.12	COMPOSITION SHINGLE	FLASHKIT PRO	ATTIC	RAFTERS	2 X 6	1'-6"	3'-0"	1'-6"

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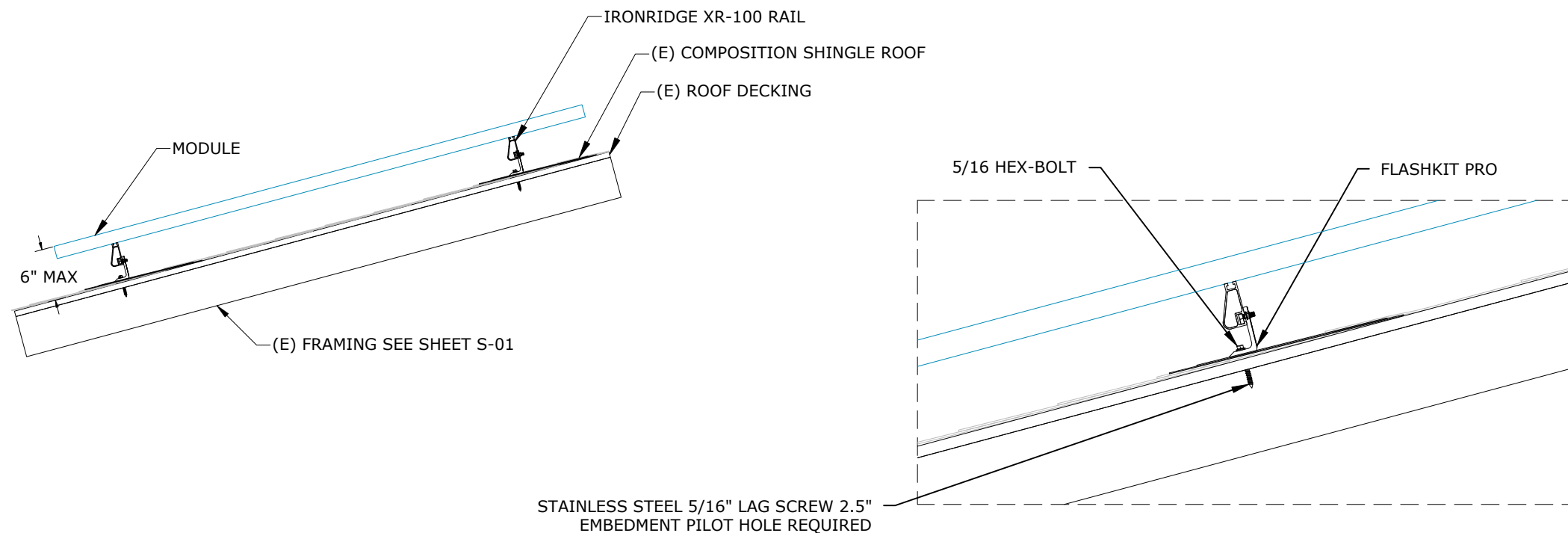
SCALE: AS NOTED
 PAPER SIZE: 17"X11"

MOUNTING DETAILS
 DATE: 08/08/2023 SHEET: S-01

DEAD LOAD CALCULATIONS

BOM	QUANTITY	LBS/UNIT	TOTAL WEIGHT (LBS)
MODULES	21	47.84	1004.64
MID-CLAMP	28	0.05	1.4
END-CLAMP	28	0.05	1.4
RAIL LENGTH	161	0.68	109.48
SPLICE BAR	0	0.36	0
FLASHKIT PRO	67	0.75	50.25
TOTAL WEIGHT OF THE SYSTEM (LBS)			1167.17
TOTAL ARRAY AREA ON THE ROOF (SQ. FT.)			441.28
WEIGHT PER SQ. FT.(LBS)			2.64
WEIGHT PER PENETRATION (LBS)			17.42

ATTACHMENT DETAIL-UNIRAC FLASHKIT PRO



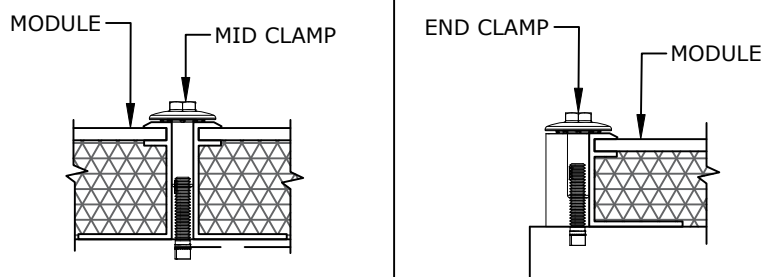
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MODULE DATA

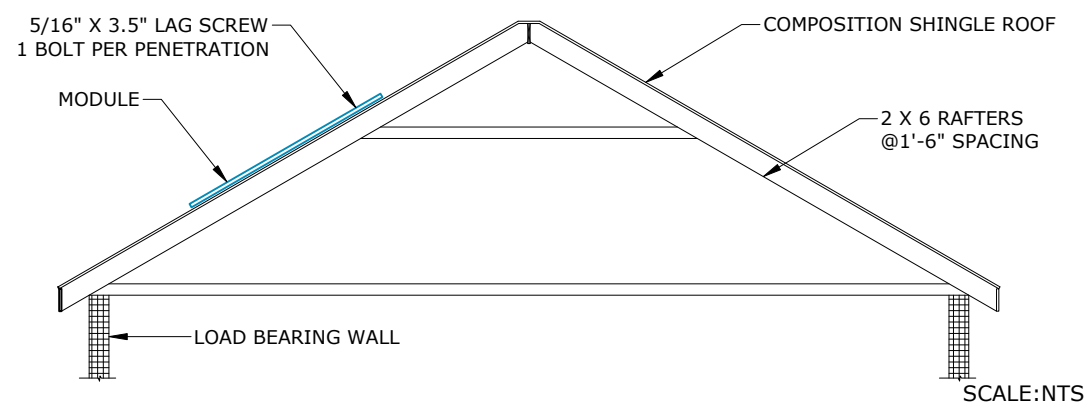
URECO FBM400MFG-BB (400W)

MODULE DIM	67.83"x44.61"x1.38"
LAG SCREW	5/16"x3.5":2.5" MIN EMBEDMENT

MID-CLAMP AND END-CLAMP ASSEMBLY



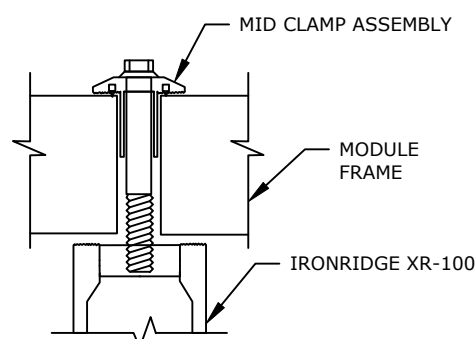
ROOF FRAMING DETAILS



SCALE:NTS

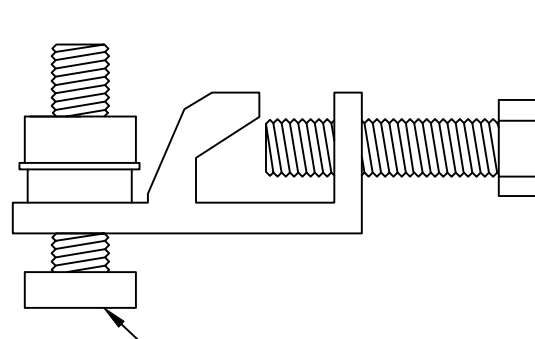
GROUNDING DETAILS

MODULE TO MODULE & MODULE TO RAIL



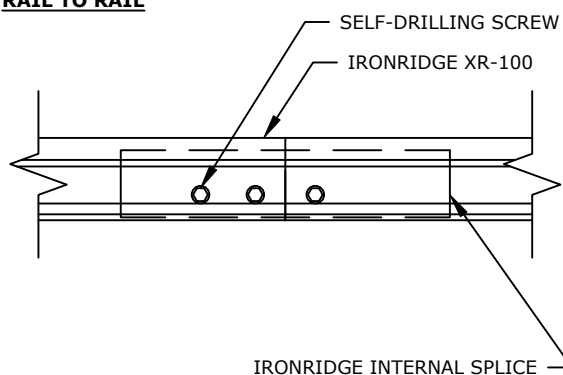
GROUNDING MID-CLAMP SCALE: NTS

GROUNDING LUG



SCALE: NTS T-BOLT

RAIL TO RAIL



SCALE: NTS

CUSTOMER INFORMATION

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 35.449392, -78.713391
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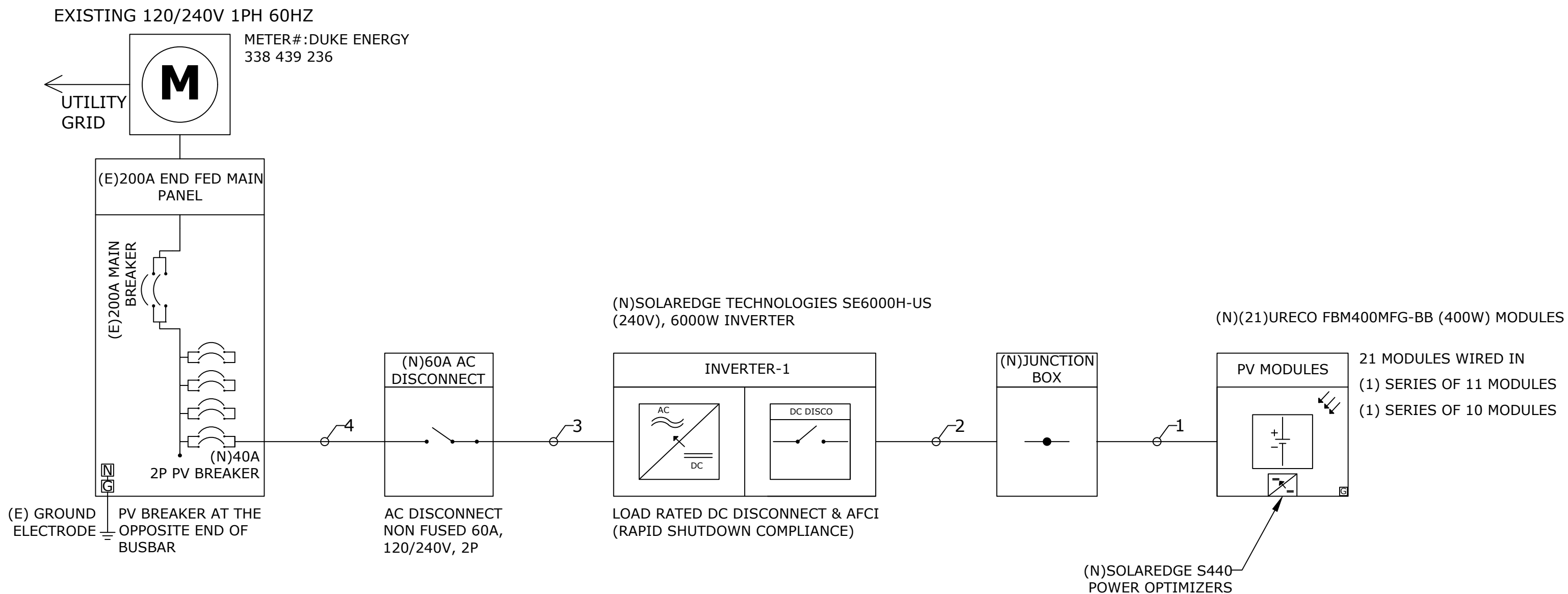
DRAWING INFORMATION

PRN NUMBER: CSN-83027 REV: B

SCALE: AS NOTED
 PAPER SIZE: 17"X11"

STRUCTURAL DETAILS
 DATE: 08/08/2023 SHEET: S-02

DC SYSTEM SIZE- 8400W, AC SYSTEM SIZE - 6000W



CONDUCTOR AND CONDUIT SCHEDULE

TAG ID	CONDUIT SIZE	CONDUCTOR	NEUTRAL	GROUND
1	NONE	(4) 10 AWG PV WIRE	NONE	(1) 10 AWG BARE COPPER
2	3/4" EMT	(4) 10 AWG THHN/THWN-2	NONE	(1) 10 AWG THHN/THWN-2
3	3/4" EMT	(2) 8 AWG THHN/THWN-2	(1) 8 AWG THHN/THWN-2	(1) 10 AWG THHN/THWN-2

CUSTOMER INFORMATION CONTRACTOR INFORMATION

<p>NAME: RICHARD WESTMORELAND ADDRESS: 77 MITCHELL MANOR DR, ANGIER, NC 27501</p> <p>35.449392, -78.713391 APN: 0406820328 UTILITY: DUKE ENERGY</p> <p>AHJ: NC- COUNTY HARNETT</p>	<p>WIRING SOLUTIONS PLUS OWNER: JOE LANDU CSLB #: L25181 ADDRESS: 4724 HARGROVE ROAD SUITE # 192 NORTH CAROLINA 27616</p>
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DRAWING INFORMATION

PRN NUMBER: CSN-83027 REV: B	<p>SINGLE LINE DIAGRAM DATE: 08/08/2023 SHEET: E-02</p>
SCALE: AS NOTED PAPER SIZE: 17"X11"	

DC SYSTEM SIZE- 8400W, AC SYSTEM SIZE - 6000W

MODULE SPECIFICATION	
MODEL	URECO FBM400MFG-BB (400W)
MODULE POWER @ STC	400 W
OPEN CIRCUIT VOLTAGE: Voc	37.2 V
MAX POWER VOLTAGE: Vmp	31.17 V
SHORT CIRCUIT CURRENT: Isc	13.68 A
MAX POWER CURRENT: Imp	12.84 A
INVERTER-1 SPECIFICATIONS	
MODEL	SOLAREEDGE TECHNOLOGIES SE6000H-US (240V)
POWER RATING	6000 W
MAX OUTPUT CURRENT	25 A
CEC WEIGHTED EFFICIENCY	99 %
MAX INPUT CURRENT	16.5 A
MAX DC VOLTAGE	480 V
SYSTEM CHARACTERISTICS	
DC SYSTEM SIZE	8400 W
INVERTER STRING VOLTAGE: Vmp	380 V
MAX INVERTER SYSTEM VOLTAGE: Voc	480 V
MAX SHORT CIRCUIT CURRENT	30 A
OPERATING CURRENT	22.11 A
OPTIMIZER CHARACTERISTICS	
MODEL	S440 POWER OPTIMIZERS
MIN INPUT VOLTAGE	8 VDC
MAX INPUT VOLTAGE	60 VDC
MAX INPUT CURRENT	14.5 ADC
MAX OUTPUT CURRENT	15 ADC

ELECTRICAL NOTES
<ol style="list-style-type: none"> 1. CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC 310.10(C). 2. CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC 310.10(D). 3. MAXIMUM DC/AC VOLTAGE DROP SHALL BE NO MORE THAN 2%. 4. ALL CONDUCTORS SHALL BE IN CONDUIT UNLESS OTHERWISE NOTED. 5. BREAKER/FUSES SIZED ACCORDING PER NEC ARTICLE 240. 6. AC GROUNDING ELECTRODE CONDUCTOR (GEC) SIZED PER NEC 250.66. 7. EQUIPMENT GROUNDING CONDUCTOR (EGC) SIZED PER NEC 250.122. 8. AMBIENT TEMPERATURE ADJUSTMENT FACTOR IS BASED ON TABLE NEC 310.15(B)(1). 9. CURRENT CARRYING CONDUCTOR ADJUSTMENT FACTOR IS BASED ON NEC 310.15(C)(1). 10. MAX. SYSTEM VOLTAGE CORRECTION IS PER NEC 690.7. 11. CONDUCTORS ARE SIZED PER NEC 310.16.

OCPD CALCULATION
<p>ALLOWABLE BACKFEED:</p> <p>MAIN PANEL RATING = 200 A MAIN BREAKER RATING = 200 A 120% RULE: = ((MAIN PANEL RATING * 1.2) - MAIN BREAKER RATING) = ((200 A*1.2) - 200 A) = 40 A ALLOWABLE BACKFEED = 40 A</p> <p>INVERTER OVERCURRENT PROTECTION:</p> <p>INVERTER OVERCURRENT PROTECTION = (INVERTER O/P CURRENT * CONTINUOUS LOAD(1.25)) = (25 *1.25) = 31.25 A PV BREAKER = 40 A</p> <p>ALLOWABLE BACKFEED 40 A ≥ 40 A OF PV BREAKER THE DESIGNED INTERCONNECTION MEETS THE 705.12(B)(3)(2) REQUIREMENTS.</p>

WIRE SIZE CALCULATIONS
<p>TAG 1: (DC)</p> <p>REQUIRED CONDUCTOR AMPACITY (15 * 1.25) = 18.75 A CORRECTED AMPACITY CALCULATION (0.91 * 1 * 40) = 36.4 A 18.75A < 36.4A</p> <p>TAG 2: (DC)</p> <p>REQUIRED CONDUCTOR AMPACITY (15 * 1.25) = 18.75 A CORRECTED AMPACITY CALCULATION (0.91 * 0.8 * 40) = 29.12 A 18.75A < 29.12A</p> <p>TAG 3: (AC)</p> <p>REQUIRED CONDUCTOR AMPACITY (25 * 1 * 1.25) = 31.25 A CORRECTED AMPACITY CALCULATION (0.91 * 1 * 55) = 50.05 A 31.25A < 50.05A</p>

DC WIRE SIZING CALCULATIONS BASED ON FOLLOWING EQUATIONS
<p>REQUIRED CONDUCTOR AMPACITY:</p> <p>Isc(A) * #OF PARALLEL STRINGS = MAX CURRENT PER 690.8(A)(1)(c) * 125% = MAX CURRENT PER 690.8(B)(1)</p> <p>CORRECTED AMPACITY CALCULATIONS:</p> <p>DERATED CONDUCTOR AMPACITY PER 690.8(B)(2) = AMPACITY * TEMPERATURE DERATE FACTOR * CONDUIT FILL DERATE DERATED CONDUCTOR AMPACITY CHECK: MAX CURRENT PER 690.8(B)(1) < DERATED CONDUCTOR AMPACITY</p>

AC WIRE SIZING CALCULATIONS BASED ON FOLLOWING EQUATIONS
<p>REQUIRED CONDUCTOR AMPACITY:</p> <p>INVERTER OUTPUT CURRENT * #OF INVERTERS = MAX CURRENT PER 690.8(A)(1)(e) * 125% = MAX CURRENT PER 690.8(B)(1)</p> <p>CORRECTED AMPACITY CALCULATIONS:</p> <p>DERATED CONDUCTOR AMPACITY PER 690.8(B)(2) = AMPACITY * TEMPERATURE DERATE FACTOR * CONDUIT FILL DERATE DERATED CONDUCTOR AMPACITY CHECK: MAX CURRENT PER 690.8(B)(1) < DERATED CONDUCTOR AMPACITY</p>

	CUSTOMER INFORMATION	CONTRACTOR INFORMATION
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	DRAWING INFORMATION	
	PRN NUMBER: CSN-83027 REV: B	
	SCALE: AS NOTED PAPER SIZE: 17"X11"	ELECTRICAL CALCULATIONS DATE: 08/08/2023 SHEET: E-03

⚠ WARNING
ELECTRIC SHOCK HAZARD
 TERMINALS ON BOTH LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION

INSTALLED ON: AC DISCONNECT, LOAD CENTERS, COMBINER PANELS, POINT OF INTERCONNECTION
 APPLICABLE CODE(S): NEC 690.13(B)

WARNING:PHOTOVOLTAIC POWER SOURCE

INSTALLED ON: CONDUIT, RACEWAYS, AND J-BOXES (LABELED EVERY 10'). REFLECTIVE. MIN 3/8" WHITE TEXT ON BLACK BACKGROUND.
 APPLICABLE CODE(S): NEC 690.31(D)(2)

PHOTOVOLTAIC DC DISCONNECT

INSTALLED ON: DC DISCONNECT(S)
 APPLICABLE CODE(S): NEC 690.13(B)

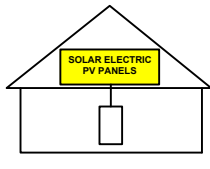
INVERTER 1

MAXIMUM DC VOLTAGE
480 V
OF PV SYSTEM

INSTALLED ON: INVERTER
 APPLICABLE CODE(S): NEC 690.53

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



INSTALLED ON: WITHIN 3 FT OF SERVICE DISCONNECTING MEANS. MIN 3/8" BLACK TEXT ON YELLOW BACKGROUND & 3/16" BLACK TEXT ON WHITE BACKGROUND.
 APPLICABLE CODE(S): NEC 690.56(C)

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

INSTALLED ON:RAPID SHUTDOWN SWITCH
 APPLICABLE CODE(S): NEC 690.56(C)(2)

PHOTOVOLTAIC SYSTEM AC DISCONNECT SWITCH
 RATED AC OPERATING CURRENT **25.00** AMPS AC
 AC NOMINAL OPERATING VOLTAGE **240** VAC


INSTALLED ON: AC DISCONNECT(S), POINT OF INTERCONNECTION.
 APPLICABLE CODE(S): NEC 690.54

⚠ WARNING
DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

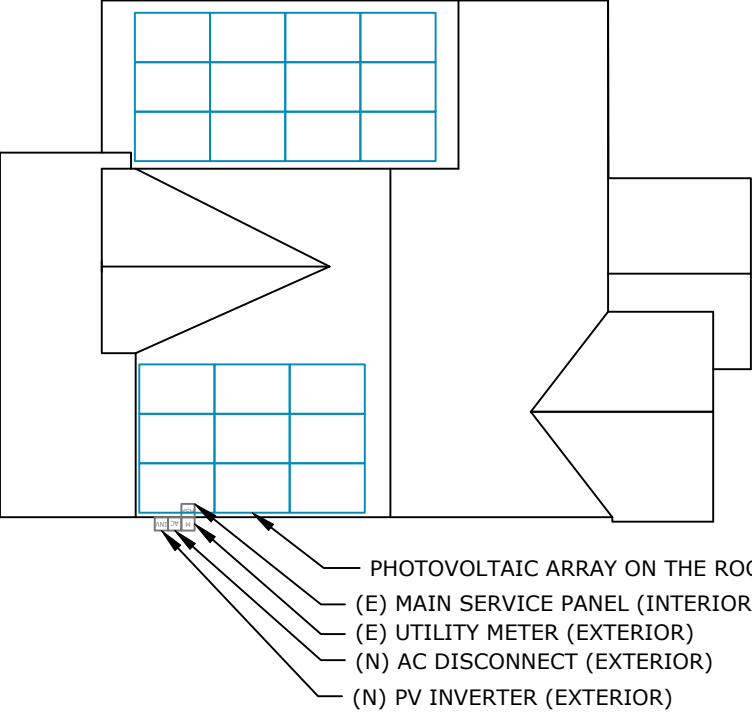
INSTALLED ON: POINT OF INTERCONNECTION
 APPLICABLE CODE(S): NEC 705.12(C)

WARNING
POWER SOURCE OUTPUT CONNECTION DO NOT RELOCATE THIS OVER-CURRENT DEVICE


INSTALLED ON: POINT OF INTERCONNECTION
 APPLICABLE CODE(S): NEC 705.12(B)(3)(2)

CAUTION: MULTIPLE SOURCES OF POWER 

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS LOCATED AS SHOWN



77 MITCHELL MANOR DR, ANGIER, NC 27501

 LABEL LOCATION SERVICE PANEL PER CODE: NEC 705.10

NOTES

- 1.PLACARDS SHALL MEET THE REQUIREMENTS OF ARTICLES 690 AND 705, UNLESS OTHERWISE SPECIFIED PER LOCAL AHJ REQUIREMENTS.
- 2.PLACARDS SHALL MEET THE REQUIREMENTS OF SECTION 110.21(B) AS REQUIRED AND SHALL COMPLY WITH ANSI Z535.4-2011, PRODUCT SAFETY SIGNS AND LABELS.
- 3.PLACARDS SHALL BE PERMANENTLY AFFIXED TO THE EQUIPMENT OR WIRING METHOD.
- 4.PLACARDS SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED AND SHALL BE HANDWRITTEN.
- 5.PLACARDS SHALL NOT COVER EXISTING MANUFACTURER LABELS.

CUSTOMER INFORMATION

NAME: RICHARD WESTMORELAND
 ADDRESS: 77 MITCHELL MANOR DR, ANGIER, NC 27501

35.449392, -78.713391
 APN: 0406820328
 UTILITY: DUKE ENERGY

AHJ: NC- COUNTY HARNETT

CONTRACTOR INFORMATION

WIRING SOLUTIONS PLUS
OWNER: JOE LANDU
CSLB #: L25181
ADDRESS: 4724 HARGROVE ROAD SUITE # 192 NORTH CAROLINA 27616

DRAWING INFORMATION

PRN NUMBER: CSN-83027 REV: B

SCALE: AS NOTED
 PAPER SIZE: 17"X11"

PLACARDS
 DATE: 08/08/2023 SHEET: PL-01

MODULE SPEC SHEET



EN



EN



FBM_MFG-BB / 108 cells
390W - 405 W
Mono-Crystalline PV Module

URE Peach module uses URE state-of-the-art cell cutting technology, and advanced module manufacturing experiences.



Key Features



Positive power tolerance
+0 ~ +5 watt



100% EL inline inspection
Better module reliability



Withstand heavy loading
front load 5400 Pa & rear load 2400 Pa



Design for 1000 VDC
Reduce the system BOS effectively



Excellent low light performance
3.5% relative eff. Reduction at low
(200W/m²)

Electrical Data

Model - STC		FBM390MFG-BB	FBM395MFG-BB	FBM400MFG-BB	FBM405MFG-BB
Maximum Rating Power (Pmax)	[W]	390	395	400	405
Module Efficiency	[%]	19.98	20.23	20.49	20.75
Open Circuit Voltage (Voc)	[V]	36.84	37.03	37.20	37.36
Maximum Power Voltage	[V]	30.82	31.00	31.17	31.36
Short Circuit Current (Isc)	[A]	13.50	13.59	13.68	13.78
Maximum Power Current	[A]	12.66	12.75	12.84	12.92

*Standard Test Condition (STC): Cell Temperature 25 °C, Irradiance 1000 W/m², AM 1.5
*Values without tolerance are typical numbers. Measurement tolerance: ± 3%

Mechanical Data

Item	Specification
Dimensions	1723 mm (L) ¹ x 1133 mm (W) ¹ x 35 mm (D) ² / 67.83" (L) ¹ x 44.61" (W) ¹ x 1.38" (D) ²
Weight	21.7 kg / 47.84 lbs
Solar Cell	12x9 pieces monocrystalline solar cells series strings
Front Glass	White toughened safety glass, 3.2mm thickness
Cell Encapsulation	EVA (Ethylene-Vinyl-Acetate)
Frame	Black anodized aluminum profile
Junction Box	IP≥ 68, 3 diodes
Cable & Connector	Potrait : 500 mm (cable length can be customized), 1 x 4 mm ² compatible with MC4
Package Configuration	31 pcs Per Pallet, 806 pcs per 40' HQ container

¹ : With assembly tolerance of ± 2 mm [± 0.08"]
² : With assembly tolerance of ± 0.8 mm [± 0.03"]

Operating Conditions

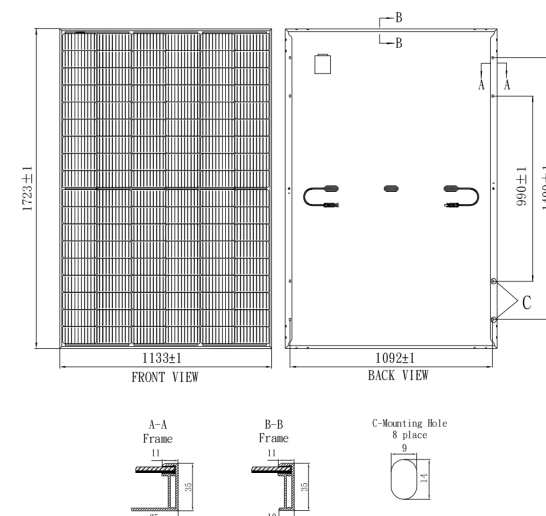
Item	Specification
Mechanical Load	5400 Pa
Maximum System Voltage	1000V
Series Fuse Rating	30 A
Operating Temperature	-40 to 85 °C

Temperature Characteristics

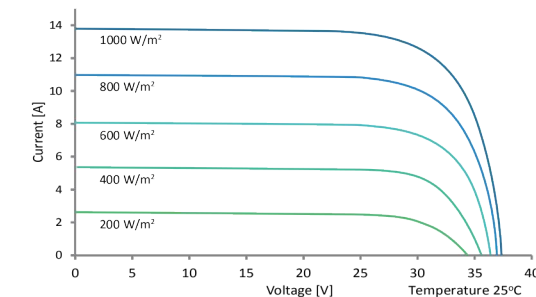
Item	Specification
Nominal Module Operating Temperature	45°C ± 2°C
Temperature Coefficient of Isc	0.048 % / °C
Temperature Coefficient of Voc	-0.27 % / °C
Temperature Coefficient of Pmax	-0.32 % / °C

*Nominal module operating temperature (NMOT): Air mass AM 1.5,
irradiance 800W/m², temperature 20°C, windspeed 1 m/s.
*Reduction in efficiency from 1000W/m² to 200W/m² at 25°C: 3.5 ± 2%.

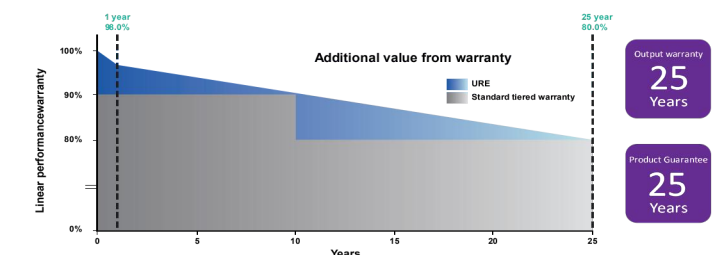
Engineering Drawing (mm)



Dependence on Irradiance



Reliability with Warranty



INVERTER SPEC SHEET

SolarEdge Home Wave Inverter For North America

SE3800H-US / SE5000H-US / SE6000H-US /
SE7600H-US / SE10000H-US / SE11400H-US



INVERTERS

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking 99% weighted efficiency
- Quick and easy inverter commissioning directly from a smartphone using SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020 per articles 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Small, lightweight, and easy to install both outdoors or indoors
- Built-in module-level monitoring
- Optional: Faster installations with built-in consumption metering (1% accuracy) and production revenue grade metering (0.5% accuracy, ANSI C12.20)

solaredge.com

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/ SolarEdge Home Wave Inverter

For North America

SE3800H-US / SE5000H-US / SE6000H-US/
SE7600H-US / SE10000H-US / SE11400H-US

Applicable to inverters with part number	SEXXXXH-XXXXBXX4					SE11400H-XXXXBXX5	Units
	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
OUTPUT							
Rated AC Power Output	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5 ⁽¹⁾						Hz
Maximum Continuous Output Current @240V	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable - 0.85 to 0.85						
GFDI Threshold	1						A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes						
INPUT							
Maximum DC Power @240V	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes						
Maximum Input Voltage	480						Vdc
Nominal DC Input Voltage	380						Vdc
Maximum Input Current @240V ⁽²⁾	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V ⁽²⁾	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45						Adc
Reverse-Polarity Protection	Yes						
Ground-Fault Isolation Detection	600k Sensitivity						
Maximum Inverter Efficiency	99.2						%
CEC Weighted Efficiency	99					99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption	< 2.5						W

(1) For other regional settings please contact SolarEdge support.
(2) A higher current source may be used; the inverter will limit its input current to the values stated.

INVERTER SPEC SHEET

/ SolarEdge Home Wave Inverter

For North America

SE3800H-US / SE5000H-US / SE6000H-US /

SE7600H-US / SE10000H-US / SE11400H-US

Applicable to inverters with part number	SEXXXXH-XXXXBXX4					SE11400H-XXXXBXX5
	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US
ADDITIONAL FEATURES						
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), wireless SolarEdge Home Network (optional) ⁽³⁾ , Wi-Fi (optional), Cellular (optional)					
Revenue Grade Metering, ANSI C12.20	Optional ⁽⁴⁾					
Consumption Metering	Optional ⁽⁴⁾					
Inverter Commissioning	With the SetApp mobile application using Built-in Wi-Fi Access Point for Local Connection					
Rapid Shutdown - NEC 2014, NEC 2017 and NEC 2020, 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect					
STANDARD COMPLIANCE						
Safety	UL1741, UL1741 SA, UL1741 SB, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07					
Grid Connection Standards	IEEE1547-2018, Rule 21, Rule 14 (H)					
Emissions	FCC Part 15 Class B					
INSTALLATION SPECIFICATIONS						
AC Output Conduit Size / AWG Range	1" Maximum / 14 – 6 AWG			1" Maximum / 14 – 4 AWG		
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1 – 2 strings / 14 – 6 AWG			1" Maximum / 1 – 3 strings / 14 – 6 AWG		
Dimensions with Safety Switch (H x W x D)	17.7 x 14.6 x 6.8 / 450 x 370 x 174			21.06 x 14.6 x 7.3 / 535 x 370 x 185	21.06 x 14.6 x 8.2 / 535 x 370 x 208 ⁽⁵⁾	in / mm
Weight with Safety Switch	22 / 10	25.1 / 11.4	26.2 / 11.9	38.8 / 17.6	44.9 / 20.4 ⁽⁵⁾	lb / kg
Noise	< 25			<50		dB(A)
Cooling	Natural Convection					
Operating Temperature Range	-40 to +140 / -40 to +60 ⁽⁶⁾					
Protection Rating	NEMA 4X (Inverter with Safety Switch)					

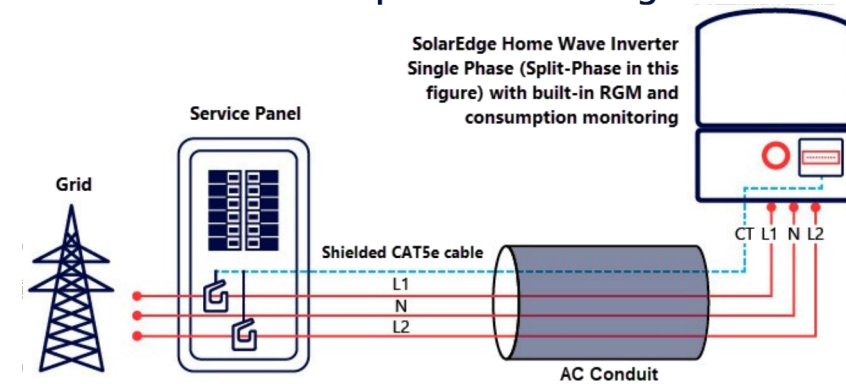
(3) For more information, refer to the [SolarEdge Home Network](#) datasheet

(4) Inverter with Revenue Grade Production and Consumption Meter P/N: SExxxxH-US000BEI4. For consumption metering, current transformers should be ordered separately: SEACT0750-200NA-20 or SEACT0750-400NA-20, 20 units per box.

(5) SE11400H-USxxxxBxx5 is the updated PN, though SE11400H-USxxxxBxx4 will still be available. All specifications are similar for both models, **EXCLUDING** the weight and dimensions [HxWxD]. The weight and dimensions of SE11400H-USxxxxBxx4 are 17.6 [kg] and 21.06-14.6-7.3 / 535-370-185 [in/mm], accordingly.

(6) Full power up to at least 50°C / 122°F; for power de-rating information refer to the [Temperature De-rating Technical Note for North America](#).

How to Enable Consumption Monitoring



By simply wiring current transformers through the inverter's existing AC conduits and connecting them to the service panel, homeowners will gain full insight into their household energy usage helping them to avoid high electricity bills.

OPTIMIZER SPEC SHEET

Power Optimizer For Residential Installations

S440 / S500 / S500B / S650B



POWER OPTIMIZER

Enabling PV power optimization at the module level

- Specifically designed to work with SolarEdge residential inverters
- Mitigates all types of module mismatch loss, from manufacturing tolerance to partial shading
- Detects abnormal PV connector behavior, preventing potential safety issues*
- Faster installations with simplified cable management and easy assembly using a single bolt
- Module-level voltage shutdown for installer and firefighter safety
- Flexible system design for maximum space utilization
- Superior efficiency (99.5%)
- Compatible with bifacial PV modules

*Functionality subject to inverter model and firmware version

solaredge.com



Power Optimizer For Residential Installations

S440 / S500 / S500B / S650B

	S440	S500	S500B	S650B	UNIT
INPUT					
Rated Input DC Power ⁽¹⁾	440	500		650	W
Absolute Maximum Input Voltage (Voc)	60		125	85	Vdc
MPPT Operating Range	8 – 60		12.5 – 105	12.5 – 85	Vdc
Maximum Short Circuit Current (Isc) of Connected PV Module	14.5	15			Adc
Maximum Efficiency			99.5		%
Weighted Efficiency			98.6		%
Overvoltage Category			II		
OUTPUT DURING OPERATION					
Maximum Output Current			15		Adc
Maximum Output Voltage	60			80	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR INVERTER OFF)					
Safety Output Voltage per Power Optimizer			1 ± 0.1		Vdc
STANDARD COMPLIANCE⁽²⁾					
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3, CISPR11, EN-55011				
Safety	IEC62109-1 (class II safety), UL1741				
Material	UL94 V-0, UV Resistant				
RoHS	Yes				
Fire Safety	VDE-AR-E 2100-712:2018-12				
INSTALLATION SPECIFICATIONS					
Maximum Allowed System Voltage			1000		Vdc
Dimensions (W x L x H)	129 x 155 x 30			129 x 165 x 45	mm
Weight	720			790	gr
Input Connector			MC4 ⁽³⁾		
Input Wire Length			0.1		m
Output Connector			MC4		
Output Wire Length			(+) 2.3, (-) 0.10		m
Operating Temperature Range ⁽⁴⁾			-40 to +85		°C
Protection Rating			IP68		
Relative Humidity			0 – 100		%

(1) Rated power of the module at STC will not exceed the Power Optimizer Rated Input DC Power. Modules with up to +5% power tolerance are allowed.

(2) For details about CE compliance, see [Declaration of Conformity – CE](#).

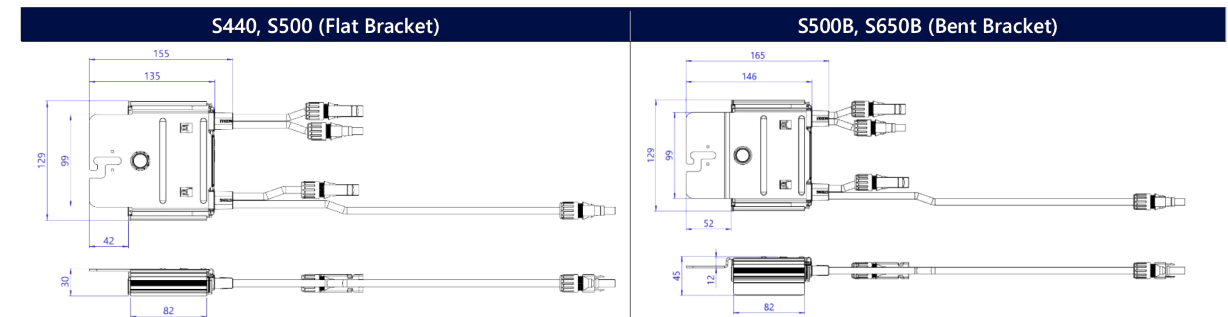
(3) For other connector types please contact SolarEdge.

(4) Power de-rating is applied for ambient temperatures above +85°C for S440 and S500, and for ambient temperatures above +75°C for S500B. Refer to the [Power Optimizers Temperature De-Rating Technical Note](#) for details.

PV System Design Using a SolarEdge Inverter ⁽⁵⁾	SolarEdge Home Wave Inverter Single Phase		SolarEdge Home Short String Inverter Three Phase	Three Phase for 230/400V Grid	Three Phase for 277/480V Grid	
	Minimum String Length (Power Optimizers)	S440, S500	8	9	16	18
	S500B, S650B	6	8		14	
Maximum String Length (Power Optimizers)		25	20	50		
Maximum Continuous Power per String		5700	5625	11250	12750	W
Maximum Allowed Connected Power per String (Permitted only when the power difference between strings is less than 2,000W)		See ⁽⁶⁾	See ⁽⁶⁾	13500	15000	W
Parallel Strings of Different Lengths or Orientations				Yes		

(5) It is not allowed to mix S-series and P-series Power Optimizers in new installations.

(6) If the inverter's rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverter's maximum input DC power. Refer to [Application Note: Single String Design Guidelines](#).



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CE RoHS

ATTACHMENT SPEC SHEET

FLASHKIT PRO



FLASHKIT PRO is the complete attachment solution for composition shingle roofs. Featuring Unirac's patented **SHED & SEAL** technology, a weather proof system which provides the ultimate protection against roof leaks. Kitted in 10 packs for maximum convenience, flashings and hardware are available in Mill or Dark finishes. With **FLASHKIT pro**, you have everything you need for a quick, professional installation.



TRUSTED WATER SEAL FLASHINGS
FEATURING SHED & SEAL TECHNOLOGY



YOUR COMPLETE SOLUTION
Flashings, lags, continuous slot L-Feet and hardware



CONVENIENT 10 PACKS
Packaged for speed and ease of handling

FLASHKIT PRO

INSTALLATION GUIDE



FLASHKIT PRO IS THE COMPLETE FLASHING AND ATTACHMENT SOLUTION FOR COMPOSITION ROOFS.



INSTALL **FLASHKIT PRO** FLASHING



INSTALL L-FOOT



ATTACH L-FOOT TO RAIL

PRE-INSTALL

- Locate roof rafters and snap chalk lines to mark the installation point for each roof attachment.
- Drill a 7/32" pilot hole at each roof attachment. Fill each pilot hole with sealant.

STEP 1 INSTALL FLASHKIT PRO FLASHING

- Add a U-shaped bead of roof sealant to the underside of the flashing with the open side of the U pointing down the roof slope. Slide the aluminum flashing underneath the row of shingles directly up slope from the pilot hole as shown. Align the indicator marks on the lower end of the flashing with the chalk lines on the roof to center the raised hole in the flashing over the pilot hole in the roof. When installed correctly, the flashing will extend under the two courses of shingles above the pilot hole.

STEP 2 INSTALL L-FOOT

- Fasten L-foot and Flashing into place by passing the included lag bolt and pre-installed stainless steel-backed EPDM washer through the L-foot EPDM grommet, and the raised hole in the flashing, into the pilot hole in the roof rafter.

- Drive the lag bolt down until the L-foot is held firmly in place. It is normal for the EPDM on the underside of the stainless steel backed EPDM washer to compress and expand beyond the outside edge of the steel washer when the proper torque is applied.

TIP:

- Use caution to avoid over-torquing the lag bolt if using an impact driver.
- Repeat Steps 1 and 2 at each roof attachment point.

STEP 3 ATTACH L-FOOT TO RAIL

- Insert the included 3/8"-16 T-bolts into the lower slot on the Rail (sold separately), spacing the bolts to match the spacing between the roof attachments.
- Position the Rail against the L-Foot and insert the threaded end of the T-Bolt through the continuous slot in the L-Foot. Apply anti-seize to bolt threads to prevent galling of the T-bolt and included 3/8" serrated flange nut. Place the 3/8" flange nut on the T-bolt and finger tighten. Repeat STEP 3 until all L-Feet are secured to the Rail with a T-bolt. Adjust the level and height of the Rail and torque each bolt to 30ft-lbs.

THE COMPLETE ROOF ATTACHMENT SOLUTION

FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR CALL (505) 248-2702

FASTER INSTALLATION. 25-YEAR WARRANTY.

FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR CALL (505) 248-2702

RACKING SPEC SHEET

Tech Brief

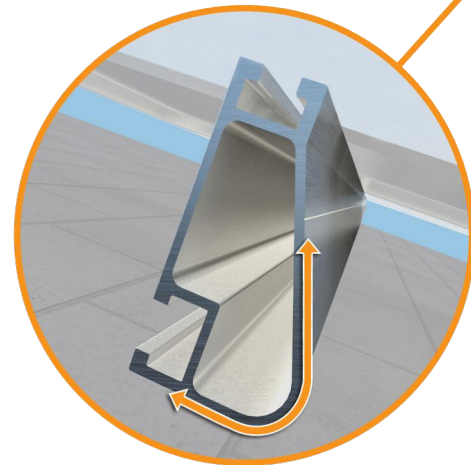
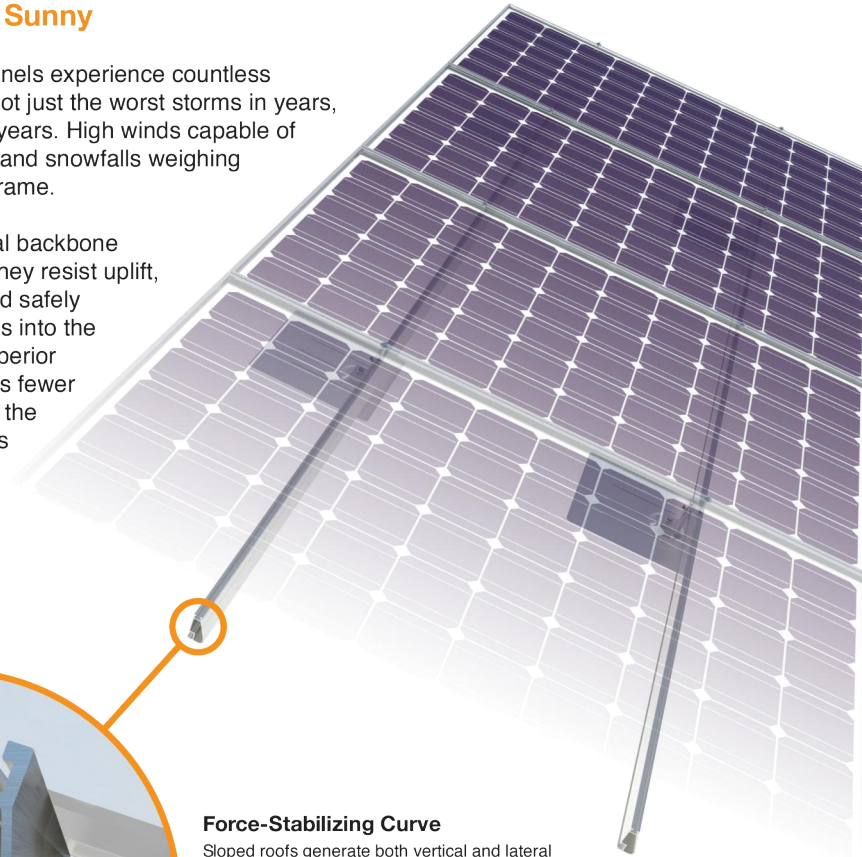


XR Rail® Family

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

Sloped 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 FlashFoot® and other pitched roof attachments.



IronRidge® offers a range of tilt 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.



Tech Brief

XR Rail® Family

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 spans up to 6 feet, while remaining light and economical.

- 6' 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 10 feet.

- 10' 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 climates and spans up to 12 feet for commercial applications.

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

Rail Selection

The table below was prepared in compliance with applicable engineering codes and standards.* Values are based on the following criteria: ASCE 7-16, Gable Roof Flush Mount, Roof Zones 1 & 2e, Exposure B, Roof Slope of 8 to 20 degrees and Mean Building Height of 30 ft. Visit IronRidge.com for detailed certification letters.

Load		Rail Span					
Snow (PSF)	Wind (MPH)	4'	5' 4"	6'	8'	10'	12'
None	90	XR10		XR100		XR1000	
	120						
	140						
	160						
20	90						
	120						
	140						
	160						
30	90						
	160						
40	90						
	160						
80	160						
	160						
120	160						

*Table is meant to be a simplified span chart for conveying general rail capabilities. Use approved certification letters for actual design guidance.

