WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE

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December 19, 2023

Scott Wyssling, PE

Digitally signed by Scott Wyssling, PE
DN: C=US, S=Utah, L=Alpine, O=Wyssling Consulting PLLC, CN="Scott Wyssling, PE", E=swyssling@wysslingconsulting.com
Reason: I am the author of this document
Location: your signing location here
Date: 2023.12.19 14:35:19-07'00'
Foxit PDF Editor Version: 11.1.0

BYLD Better
1213 W Moorehead Street Suite 500
Charlotte, NC 28208

Re: Engineering Services
Greene Residence
66 Williams Creek Drive, Erwin NC
7.700 kW System

To Whom It May Concern:

We have received information regarding solar panel installation on the roof of the above referenced structure. Our evaluation of the structure is to verify the existing capacity of the roof system and its ability to support the additional loads imposed by the proposed solar system.

A. Site Assessment Information

1. Site visit documentation identifying attic information including size and spacing of framing for the existing roof structure.
2. Design drawings of the proposed system including a site plan, roof plan and connection details for the solar panels. This information will be utilized for approval and construction of the proposed system.

B. Description of Structure:

Roof Framing:	Prefabricated wood trusses with all truss members constructed of 2x4 dimensional lumber at 24" on center.
Roof Material:	Composite Asphalt Shingles
Roof Slope:	45 degrees
Attic Access:	Accessible
Foundation:	Permanent

C. Loading Criteria Used

- **Dead Load**
  - Existing Roofing and framing = 7 psf
  - New Solar Panels and Racking = 3 psf
  - TOTAL = 10 PSF
- **Live Load** = 20 psf (reducible) – 0 psf at locations of solar panels
- **Ground Snow Load** = 10 psf
- **Wind Load** based on ASCE 7-10
  - Ultimate Wind Speed = 119 mph (based on Risk Category II)
  - Exposure Category C

Analysis performed of the existing roof structure utilizing the above loading criteria is in accordance with the 2018 North Carolina Residential Code, including provisions allowing existing structures to not require strengthening if the new loads do not exceed existing design loads by 105% for gravity elements and 110% for seismic elements. This analysis indicates that the existing framing will support the additional panel loading without damage, if installed correctly.

D. Solar Panel Anchorage

1. The solar panels shall be mounted in accordance with the most recent Ironridge installation manual. If during solar panel installation, the roof framing members appear unstable or deflect non-uniformly, our office should be notified before proceeding with the installation.
2. The maximum allowable withdrawal force for a 5/16" lag screw is 229 lbs per inch of penetration as identified in the National Design Standards (NDS) of timber construction specifications. Based on a minimum penetration depth of 2½", the allowable capacity per connection is greater than the design withdrawal force (demand). Considering the variable factors for the existing roof framing and installation tolerances, the connection using one 5/16" diameter lag screw with a minimum of 2½" embedment will be adequate and will include a sufficient factor of safety.
3. Considering the wind speed, roof slopes, size and spacing of framing members, and condition of the roof, the panel supports shall be placed no greater than 48" on center.

Based on the above evaluation, this office certifies that with the racking and mounting specified, the existing roof system will adequately support the additional loading imposed by the solar system. This evaluation is in conformance with the *2018 North Carolina Residential Code*, current industry standards, and is based on information supplied to us at the time of this report.

Should you have any questions regarding the above or if you require further information do not hesitate to contact me.

Very truly yours,

Scott E. Wyssling, PE
North Carolina License No. 46546
North Carolina COA P-2308

THIS PLAN HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY SCOTT WYSSLING, PE USING A DIGITAL SIGNATURE AND DATE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

Wyssling Consulting, PLLC
76 N Meadowbrook Drive Alpine UT 84004
North Carolina COA # P-2308

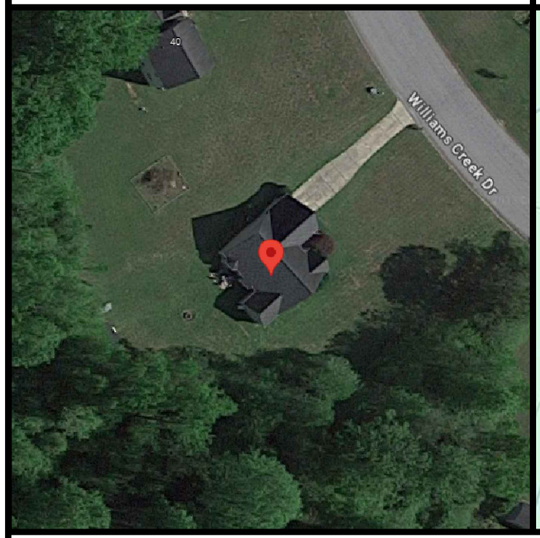
Signed 12/19/2023

NEW PV ROOFTOP SYSTEM DESIGN

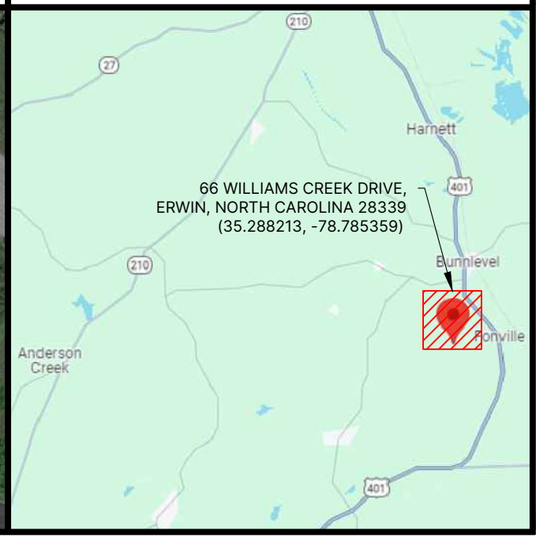
20 MODULES - 7.700 KW DC & 7.600 KW AC SYSTEM SIZE

JESSE GREENE RESIDENCE - 66 WILLIAMS CREEK DRIVE, ERWIN, NORTH CAROLINA 28339

AERIAL MAP



VICINITY MAP



SHEET INDEX

NOTICE TO CONTRACTOR
All construction must comply with current NC Building Codes and is subject to field inspection and verification.

APPROVED
Limited building only review
Permit holder responsible for full compliance with the code

01/11/2024

Harnett COUNTY NORTH CAROLINA

SCOPE OF WORK

INSTALL 7.700 KW DC ROOF MOUNTED
PV SYSTEM UTILIZING
(20) MISSION SOLAR MSE385SX5R [BLK]
(1) TESLA INVERTER 7.6KW
(7) TESLA RSD OPTIMIZERS
IRONRIDGE XR10 RACKING WITH
IRONRIDGE - FLASHVUE MOUNTS
EXISTING 200 A BUSBAR WITH 200 A MAIN BREAKER

CONTRACTOR

BYLD BETTER
1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

CODE REFERENCE

AHJ: ERWIN

2017 NORTH CAROLINA ELECTRIC CODE (NEC)
2018 NORTH CAROLINA BUILDING CODE
2018 NORTH CAROLINA RESIDENTIAL CODE

DESIGN CRITERIA

ASCE 7-10 WIND SPEED: 119 MPH
EXPOSURE CATEGORY C
GROUND SNOW LOAD: 10 PSF

GENERAL NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND REVIEW ALL MANUFACTURER INSTALLATION DOCUMENTS PRIOR TO INITIATING CONSTRUCTION.
2. ALL COMPONENTS SHALL BE NEW AND LISTED BY A RECOGNIZED ELECTRICAL TESTING LABORATORY AND LISTED FOR THEIR SPECIFIC APPLICATION.
3. OUTDOOR EQUIPMENT SHALL BE NEMA 3R RATED OR BETTER.
4. ACCESS TO ELECTRICAL COMPONENTS OVER 150 VOLTS TO GROUND SHALL BE RESTRICTED TO QUALIFIED PERSONNEL.
5. CONTRACTOR SHALL OBTAIN ELECTRICAL PERMITS PRIOR TO INSTALLATION AND SHALL COORDINATE ALL INSPECTIONS, TESTING COMMISSIONING, AND ACCEPTANCE WITH THE CLIENT, UTILITY CO. AND CITY INSPECTORS AS NEEDED.
6. EACH MODULE TO BE GROUNDED USING THE SUPPLIED CONNECTION POINT PER THE MANUFACTURER'S REQUIREMENTS. ALL PV MODULES, EQUIPMENT, AND METALLIC COMPONENTS ARE TO BE BONDED. IF THE EXISTING GROUNDING ELECTRODE SYSTEM CANNOT BE VERIFIED OR IS ONLY METALLIC WATER PIPING, IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL A SUPPLEMENTAL GROUNDING ELECTRODE.
7. DC CONDUCTORS SHALL BE RUN IN EMT AND/OR MC (METAL CLAD CABLE) AND SHALL BE LABELED. ALL DC CONDUCTORS RUN INSIDE OF THE STRUCTURE SHALL BE INSTALLED A MINIMUM OF 18" BELOW THE ROOF DECK.
8. EXPOSED NON-CURRENT CARRYING METAL PARTS OF ELECTRICAL EQUIPMENT SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE NEC.
9. CONFIRM LINE SIDE VOLTAGE AT THE ELECTRIC UTILITY SERVICE PRIOR TO CONNECTING INVERTER. VERIFY SERVICE VOLTAGE IS WITHIN INVERTER VOLTAGE OPERATIONAL RANGE.
10. ELECTRICAL CONTRACTOR TO PROVIDE CONDUIT EXPANSION JOINTS AND ANCHOR CONDUIT RUNS AS REQUIRED PER CODE.
11. ALL WIRING MUST BE PROPERLY SUPPORTED BY DEVICES OR MECHANICAL MEANS DESIGNED AND LISTED FOR SUCH USE, AND FOR ROOF-MOUNTED SYSTEMS, WIRING MUST BE PERMANENTLY AND COMPLETELY HELD OFF OF THE ROOF SURFACE.
12. ALL ROOF PENETRATIONS MUST BE SEALED OR FLASHED.
13. EQUIPMENT MAY BE SUBSTITUTED FOR SIMILAR EQUIPMENT BASED ON AVAILABILITY. SUBSTITUTED EQUIPMENT SHALL COMPLY WITH DESIGN CRITERIA.
14. REMOVAL OF AN INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR AND THE PHOTOVOLTAIC SOURCE AND/OR OUTPUT CIRCUIT GROUNDED CONDUCTORS.
15. WHENEVER A DISCREPANCY IN THE QUALITY OF EQUIPMENT ARISES ON THE DRAWING OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL MATERIAL AND SERVICES REQUIRED BY THE STRICTEST CONDITIONS NOTED ON THE DRAWINGS OR IN THE SPECIFICATIONS TO ENSURE COMPLETE COMPLIANCE AND LONGEVITY OF THE OPERABLE SYSTEM REQUIRED BY THE ENGINEERS.

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

DESIGN ENGINEER

WYSSLING CONSULTING
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76 N. MEADOWBROOK DRIVE
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swyssling@wysslingconsulting.com
(201) 874-3483

NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT

BYLD BETTER

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1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

GREENE, JESSE
66 WILLIAMS CREEK DRIVE
ERWIN, NC 28339
7.700 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

COVER SHEET

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Signed 12/19/2023

SCOTT E. WYSSLING, P.E.
NORTH CAROLINA LICENSE NO. 46546

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

PV-1

SITE PLAN LEGEND

UTILITY METER	UM
MAIN SERVICE PANEL	MSP
GAS METER	GM
AC DISCONNECT	AC
DC DISCONNECT	DC
AC COMBINER PANEL	COM
INVERTER	INV
BACKUP INTERFACE	BI
BATTERY	B
PRODUCTION METER	PM
SUBPANEL	SUB
JUNCTION BOX	JB
FIRE PATHWAY	
SATELLITE DISH	
PROPERTY LINE	
ATTIC RUN CONDUIT	
EXTERNAL CONDUIT	
CHIMNEY	
ROOF OBSTRUCTION (TYP.)	
ROOF VENT (TYP.)	

UTILITY: DUKE ENERGY PROGRESS

MODULE SPEC AND ROOF INFO:

PV MODULE TYPE - MISSION SOLAR MSE385SX5R [BLK] (385W)
WEIGHT OF INDIVIDUAL PANEL - 49.00 LBS
INDIVIDUAL SOLAR PANEL AREA - 21.43 SQ FT
ROOF AREA - 2140 SQ FT

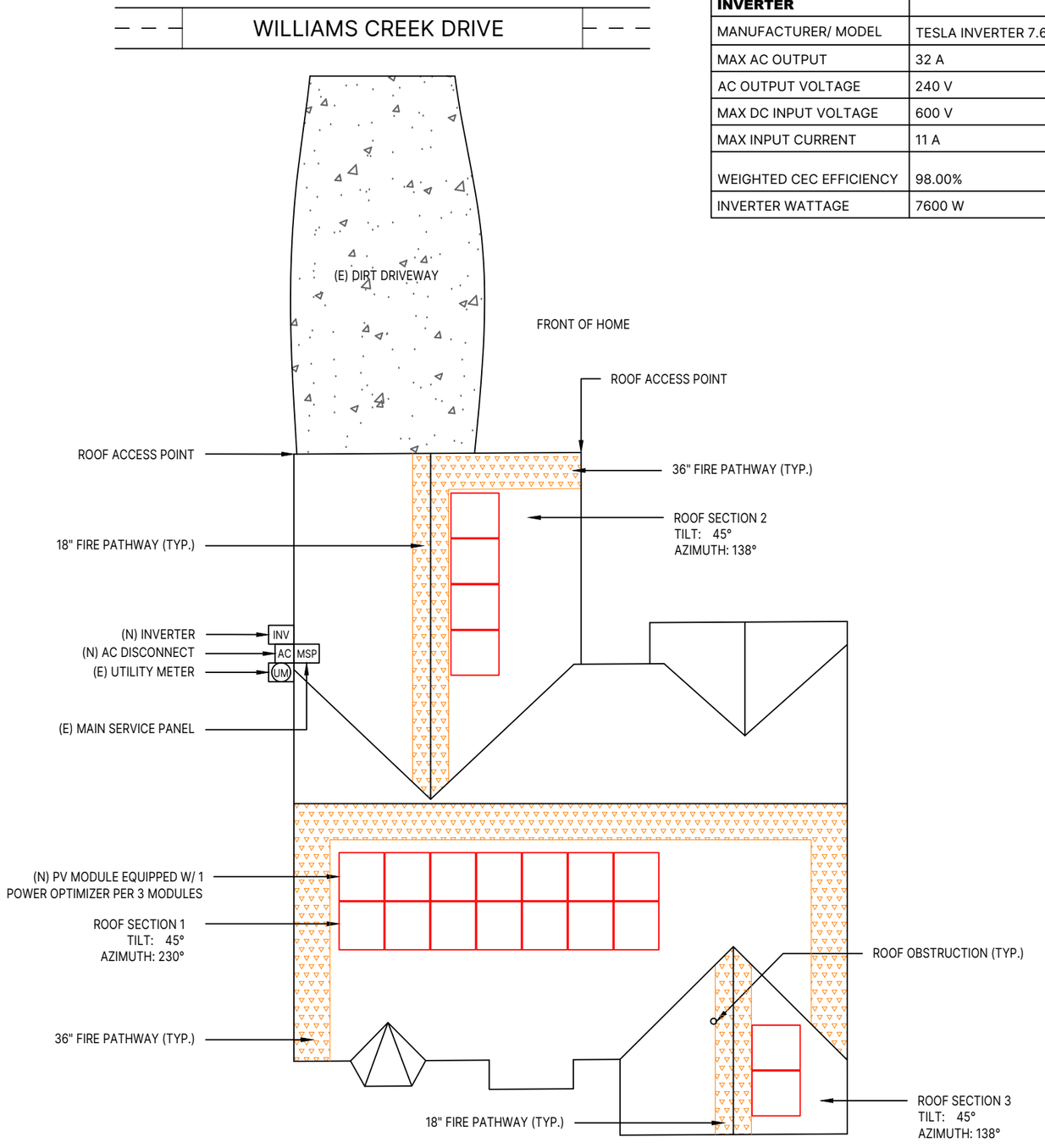
ROOF COVERAGE - 20.0%

EQUIPMENT LIST:

(20) MISSION SOLAR MSE385SX5R [BLK]
(1) TESLA INVERTER 7.6KW
(7) TESLA RSD OPTIMIZERS
IRONRIDGE XR10 RACKING WITH IRONRIDGE - FLASHVUE MOUNTS

SITE PLAN NOTES:

1. VERIFY ALL OBSTRUCTIONS AND DIMENSIONS IN THE FIELD.
2. PROVIDE RAIL SPLICES AS REQUIRED BY MANUFACTURER'S GUIDELINES.
3. NO SIGNIFICANT SHADING WILL RESULT FROM EXISTING ROOF OBSTRUCTIONS.
4. PV MODULES CANNOT BE INSTALLED OVER OR BLOCK ATTIC, PLUMBING, FURNACE OR WATER HEATER VENTS
5. AC DISCONNECT SHALL BE VISIBLE-OPEN TYPE, LOCAKABLE AND READILY ACCESSIBLE. TO BE WITHIN 10' OF THE UTILITY METER



SCALE: 3/32" = 1'-0"

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

INVERTER	
MANUFACTURER/ MODEL	TESLA INVERTER 7.6KW
MAX AC OUTPUT	32 A
AC OUTPUT VOLTAGE	240 V
MAX DC INPUT VOLTAGE	600 V
MAX INPUT CURRENT	11 A
WEIGHTED CEC EFFICIENCY	98.00%
INVERTER WATTAGE	7600 W

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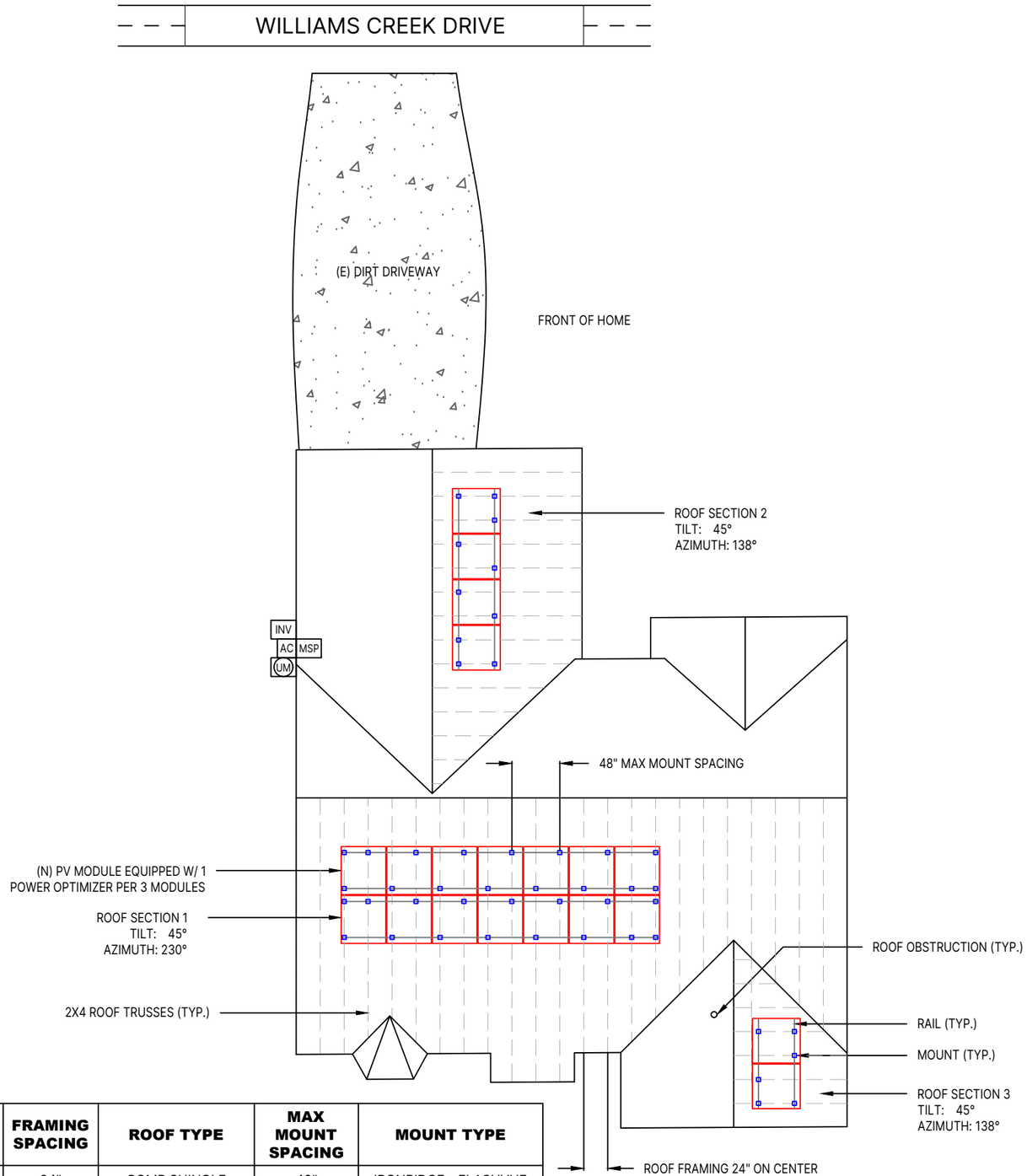
DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

PV-2

MOUNTING PLAN LEGEND

UTILITY METER	UM
MAIN SERVICE PANEL	MSP
GAS METER	GM
AC DISCONNECT	AC
DC DISCONNECT	DC
AC COMBINER PANEL	COM
INVERTER	INV
BACKUP INTERFACE	BI
BATTERY	B
PRODUCTION METER	PM
SUBPANEL	SUB
JUNCTION BOX	JB
FIRE PATHWAY	
SATELLITE DISH	
PROPERTY LINE	
ATTIC RUN CONDUIT	
EXTERNAL CONDUIT	
RAIL	
MOUNT	
ROOF FRAMING	
CHIMNEY	
ROOF OBSTRUCTION (TYP.)	
ROOF VENT (TYP.)	



MOUNTING PLAN NOTES:

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2. PROVIDE RAIL SPLICES AS REQUIRED BY MANUFACTURER'S GUIDELINES.
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4. PV MODULES CANNOT BE INSTALLED OVER OR BLOCK ATTIC, PLUMBING, FURNACE OR WATER HEATER VENTS

MOUNT QUANTITY:

1. (48) IRONRIDGE - FLASHVUE ATTACHMENTS
DISTRIBUTED LOAD - (ARRAY) WEIGHT/AREA = 2.26 lbs/ ft²
TOTAL WEIGHT OF SYSTEM - 980 lbs

	TILT	AZIMUTH	# OF MODULES	ROOF FRAMING	FRAMING SPACING	ROOF TYPE	MAX MOUNT SPACING	MOUNT TYPE
ROOF SECTION 1	45°	230°	14	2X4 - TRUSSES	24"	COMP SHINGLE	48"	IRONRIDGE - FLASHVUE
ROOF SECTION 2	45°	138°	4	2X4 - TRUSSES	24"	COMP SHINGLE	48"	IRONRIDGE - FLASHVUE
ROOF SECTION 3	45°	138°	2	2X4 - TRUSSES	24"	COMP SHINGLE	48"	IRONRIDGE - FLASHVUE

SCALE: 3/32" = 1'-0"

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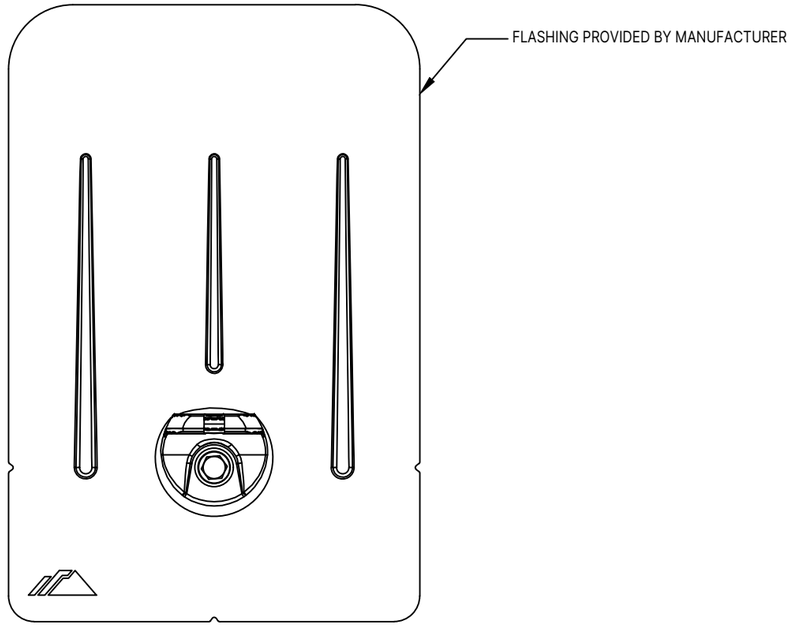
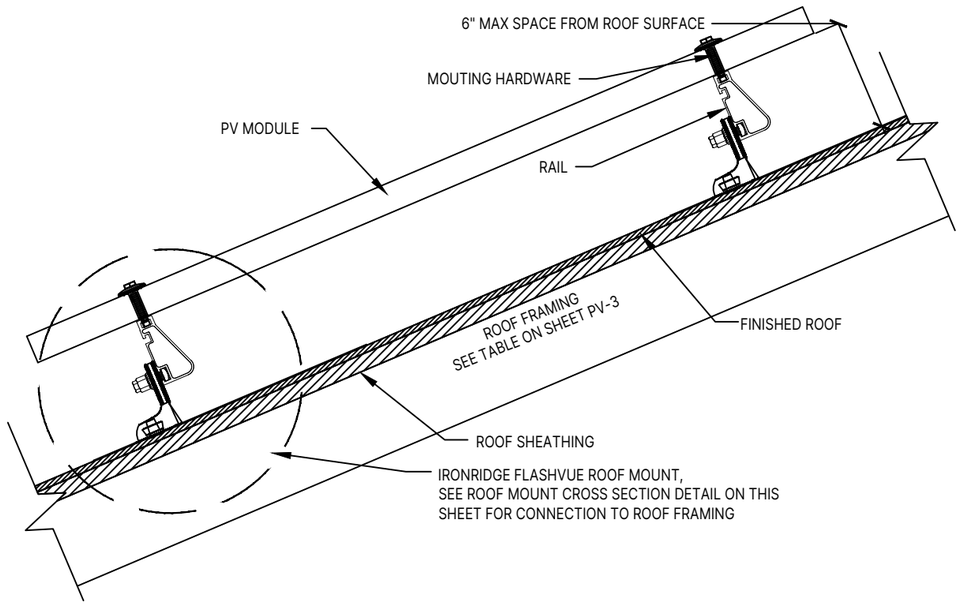
PV-3



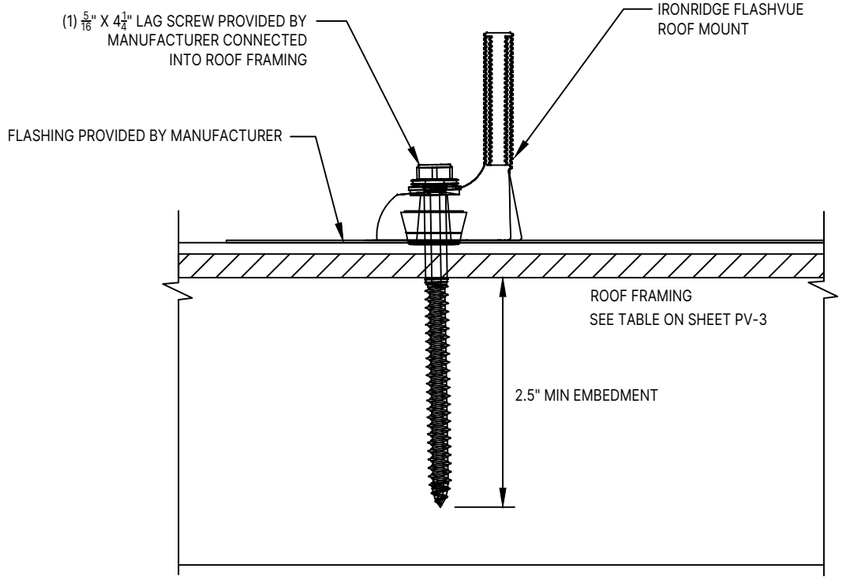
ROOF MOUNT PLAN VIEW DETAIL

NTS



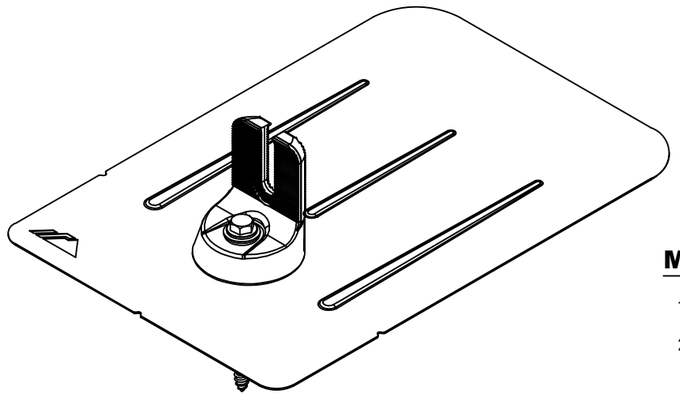
GENERAL ROOF MOUNT DETAIL

NTS



ROOF MOUNT CROSS SECTION DETAIL

NTS



ROOF MOUNT

NTS

MOUNT INSTALLATION NOTES

1. CONTRACTOR IS TO FOLLOW THE PLAN FOR INSTALLING ROOF MOUNTS.
2. IF THE CONTRACTOR IDENTIFIES THE ROOF FRAMING IS DIFFERENT FROM WHAT IS IDENTIFIED ON THIS PLAN, CONTRACTOR SHALL NOTIFY THE ENGINEER BEFORE PROCEEDING WITH INSTALLATION.
3. CONTRACTOR IS TO LOCATE THE ROOF FRAMING BY UTILIZING A HAMMER.
4. WHEN THE ROOF FRAMING IS LOCATED, CONTRACTOR IS TO DRILL A PILOT HOLE TO CONFIRM CENTER OF ROOF FRAMING. IF THE ROOF FRAMING IS MISSED, AND A NEW PILOT HOLE IS TO BE DRILLED, CONTRACTOR TO UTILIZE SILICON/CAULK TO SEAL THE ORIGINAL PILOT HOLE.
5. DIRECT TO DECK MOUNTS ARE ONLY TO BE USED WITH APPROVED DESIGN BY THE ENGINEER. DIRECT TO DECK MOUNT INSTALLATION IS NOT A SUBSTITUTION FOR LAG SCREWS INTO ROOF FRAMING.
6. CONTRACTOR TO FOLLOW MANUFACTURERS SPECIFICATIONS FOR INSTALLATION AND REQUIRED SCREWS.

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

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STRUCTURAL DETAILS

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DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

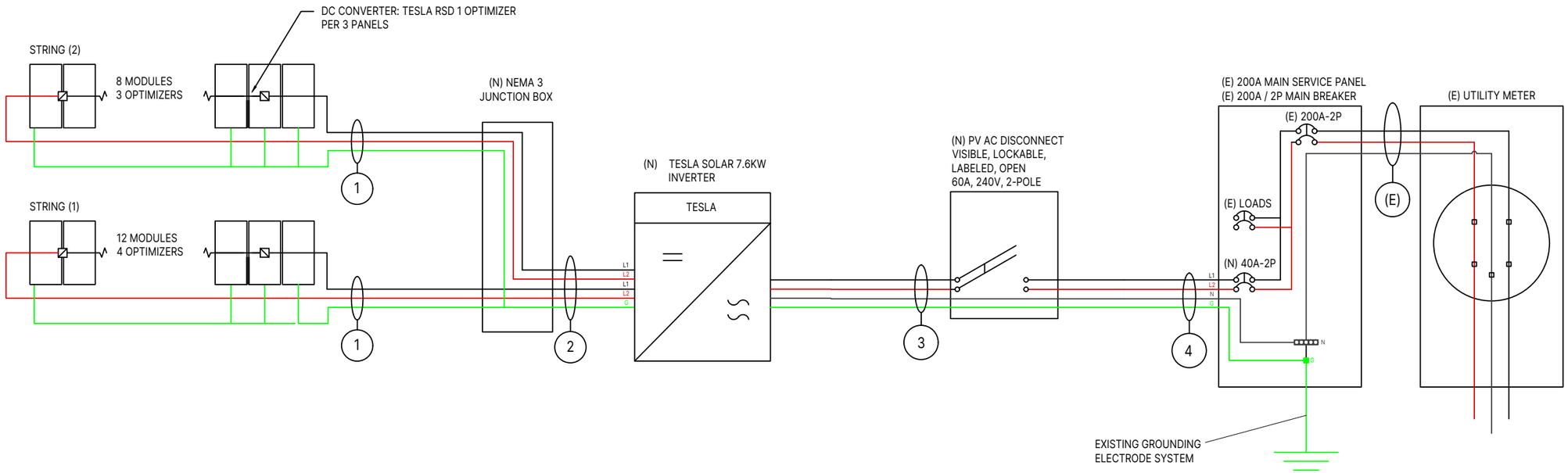
S-1

CONDUCTOR SCHEDULE

	CONDUCTORS				GROUND		CONDUIT
TAG ID	WIRES IN CONDUIT	WIRE AWG	TYPE, MATERIAL	AMPACITY	SIZE	TYPE, MATERIAL	
1	3	#10 AWG	PV CABLE	30	#6 AWG	BARE, CU	
2	5	#10 AWG	THWN-2, CU	30	#10 AWG	THHW, CU	3/4" CONDUIT
3	4	#8 AWG	THWN-2, CU	50	#10 AWG	THHW, CU	3/4" CONDUIT
4	4	#8 AWG	THWN-2, CU	50	#10 AWG	THHW, CU	3/4" CONDUIT

EQUIPMENT LIST:

(20) MISSION SOLAR MSE385SX5R [BLK]
(1) TESLA INVERTER 7.6KW
(7) TESLA RSD OPTIMIZERS
IRONRIDGE XR10 RACKING WITH IRONRIDGE - FLASHVUE MOUNTS



GENERAL NOTES

1. AC DISCONNECT SHALL BE VISIBLE-OPEN TYPE, LOCKABLE AND READILY ACCESSIBLE. TO BE WITHIN 10' OF THE UTILITY METER

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ELECTRICAL DIAGRAM

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

E-1

SYSTEM SIZE

AC SYSTEM SIZE: 11.400 kW
DC SYSTEM SIZE: 7.700 kW

INTERCONNECTION CALCULATIONS

ITEM	UNIT	PANEL
BUS RATING	AMPS	200A
MAIN OCPD	AMPS	200A
ALLOWED PV PER NEC	AMPS	40A

CONDUCTOR CALCULATIONS

TAG 1 (SEE E-1)	TAG 2 (SEE E-1)	TAG 3 (SEE E-1)	TAG 4 (SEE E-1)
UNDER MODULES, NOT IN CONDUIT	#10 AWG MAX CURRENT = 30A	#8 AWG MAX CURRENT = 50A	#8 AWG MAX CURRENT = 50A
#10 AWG MAX CURRENT = 30A			
TESLA INVERTER 7.6KW MAX CIRCUIT CURRENT	TESLA INVERTER 7.6KW MAX CIRCUIT CURRENT	TESLA INVERTER 7.6KW MAX OUTPUT = 32 A	TESLA INVERTER 7.6KW MAX OUTPUT = 32 A
15 A FOR STRING 1	15 A FOR STRING 1	32 A * 1.25 A = 40 A	32 A * 1.25 A = 40 A
15 A FOR STRING 2	15 A FOR STRING 2	RECOMMENDED OCPD = 40 A	RECOMMENDED OCPD = 40 A

EQUIPMENT INFORMATION

MODULE	
MANUFACTURER/ MODEL	MISSION SOLAR MSE385SX5R [BLK]
PMAX	385 W
VOC	45.03 V
VMP	36.93 V
IMP	10.42 A
ISC	10.97 A
TEMPERATURE COOEFFICIENT OF PMAX	-0.361 %/°C
TEMPERATURE COEFFICIENT OF VOC	-0.262 %/°C

INVERTER	
MANUFACTURER/ MODEL	TESLA INVERTER 7.6KW
MAX AC OUTPUT	32 A
AC OUTPUT VOLTAGE	240 V
MAX DC INPUT VOLTAGE	600 V
MAX INPUT CURRENT	11 A
WEIGHTED CEC EFFICIENCY	98.00%
INVERTER WATTAGE	7600 W

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

DESIGN ENGINEER

WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE

76 N. MEADOWBROOK DRIVE
ALPINE, UTAH 84004
swyssling@wysslingconsulting.com
(201) 874-3483

NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT

BYLD BETTER

BYLD BETTER
1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

GREENE, JESSE
66 WILLIAMS CREEK DRIVE
ERWIN, NC 28339
7.700 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

EQUIPMENT INFORMATION

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

E-2

⚠ WARNING

ELECTRIC SHOCK HAZARD

THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED

AT EACH JUNCTION BOX, COMBINER BOX, DISCONNECT AND DEVICE WHERE ENERGIZED UNGROUNDED CONDUCTORS MAY BE EXPOSED DURING SERVICE [NEC. 690.35(F)]

⚠ WARNING

ELECTRIC SHOCK HAZARD

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

FOR PV DISCONNECTING MEANS WHERE ALL TERMINALS OF THE DISCONNECTING MEANS MAY BE ENERGIZED IN THE OPEN POSITION.
NEC 690.17(E), NEC 705.22

PHOTOVOLTAIC SYSTEM ⚠ AC DISCONNECT ⚠

RATED AC OUTPUT CURRENT	32 A
NOMINAL OPERATING AC VOLTAGE	240 V

AT POINT OF INTERCONNECTION, MARKED AT AC DISCONNECT MEANS NEC 690.54, NEC 690.13(B)

⚠ WARNING

DUAL POWER SUPPLY

SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

AT POINT OF INTERCONNECTION FOR EQUIPMENT CONTAINING OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO A BUSBAR OR CONDUCTOR SUPPLIED FROM MULTIPLE SOURCES, EACH SERVICE EQUIPMENT AND ALL ELECTRIC POWER PRODUCTION SOURCE LOCATIONS. NEC 705.12(B)(2)(3)

WARNING: PHOTOVOLTAIC POWER SOURCE

AT DIRECT-CURRENT EXPOSED RACEWAYS, CABLE TRAYS, COVERS AND ENCLOSURES OF JUNCTION BOXES, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.NEC 690.31(G)(3&4)

PHOTOVOLTAIC AC DISCONNECT

MAXIMUM AC OPERATING CURRENT: 32

NOMINAL OPERATING AC VOLTAGE: 240

AT POINT OF INTERCONNECTION, MARKED AT DISCONNECTING MEANS [NEC 690.54]

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

SIGN LOCATED AT UTILITY SERVICE EQUIPMENT.
NEC 690.56(C)

⚠ WARNING

THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR

SIGN LOCATED AT LOAD CENTER IF CONTAINING 3 OR MORE POWER SOURCES.
NEC 705.12(B)(2)(3)(C)

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUTDOWN CONDUCTORS OUTSIDE THE ARRAY CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT

FOR PV SYSTEMS THAT ONLY SHUT DOWN CONDUCTORS LEAVING THE ARRAY: AWAY FROM SERVICE DISCONNECTING MEANS TO WHICH THE PV SYSTEMS ARE CONNECTED AND SHALL INDICATE THE LOCATION OF ALL IDENTIFIED RAPID SHUTDOWN SWITCHES IF NOT AT THE SAME LOCATION. NEC 690.56(C)(1)(B).

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

NEXT TO RAPID SHUTDOWN DISCONNECT FOR SYSTEM. NEC 690.56(C)(3)

DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE

MAXIMUM VOLTAGE 240.0000 VDC

MAXIMUM CIRCUIT CURRENT 32.0 AMPS

MAXIMUM RATED DC TO DC CONVERTER OUTPUT 15.0 AMPS

AT EACH DC DISCONNECTING MEANS [NEC 690.53]

⚠ WARNING

INVERTER OUTPUT CONNECTION: DO NOT RELOCATE THIS OVERCURRENT DEVICE

PLACED ADJACENT TO THE BACK-FED BREAKER FROM THE INVERTER IF TIE IN CONSISTS OF LOAD SIDE CONNECTION TO BUSBAR.
NEC 705.12(B)(2)(3)(b)

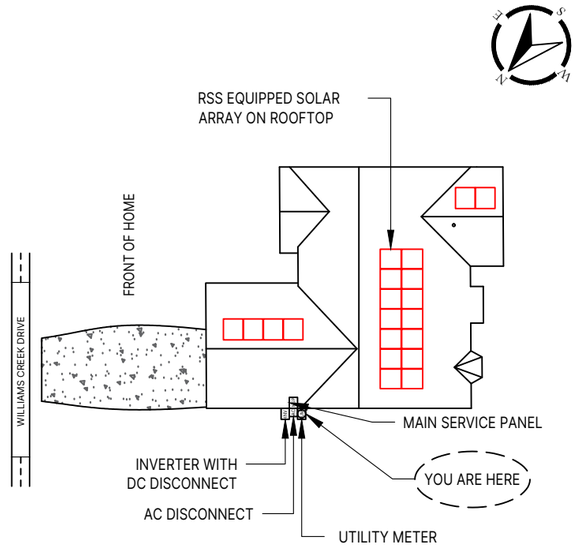
LABELING NOTES:

1. LABELS CALLED OUT ACCORDING TO ALL COMMON CONFIGURATIONS. ELECTRICIAN TO DETERMINE EXACT REQUIREMENTS IN THE FIELD PER CURRENT NEC AND LOCAL CODES AND MAKE APPROPRIATE ADJUSTMENTS.
3. LABELING REQUIREMENTS BASED ON THE 2017 NATIONAL ELECTRIC CODE, OSHA STANDARD 19010.145, ANSI Z535.
4. LABELS SHALL NOT BE HAND-WRITTEN (NEC 110.21(B))
5. MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
6. LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED [NEC 110.21]
7. LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8", WHITE ON RED BACKGROUND; REFLECTIVE, AND PERMANENTLY AFFIXED [IFC 605.11.1.1]

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

CAUTION

MULTIPLE SOURCES OF POWER



66 WILLIAMS CREEK DRIVE, ERWIN, NORTH CAROLINA 28339

LABEL LOCATION: MSP CODE REF: NEC 2017 - 705.10

DESIGN ENGINEER

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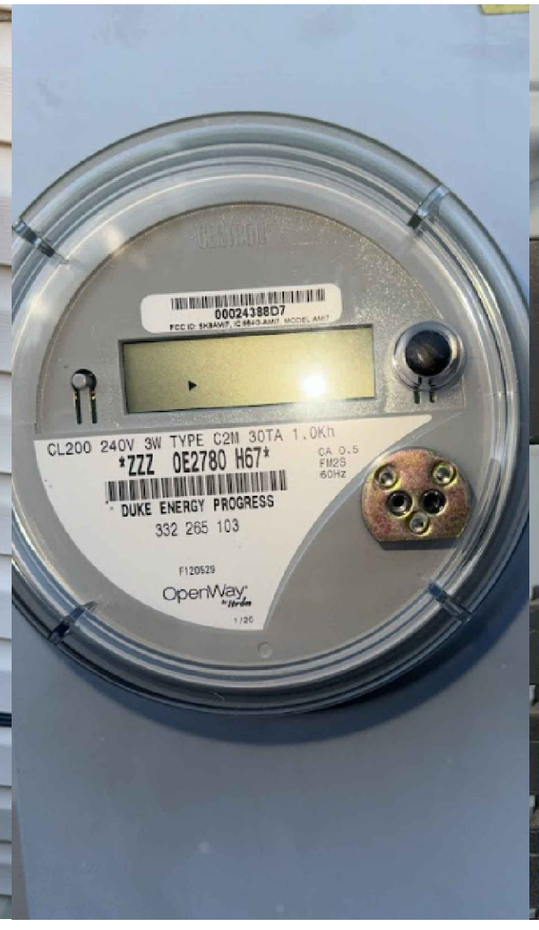
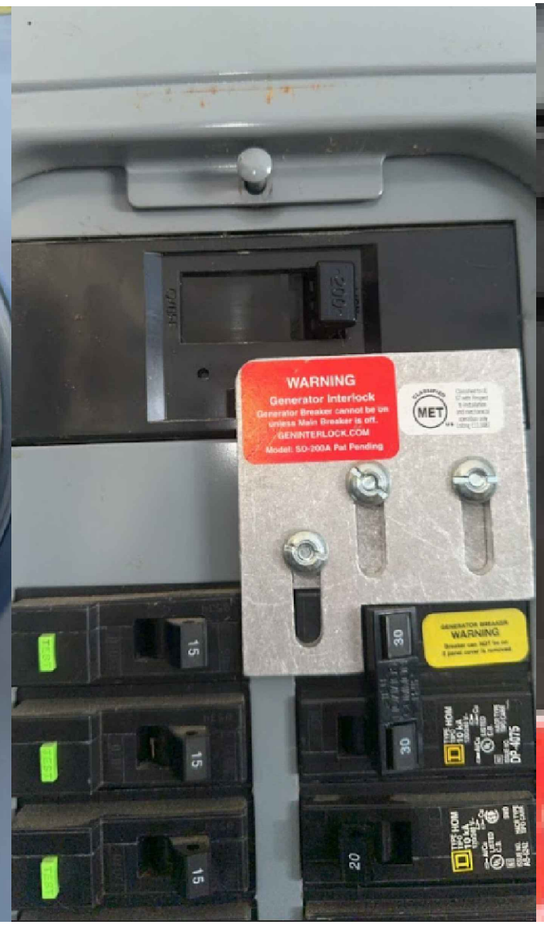
NO	DATE:	COMMENTS
1		
2		

PV LABELS

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

E-3





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SITE PHOTOS

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

PV-4

MSE PERC 66

MISSION SOLAR ENERGY

385W Positive Power Tolerance

Class leading power output **-0 to +3%**

True American Quality
True American Brand

Mission Solar Energy is headquartered in San Antonio, Texas where we manufacture our modules. We produce American, high-quality solar modules ensuring the highest-in-class power output and best-in-class reliability. Our product line is tailored for residential, commercial and utility applications. Every Mission Solar Energy solar module is certified and surpasses industry standard regulations, proving excellent performance over the long term.

Demand the best. Demand Mission Solar Energy.

Certified Reliability
- Tested to UL 61730 & IEC Standards
- PID resistant
- Resistance to salt mist corrosion

Advanced Technology
- 6 Busbar
- Passivated Emitter Rear Contact
- Ideal for all applications

Extreme Weather Resilience
- Up to 5,400 Pa front load & 3,600 Pa back load
- Tested load to UL 61730
- 40 mm frame

BAA Compliant for Government Projects
- Buy American Act
- American Recovery & Reinvestment Act

MODULES ASSEMBLED DESIGNED & ENGINEERED IN THE USA

25 YEAR FRAME-TO-FRAME WARRANTY

FRAME-TO-FRAME WARRANTY

Degradation guaranteed not to exceed 2% in year one and 0.58% annually from years two to 30 with 84.08% capacity guaranteed in year 25.
For more information, visit www.missionsolar.com/warranty

CERTIFICATIONS

CEC · TÜV SÜD · c UL us LISTED

UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

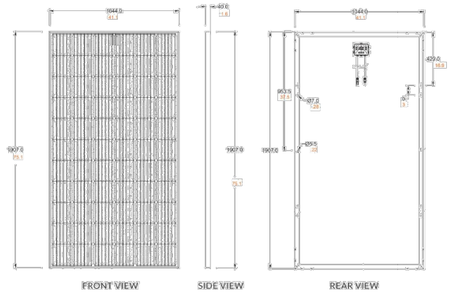
If you have questions or concerns about certification of our products in your area, please contact Mission Solar Energy.

Class Leading
375-385W

MSE PERC 66

BASIC DIMENSIONS

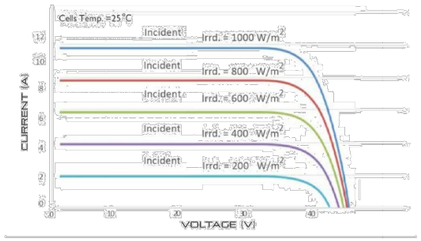
[UNITS: MM/IN]



CURRENT-VOLTAGE CURVE

MSE385SX5R: 385WP, 66 CELL SOLAR MODULE

Current-voltage characteristics with dependence on irradiance and module temperature



CERTIFICATIONS AND TESTS

IEC	61215, 61730, 61701
UL	61730

TÜV SÜD · CEC · c UL us LISTED

ELECTRICAL SPECIFICATION

PRODUCT TYPE	MSExxxSX5R (xxx = P_{max})			
Power Output	P_{max}	W	375	380	385
Module Efficiency		%	18.8	19.1	19.3
Tolerance		%	0/+3	0/+3	0/+3
Short Circuit Current	I_{sc}	V	10.85	10.91	10.97
Open Circuit Voltage	V_{oc}	A	44.64	44.84	45.03
Rated Current	I_{mp}	V	10.26	10.34	10.42
Rated Voltage	V_{mp}	V	36.56	36.75	36.93
Fuse Rating		A	20	20	20
System Voltage		V	1,000	1,000	1,000

TEMPERATURE COEFFICIENTS

Normal Operating Cell Temperature (NOCT)	44.43°C (±3.7%)
Temperature Coefficient of Pmax	-0.361%/°C
Temperature Coefficient of Voc	-0.262%/°C
Temperature Coefficient of Isc	0.039%/°C

OPERATING CONDITIONS

Maximum System Voltage	1,000Vdc
Operating Temperature Range	-40°C (-40°F) to +85°C (185°F)
Maximum Series Fuse Rating	20A
Fire Safety Classification	Type 1
Front & Back Load (UL Standard)	Up to 5,400 Pa front and 3,600 Pa back load, Tested to UL 61730
Hail Safety Impact Velocity	25mm at 23 m/s

MECHANICAL DATA

Solar Cells	P-type mono-crystalline silicon
Cell Orientation	66 cells (6x11)
Module Dimension	1,907mm x 1,044mm x 40mm
Weight	22 kg (49 lbs.)
Front Glass	3.2mm, tempered, low-iron, anti-reflective
Frame	Anodized
Encapsulant	Ethylene vinyl acetate (EVA)
Junction Box	Protection class IP67 with 3 bypass-diodes
Cable	1.0m, Wire 4mm2 (12AWG)
Connector	Staubli PV-KBT4/6II-UR and PV-KST4/6II-UR, MC4, Renhe 05-8

SHIPPING INFORMATION

Container Feet	Ship To	Pallet	Panels	380 W Bin
53'	Most States	30	780	296.40 kW
Double Stack	CA	26	676	256.88 kW

PALLET [26 PANELS]

Weight	Height	Width	Length
1,274 lbs. (572 kg)	47.56 in (120.80 cm)	46 in (116.84 cm)	77 in (195.58 cm)

Mission Solar Energy
8303 S. New Braunfels Ave., San Antonio, Texas 78235
www.missionsolar.com | info@missionsolar.com

Mission Solar Energy reserves the right to make specification changes without notice.

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

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NO	DATE:	COMMENTS
1		
2		

MODULE SPEC SHEET

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

SPECS-1

SOLAR INVERTER

3.8 kW | 7.6 kW

Tesla Solar Inverter completes the Tesla home solar system, converting DC power from solar to AC power for home consumption. Tesla's renowned expertise in power electronics has been combined with robust safety features and a simple installation process to produce an outstanding solar inverter that is compatible with both Solar Roof and traditional solar panels. Once installed, homeowners use the Tesla mobile app to manage their solar system and monitor energy consumption, resulting in a truly unique ecosystem experience.

KEY FEATURES

- Built on Powerwall 2 technology for exceptional efficiency and reliability
- Wi-Fi, Ethernet, and cellular connectivity with easy over-the-air updates
- Designed to integrate with Tesla Powerwall and Tesla App
- 3.8 kW and 7.6 kW models available

SOLAR INVERTER

Tesla Solar Inverter provides DC to AC conversion and integrates with the Tesla ecosystem, including Solar Panels, Solar Roof, Powerwall, and vehicle charging, to provide a seamless sustainable energy experience.

KEY FEATURES

- Integrated rapid shutdown, arc fault, and ground fault protection
- No neutral wire simplifies installation
- 2x the stancard number of MPPTs for high production on complex roofs

ELECTRICAL SPECIFICATIONS

OUTPUT (AC)	3.8 kW	7.6 kW
Nominal Power	3,800 W	7,600 W
Maximum Apparent Power	3,328 VA at 208 V 3,840 VA at 240 V	6,656 VA at 208 V 7,680 VA at 240 V
Maximum Continuous Current	16 A	32 A
Breaker (Overcurrent Protection)	20 A	40 A
Nominal Power Factor	1 - 0.85 (leading / lagging)	
THD (at Nominal Power)	<5%	
INPUT (DC)		
MPPT	2	4
Input Connectors per MPPT	1-2	1-2-1-2
Maximum Input Voltage	600 VDC	
DC Input Voltage Range	60 - 550 VDC	
DC MPPT Voltage Range[1]	60 - 480 VDC	
Maximum Current per MPPT (I_{mp})	11 A	
Maximum Short Circuit Current per MPPT (I_{sc})	15 A	

PERFORMANCE SPECIFICATIONS

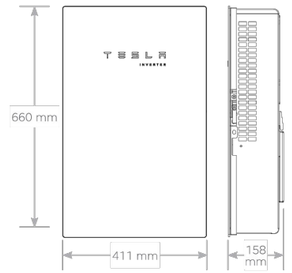
Peak Efficiency[2]	97.5%	98.0%
CEC Efficiency[2]	97.5%	
Allowable DC/AC Ratio	1.4	
Customer Interface	Tesla Mobile App	
Internet Connectivity	Wi-Fi (2.4 GHz, 802.11 b/g/n), Ethernet, Cellular (LTE/4G)[3]	
AC Remote Metering Support	Wi-Fi (2.4 GHz, 802.11 b/g/n), RS-485	
Protections	Integrated arc fault circuit interrupter (AFCI), Rapid Shutdown	
Supported Grid Types	60 Hz, 240 V Split Phase 60 Hz, 208 V Wye	
Required Number of Tesla Solar Shutdown Devices per Solar Module	See *Solar Shutdown Device Requirements per Module* on page 3	
Warranty	12.5 years	

[1] Maximum current.
[2] Expected efficiency pending final CEC listing.
[3] Cellular connectivity subject to network operator service coverage and signal strength.

MECHANICAL SPECIFICATIONS

Dimensions	660 mm x 411 mm x 158 mm (26 in x 16 in x 6 in)
Weight	52 lb[4]
Mounting options	Wall mount (bracket)

[4] Door and bracket can be removed for a mounting weight of 37 lb.



ENVIRONMENTAL SPECIFICATIONS

Operating Temperature[5]	-30°C to 45°C (-22°F to 113°F)
Operating Humidity (RH)	Up to 100%, condensing
Storage Temperature	-30°C to 70°C (-22°F to 158°F)
Maximum Elevation	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Rating	Type 3R
Ingress Rating	IP55 (Wiring compartment)
Pollution Rating	PD2 for power electronics and terminal wiring compartment, PD3 for all other components
Operating Noise @ 1 m	< 40 db(A) nominal, < 50 db(A) maximum

[5] For the 7.6 kW Solar Inverter, performance may be de-rated to 6.2 kW at 240 V or 5.37 kW at 208 V when operating at temperatures greater than 45°C.

COMPLIANCE INFORMATION

Grid Certifications	UL 1741, UL 1741 SA, IEEE 1547, IEEE 1547.1
Safety Certifications	UL 1699B, UL 1741, UL 1998 (US)
Emissions	EN 61000-6-3 (Residential), FCC 47CFR15.109 (a)

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INVERTER SPEC SHEET

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

SPECS-2

SOLAR SHUTDOWN DEVICE

The Tesla Solar Shutdown Device is part of the PV system rapid shutdown (RSD) function in accordance with Article 690 of the applicable NEC. When paired with the Tesla Solar Inverter, the PVRSS is initiated by any loss of AC power.

ELECTRICAL SPECIFICATIONS

Nominal Input DC Current Rating (I_{mp})	12 A
Maximum Input Short Circuit Current (I_{sc})	15 A
Maximum System Voltage	600 V DC

RSD MODULE PERFORMANCE

Maximum Number of Devices per String	5
Control	Power Line Excitation
Passive State	Normally open
Maximum Power Consumption	7 W
Warranty	25 years

COMPLIANCE INFORMATION

Certifications	UL 1741 PVRSS PVRSA (Photovoltaic Rapid Shutdown Array)

PVRSS

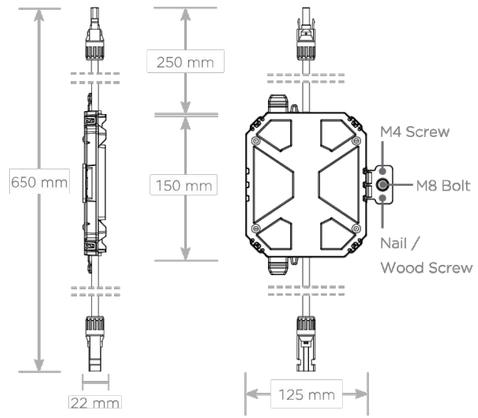
RSD Initiation Method	Loss of AC power
Compatible Equipment	Tesla Solar Inverter

ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-30°C to 70°C (-22°F to 158°F)
Enclosure Rating	NEMA 4 / IP65

MECHANICAL SPECIFICATIONS

Electrical Connections	MC4 Connector
Housing	Plastic
Dimensions	125 mm x 150 mm x 22 mm (5 in x 6 in x 1 in)
Weight	350 g (0.77 lb)
Mounting Options	ZEP Home Run Clip M4 Screw (#10) M8 Bolt (5/16") Nail / Wood screw



SOLAR SHUTDOWN DEVICE REQUIREMENTS PER MODULE

The following modules have been certified as part of a PV Rapid Shutdown Array (PVRSA) when installed together with the Tesla Solar Inverter and Tesla Solar Shutdown Devices. See the Tesla Solar Inverter Installation Manual for guidance on installing Tesla Solar Inverter and Solar Shutdown Devices with other modules.

Brand	Model	Required Solar Shutdown Devices
Tesla	Solar Roof V3	1 Solar Shutdown Device per 10 modules
Hanwha	Q.PEAK DUO BLK-G5	1 Solar Shutdown Device per 3 modules
Hanwha	Q.PEAK DUO BLK-G6+	1 Solar Shutdown Device per 3 modules

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OPTIMIZER SPEC SHEET

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

SPECS-3

Tech Brief

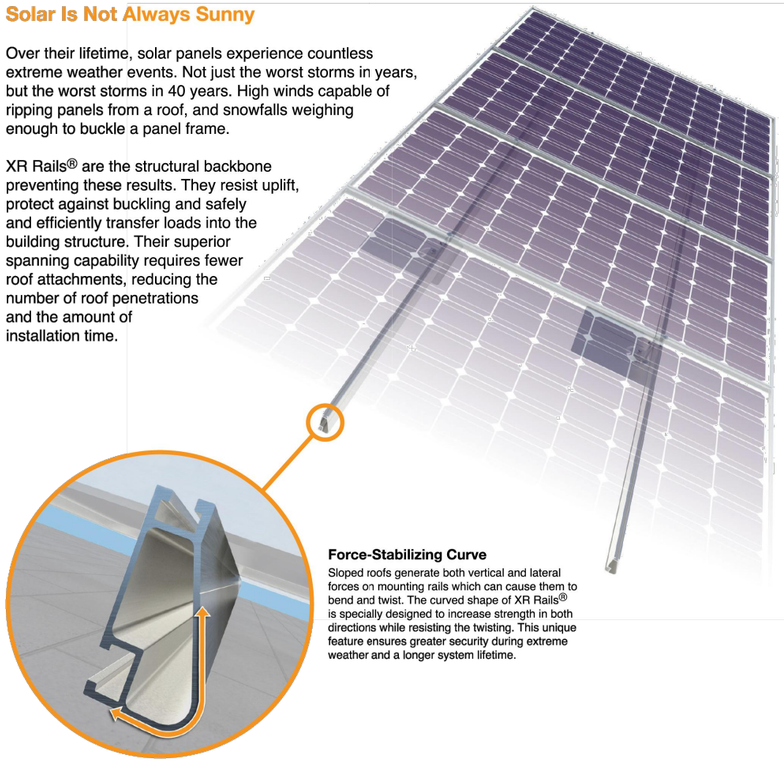
IRONRIDGE

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.

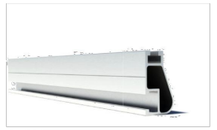
Corrosion-Resistant Materials

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

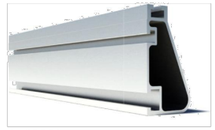
XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves spans up to 6 feet, while remaining light and economical.

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

XR100

XR100 is a residential and commercial 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						
120	160						

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

DESIGN ENGINEER

WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE
76 N. MEADOWBROOK DRIVE
ALPINE, UTAH 84004
swyssling@wysslingconsulting.com
(201) 874-3483
NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT

BYLD BETTER

BYLD BETTER
1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

GREENE, JESSE
66 WILLIAMS CREEK DRIVE
ERWIN, NC 28339
7.700 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

RAIL SPEC SHEET

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

SPECS-4

ENGINEERED PLANS PREPARED BY ENGINEERS IN THE USA

Tech Brief

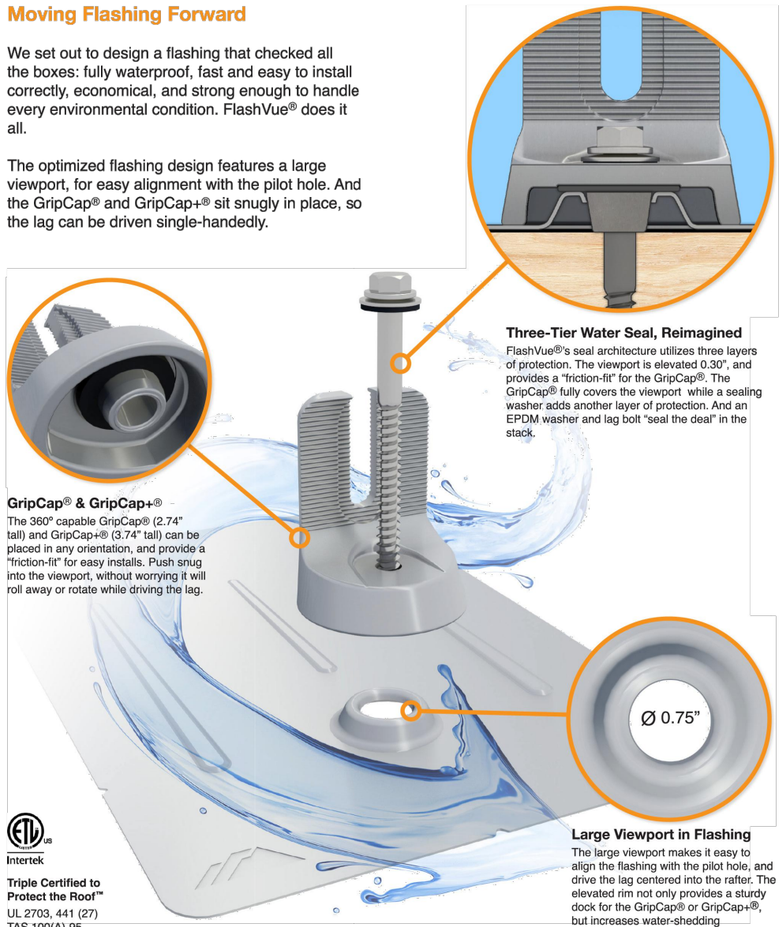
IRONRIDGE

FlashVue®

Moving Flashing Forward

We set out to design a flashing that checked all the boxes: fully waterproof, fast and easy to install correctly, economical, and strong enough to handle every environmental condition. FlashVue® does it all.

The optimized flashing design features a large viewport, for easy alignment with the pilot hole. And the GripCap® and GripCap+® sit snugly in place, so the lag can be driven single-handedly.



Three-Tier Water Seal, Reimagined
FlashVue®'s seal architecture utilizes three layers of protection. The viewport is elevated 0.30", and provides a "friction-fit" for the GripCap®. The GripCap® fully covers the viewport while a sealing washer adds another layer of protection. And an EPDM washer and lag bolt "seal the deal" in the stack.

GripCap® & GripCap+®
The 360° capable GripCap® (2.74" tall) and GripCap+® (3.74" tall) can be placed in any orientation, and provide a "friction-fit" for easy installs. Push snug into the viewport, without worrying it will roll away or rotate while driving the lag.

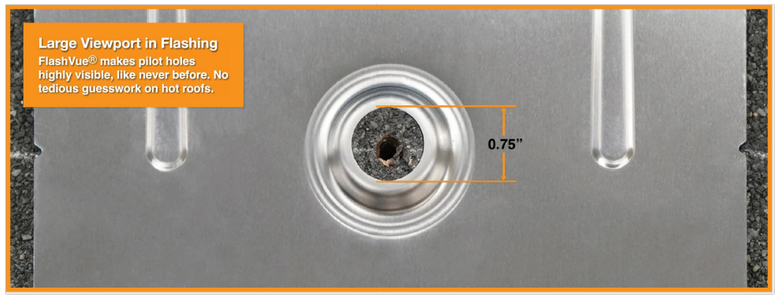
Intertek

Triple Certified to Protect the Roof™
UL 2703, 441 (27)
TAS 100(A)-95

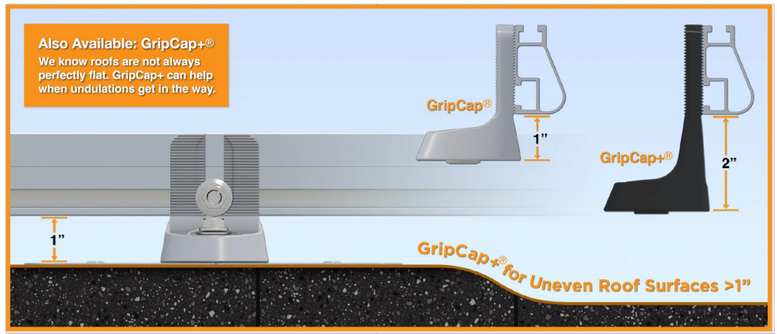
Large Viewport in Flashing
The large viewport makes it easy to align the flashing with the pilot hole, and drive the lag centered into the rafter. The elevated rim not only provides a sturdy dock for the GripCap® or GripCap+®, but increases water-shedding capabilities.

Tech Brief

See Your Pilot Holes



Solve Roof Undulations



Trusted Strength & Certification

Attachment Loading
FlashVue® has been tested and rated to support 1161 (lbs) of uplift and 353 (lbs) of lateral load.

Structural Certification
Designed and certified for compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings
Passed both the UL 441 Section 27 “Rain Test” and TAS 100-95 “Wind Driven Rain Test” by Intertek.

UL 2703 Listed System
Conforms to UL 2703 mechanical and bonding requirements. See Flush Mount Manual for more info.

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REVISIONS

NO	DATE:	COMMENTS
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2		

MOUNTING SPEC SHEET

DATE:	12/18/2023
DRAWN BY:	MSB
REVIEWED BY:	JQH

SPECS-5