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February 6, 2024

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

Re: Engineering Services
Lane Residence
591 Omaha Drive, Broadway, NC
7.600 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: 2x6 dimensional lumber at 16" on center with a knee wall support near midspan of the rafters.
Roof Material: Composite Asphalt Shingles
Roof Slope: 37 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** = 15 psf
- **Wind Load** based on ASCE 7-10
 - Ultimate Wind Speed = 115 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.

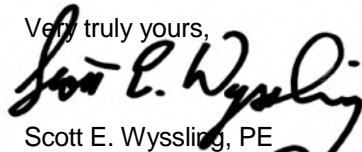
D. Solar Panel Anchorage

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 #14 screw is 189 lbs per inch of penetration as identified in the National Design Standards (NDS) of timber construction specifications. Based on a minimum penetration depth of 2", 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 two (2) #14 screw with a minimum of 2" 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

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Signed 2/06/2024

NEW PV ROOFTOP SYSTEM DESIGN

16 MODULES - 6.320 KW DC & 7.600 KW AC SYSTEM SIZE
 MONICA LANE RESIDENCE - 591 OMAHA DRIVE, BROADWAY, NORTH CAROLINA 27505

DESIGN ENGINEER



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

NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT



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

LANE, MONICA
 591 OMAHA DRIVE
 BROADWAY, NC 27505
 6.320 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

COVER SHEET

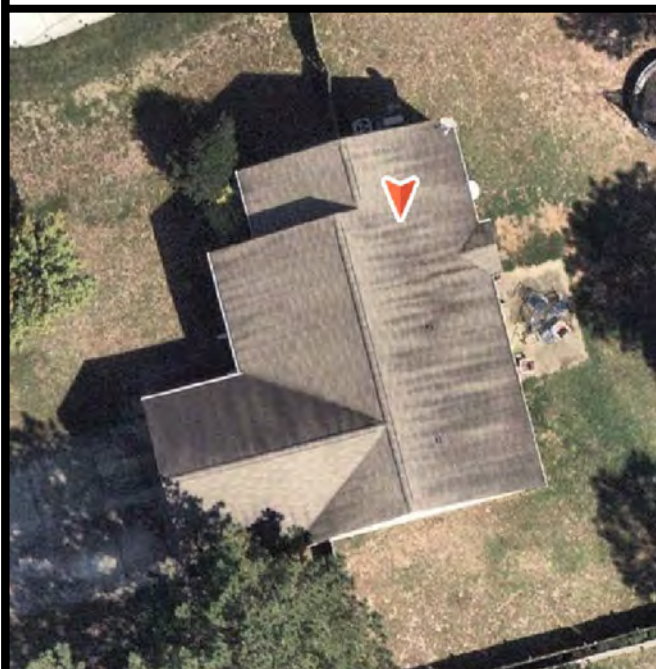


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 NORTH CAROLINA LICENSE NO. 46546

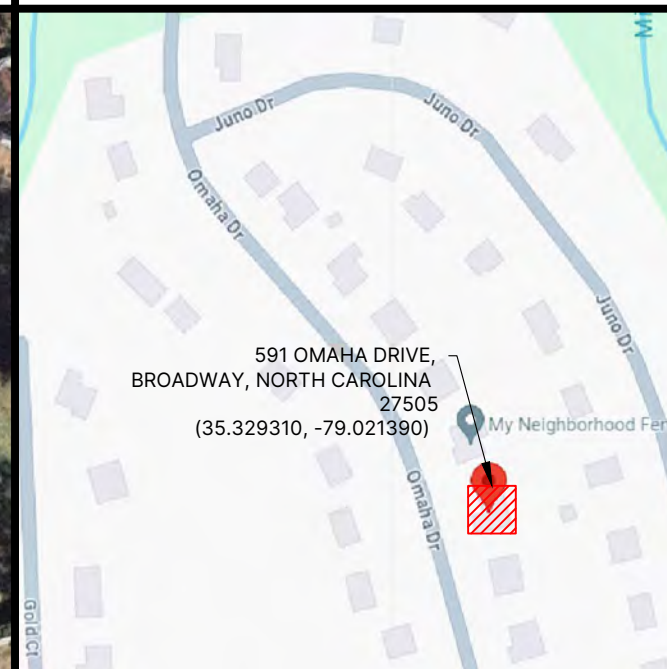
DATE:	2/5/2024
DRAWN BY:	FBM
REVIEWED BY:	AGO

PV-1

AERIAL MAP



VICINITY MAP



SHEET INDEX

PV-1	COVER SHEET
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SCOPE OF WORK

INSTALL 6.320 KW DC ROOF MOUNTED PV SYSTEM UTILIZING
 (16) MISSION SOLAR PERC 66 MSE395SX9R
 (1) TESLA INVERTER 7.6KW
 (6) TESLA OPTIMIZERS
 (1) TESLA BACKUP GATEWAY
 (1) 60A UTILITY AC DISCONNECT
 IRONRIDGE AIRE RACKING WITH IRONRIDGE - HUG MOUNTS
 EXISTING 200 A BUSBAR WITH 200 A MAIN BREAKER
 INTERCONNECTION METHOD: LOAD SIDE BREAKER
 ROOF TYPE: COMP SHINGLE

CONTRACTOR

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

CODE REFERENCE

AHJ: BROADWAY
 2020 NORTH CAROLINA ELECTRIC CODE
 2018 NORTH CAROLINA BUILDING CODE
 2018 NORTH CAROLINA RESIDENTIAL CODE

DESIGN CRITERIA

ASCE 7-16 WIND SPEED: 115 MPH
 EXPOSURE CATEGORY C
 GROUND SNOW LOAD: 15 PSF

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GENERAL NOTES

- CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND REVIEW ALL MANUFACTURER INSTALLATION DOCUMENTS PRIOR TO INITIATING CONSTRUCTION.
- ALL COMPONENTS SHALL BE NEW AND LISTED BY A RECOGNIZED ELECTRICAL TESTING LABORATORY AND LISTED FOR THEIR SPECIFIC APPLICATION.
- OUTDOOR EQUIPMENT SHALL BE NEMA 3R RATED OR BETTER.
- ACCESS TO ELECTRICAL COMPONENTS OVER 150 VOLTS TO GROUND SHALL BE RESTRICTED TO QUALIFIED PERSONNEL.
- 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.
- 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.
- 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.
- EXPOSED NON-CURRENT CARRYING METAL PARTS OF ELECTRICAL EQUIPMENT SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE NEC.
- CONFIRM LINE SIDE VOLTAGE AT THE ELECTRIC UTILITY SERVICE PRIOR TO CONNECTING INVERTER. VERIFY SERVICE VOLTAGE IS WITHIN INVERTER VOLTAGE OPERATIONAL RANGE.
- ELECTRICAL CONTRACTOR TO PROVIDE CONDUIT EXPANSION JOINTS AND ANCHOR CONDUIT RUNS AS REQUIRED PER CODE.
- 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.
- ALL ROOF PENETRATIONS MUST BE SEALED OR FLASHED.
- EQUIPMENT MAY BE SUBSTITUTED FOR SIMILAR EQUIPMENT BASED ON AVAILABILITY. SUBSTITUTED EQUIPMENT SHALL COMPLY WITH DESIGN CRITERIA.
- 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.
- 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 COMPLETED BY ENGINEERS IN THE USA

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)
IQ SYSTEM CONTROLLER	(IQ)
BACKUP INTERFACE	(BI)
BATTERY	(B)
PRODUCTION METER	(PM)
SUBPANEL	(SUB)
JUNCTION BOX	(JB)
FIRE PATHWAY	(FP)
SATELLITE DISH	(SD)
PROPERTY LINE	(PL)
ATTIC RUN CONDUIT	(ARC)
EXTERNAL CONDUIT	(EC)
CHIMNEY	(CH)
ROOF OBSTRUCTION (TYP.)	(RO)
ROOF VENT (TYP.)	(RV)

UTILITY: DUKE

MODULE SPEC AND ROOF INFO:

PV MODULE TYPE - MISSION SOLAR PERC 66 MSE395SX9R (395W)
 WEIGHT OF INDIVIDUAL PANEL - 48.50 LBS
 INDIVIDUAL SOLAR PANEL AREA - 21.64 SQ FT
 ROOF AREA - 2474 SQ FT

ROOF COVERAGE - 14.0%

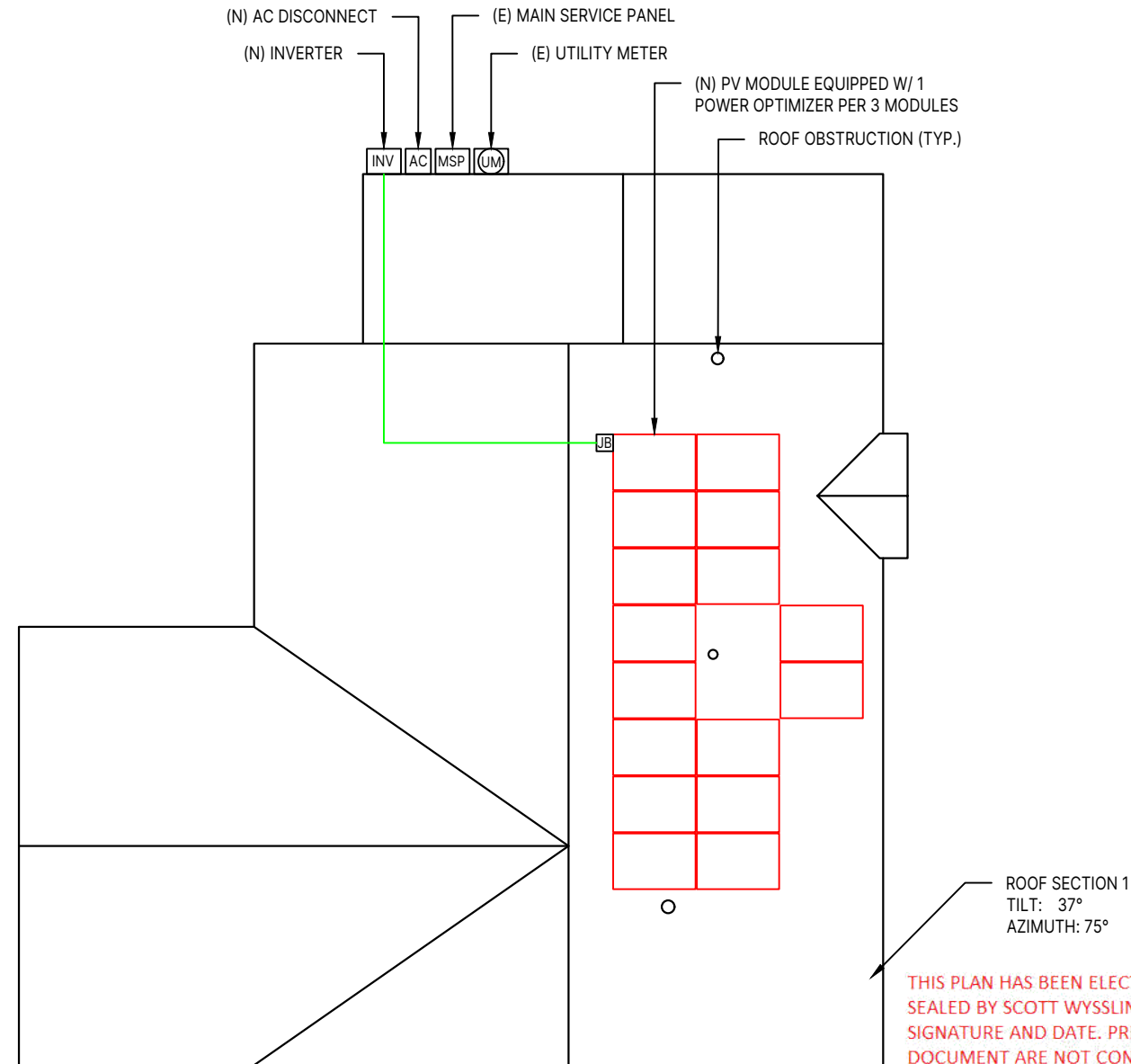
EQUIPMENT LIST:

(N) (16) MISSION SOLAR PERC 66 MSE395SX9R
 (N) (1) TESLA INVERTER 7.6KW
 (N) (6) TESLA OPTIMIZERS
 (1) TESLA BACKUP GATEWAY
 (N) (1) 60A UTILITY AC DISCONNECT
 IRONRIDGE AIRE RACKING WITH IRONRIDGE - HUG 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, LOCKABLE AND READILY ACCESSIBLE. TO BE WITHIN 10' OF THE UTILITY METER
6. 3/4" OR GREATER CONDUIT RUN (7/8" ABOVE ROOF SURFACE)
7. ROOF ACCESS POINTS 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 IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES OR SIGNS.

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



ROOF SECTION 1
 TILT: 37°
 AZIMUTH: 75°

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

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

DESIGN ENGINEER



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

NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT



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

LANE, MONICA
 591 OMAHA DRIVE
 BROADWAY, NC 27505
 6.320 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

SITE PLAN



Signed 2/06/2024

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

DATE:	2/5/2024
DRAWN BY:	FBM
REVIEWED BY:	AGO

PV-2

MOUNTING PLAN LEGEND

UTILITY METER	
MAIN SERVICE PANEL	
GAS METER	
AC DISCONNECT	
DC DISCONNECT	
AC COMBINER PANEL	
INVERTER	
IQ SYSTEM CONTROLLER	
BACKUP INTERFACE	
BATTERY	
PRODUCTION METER	
SUBPANEL	
JUNCTION BOX	
SATELLITE DISH	
PROPERTY LINE	
ATTIC RUN CONDUIT	
EXTERNAL CONDUIT	
RAIL	
MOUNT	
ROOF FRAMING	
CHIMNEY	
ROOF OBSTRUCTION (TYP.)	
ROOF VENT (TYP.)	

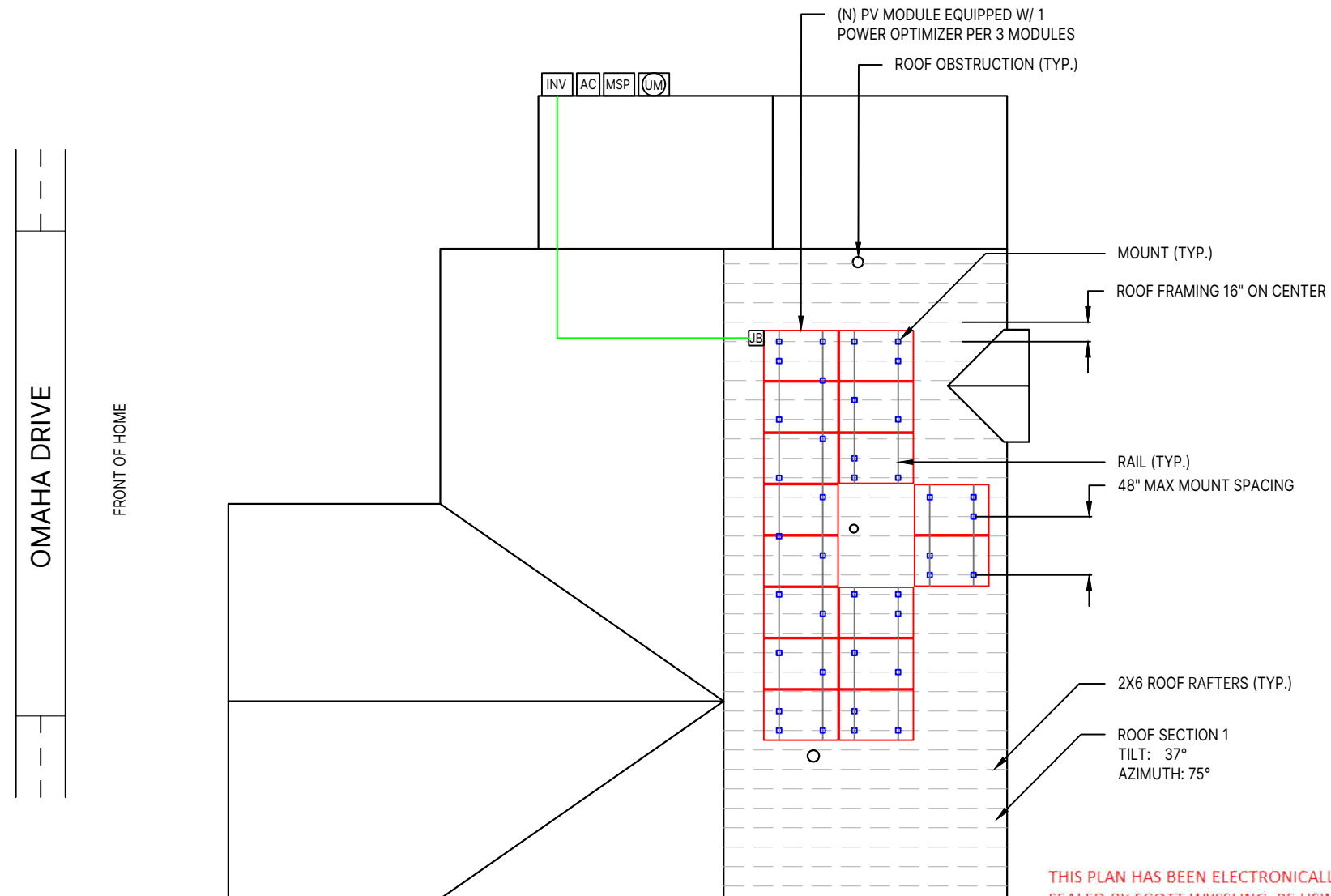
MOUNTING PLAN NOTES:

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. ACTUAL ROOF CONDITIONS AND ROOF FRAMING (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

MOUNT QUANTITY:

1. (42) IRONRIDGE - HUG ATTACHMENTS
DISTRIBUTED LOAD - (ARRAY) WEIGHT/AREA = 2.24 lbs/ ft²
TOTAL WEIGHT OF SYSTEM - 776 lbs

	TILT	AZIMUTH	# OF MODULES	ROOF FRAMING	FRAMING SPACING	ROOF TYPE	MAX MOUNT SPACING	MOUNT TYPE
ROOF SECTION 1	37°	75°	16	2X6 - RAFTERS	16"	COMP SHINGLE	48"	IRONRIDGE - HUG



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SOLAR COMPANY/CLIENT

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500
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LANE, MONICA
591 OMAHA DRIVE
BROADWAY, NC 27505
6.320 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

MOUNTING PLAN

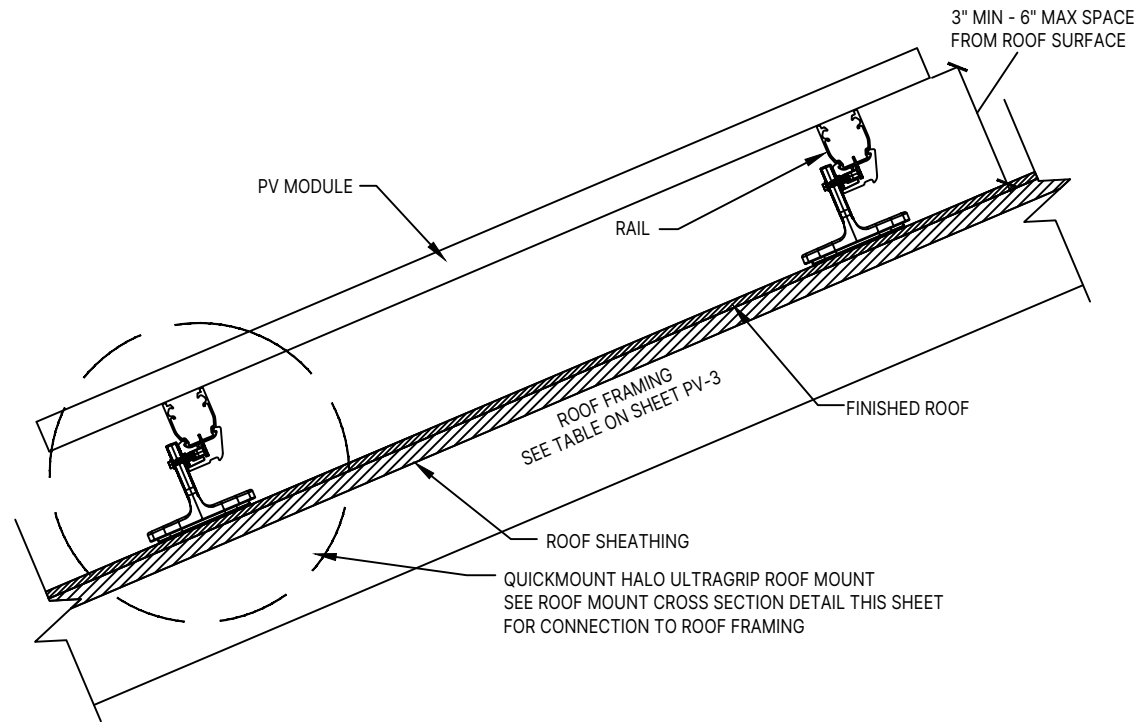


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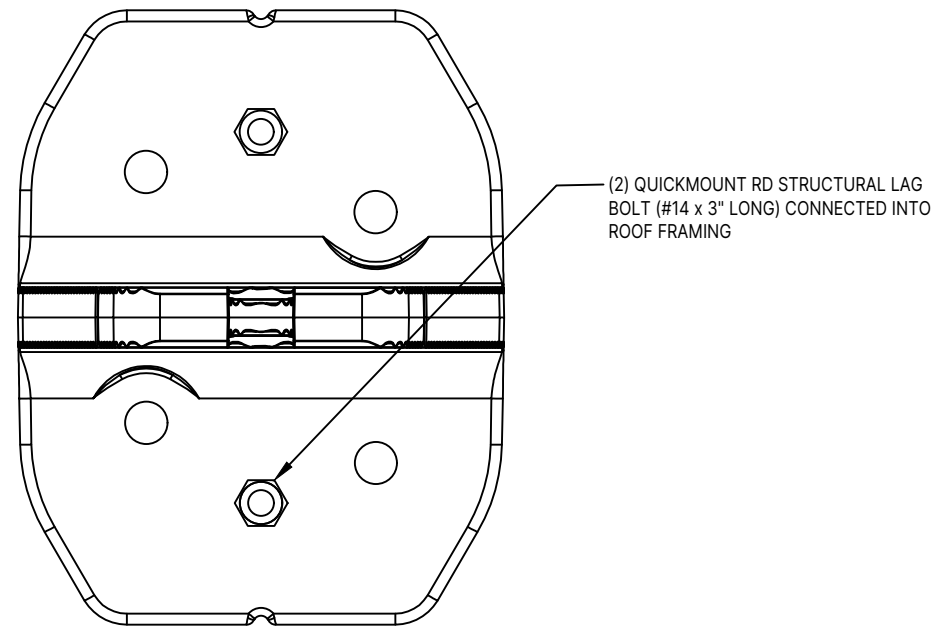
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REVIEWED BY: AGO

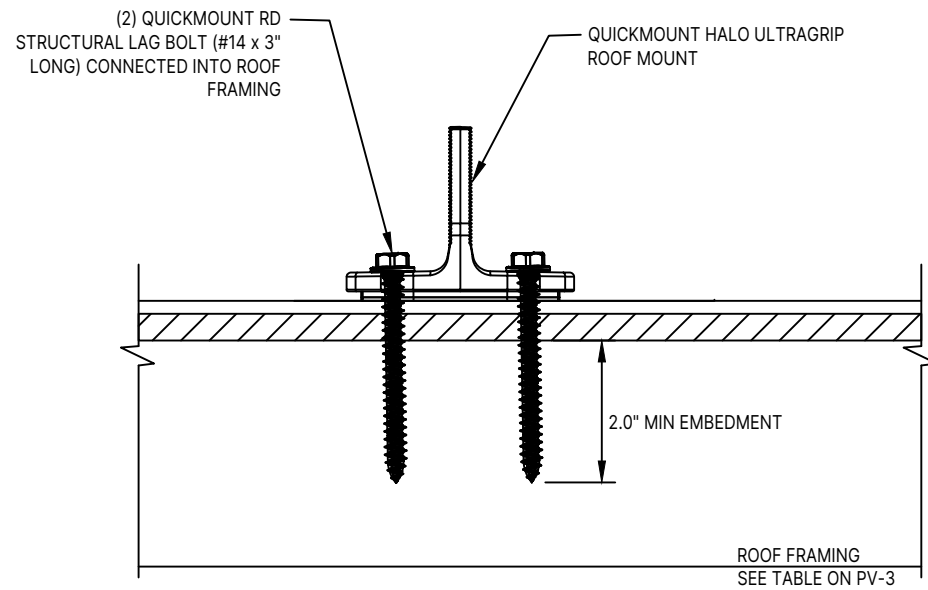
PV-3



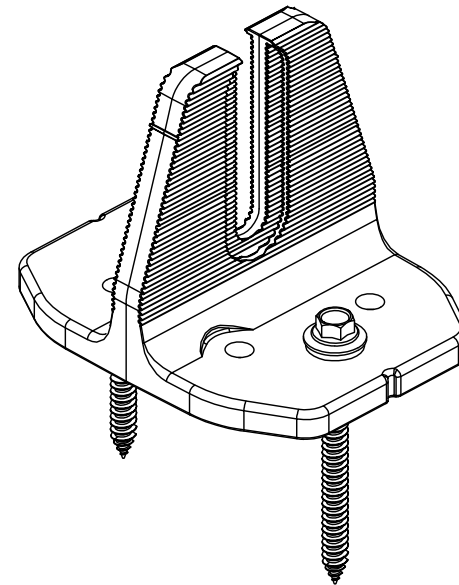
GENERAL ROOF MOUNT DETAIL
NTS



ROOF MOUNT PLAN VIEW DETAIL
NTS



ROOF MOUNT CROSS SECTION DETAIL
NTS



ROOF MOUNT
NTS

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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 COMPLETED BY ENGINEERS IN THE USA 

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**STRUCTURAL
DETAILS**



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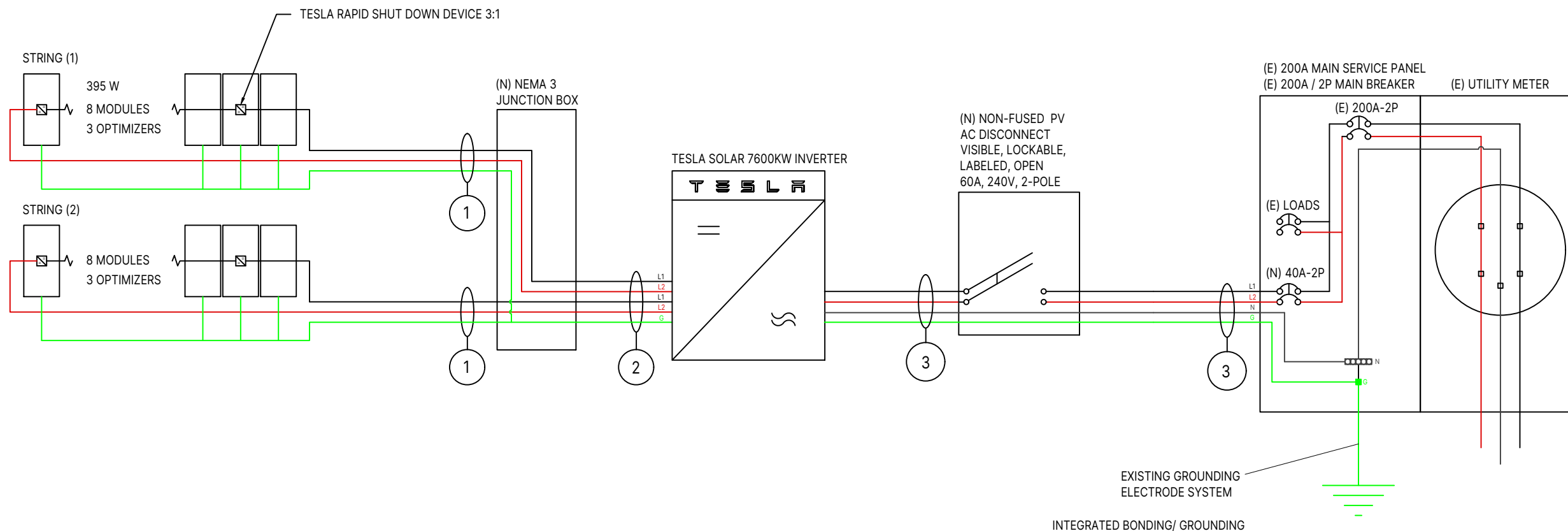
S-1

CONDUCTOR SCHEDULE

TAG ID	CONDUCTORS				GROUND		CONDUIT
	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

EQUIPMENT LIST:

- (N) (16) MISSION SOLAR PERC 66 MSE395SX9R
- (N) (1) TESLA INVERTER 7.6KW
- (N) (6) TESLA OPTIMIZERS
- (1) TESLA BACKUP GATEWAY
- (N) (1) 60A UTILITY AC DISCONNECT
- IRONRIDGE AIRE RACKING WITH IRONRIDGE - HUG MOUNTS



GENERAL NOTES

1. AC DISCONNECT SHALL BE VISIBLE-OPEN TYPE, LOCKABLE AND READILY ACCESSIBLE. TO BE WITHIN 10' OF THE UTILITY METER
2. 3/4" OR GREATER CONDUIT RUN (7/8" ABOVE ROOF SURFACE
3. GAS METER LOCATED IN PROXIMITY OF THE PV INSTALLATION, LOAD CENTER, AND/OR DISCONNECTS. DISCONNECTS SHALL BE LOCATED IN COMPLIANCE WITH UTILITY AND THE AHJ (AUTHORITY HAVING JURISDICTION).
4. PER NEC REQUIREMENTS GROUNDING CONDUCTORS SMALLER THAN #6 AWG SHALL BE PROTECTED IN A CONDUIT, RACEWAY, OR ARMORED PROTECTIVE SHEATHING (NEC 250.64).
5. THE WORKING CLEARANCES AROUND THE EXISTING ELECTRICAL EQUIPMENT AS WELL AS THE NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26.
6. ANY CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT. (NEC300.6 C1, 310.8 D).
7. ROOM FOR EQUIPMENT WITHIN 5 FEET FROM MSP.

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**ELECTRICAL
DIAGRAM**

DATE: 2/5/2024

DRAWN BY: FBM

REVIEWED BY: AGO

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

E-1

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)
UNDER MODULES, NOT IN CONDUIT	#10 AWG MAX CURRENT = 30A	#8 AWG MAX CURRENT = 50A
#10 AWG MAX CURRENT = 30A		
		TESLA INVERTER 7.6KW MAX OUTPUT = 32 A
TESLA INVERTER 7.6KW MAX CIRCUIT CURRENT	TESLA INVERTER 7.6KW MAX CIRCUIT CURRENT	32 A * 1.25 A = 40
15 A FOR CIRCUIT 2	15 A FOR CIRCUIT 2	RECOMMENDED OCPD = 40
15 A FOR CIRCUIT 2	15 A FOR CIRCUIT 2	

EQUIPMENT INFORMATION

MODULE	
MANUFACTURER/ MODEL	MISSION SOLAR PERC 66 MSE395SX9R
P _{MAX}	395 W
V _{OC}	45.18 V
V _M P	36.99 V
I _M P	10.68 A
I _{SC}	11.24 A
TEMPERATURE COEFFICIENT OF P _{MAX}	-0.367 %/°C
TEMPERATURE COEFFICIENT OF V _{OC}	-0.259 %/°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

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ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

E-2

PHOTOVOLTAIC AC DISCONNECT
 MAXIMUM AC OPERATING CURRENT: 32
 NOMINAL OPERATING AC VOLTAGE: 240

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

**WARNING DUAL POWER SOURCE
 SECOND SOURCE IS PHOTOVOLTAIC SYSTEM**

AT POINT OF INTERCONNECTION.
 [NEC 705.12(C), 690.59]

**MAIN PHOTOVOLTAIC
 SYSTEM DISCONNECT**

EACH PV SYSTEM DISCONNECTING MEANS
 SHALL PLAINLY INDICATE WHETHER IN THE
 OPEN (OFF) OR CLOSED (ON) POSITION AND
 BE PERMANENTLY MARKED [NEC. 690.13(B)]

**PHOTOVOLTAIC
 DC DISCONNECT**

AT EACH DC DISCONNECTING MEANS
 [NEC 690.13(B)]

**PHOTOVOLTAIC
 AC DISCONNECT**

AT EACH AC DISCONNECTING
 MEANS [NEC 690.13(B)]

**WARNING: PHOTOVOLTAIC
 POWER SOURCE**

AT EXPOSED RACEWAYS, CABLE TRAYS,
 AND OTHER WIRING METHODS; SPACED
 AT MAXIMUM 10FT SECTION OR WHERE
 SEPARATED BY ENCLOSURES, WALLS,
 PARTITIONS, CEILINGS, OR FLOORS
 [NEC 690.31(D)(2)]

**WARNING
 ELECTRICAL SHOCK HAZARD**
 DO NOT TOUCH TERMINALS
 TERMINALS ON BOTH LINE AND LOAD SIDES
 MAY BE ENERGIZED IN THE OPEN POSITION

AT BUILDING OR STRUCTURE MAIN
 DISCONNECTING MEANS. [NEC 690.12(E),
 NEC 690.13(B)]

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

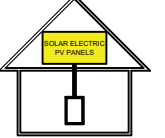
PERMANENT WARNING LABELS SHALL BE
 APPLIED TO DISTRIBUTION EQUIPMENT

WARNING
 INVERTER OUTPUT CONNECTION. DO NOT
 RELOCATE THIS OVERCURRENT DEVICE

A PERMANENT WARNING LABEL SHALL BE
 APPLIED TO THE DISTRIBUTION
 EQUIPMENT ADJACENT TO THE
 BACK-FED BREAKER FROM THE
 INVERTER.
 [NEC 705.12(B)(3)(2)]

**SOLAR PV SYSTEM EQUIPPED
 WITH RAPID SHUTDOWN**

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

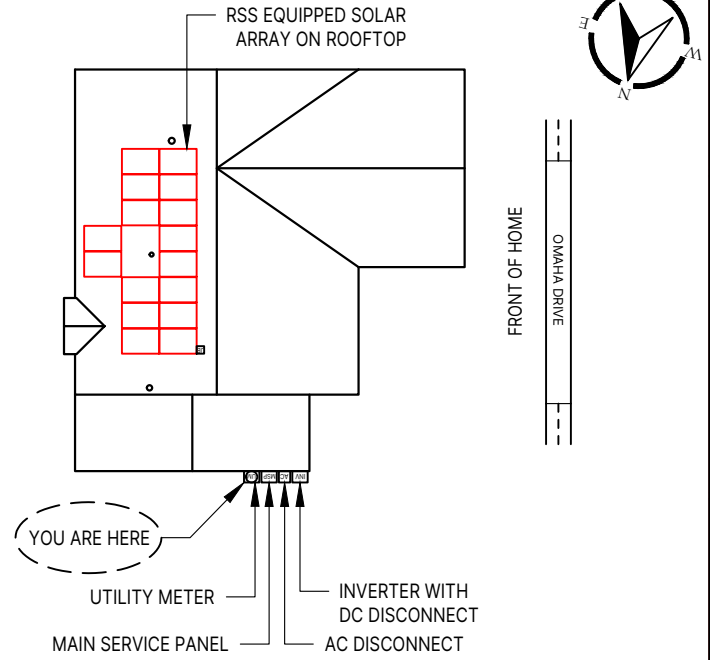


FOR PV SYSTEMS THAT SHUT DOWN THE
 ARRAY AND CONDUCTORS LEAVING THE
 ARRAY: THE TITLE "SOLAR PV SYSTEM IS
 EQUIPPED WITH RAPID SHUTDOWN"
 SHALL UTILIZE CAPITALIZED
 CHARACTERS WITH A MINIMUM HEIGHT
 OF 3/8 IN. IN BLACK ON YELLOW
 BACKGROUND, AND THE REMAINING
 CHARACTERS SHALL BE CAPITALIZED
 WITH A MINIMUM HEIGHT OF 3/16 IN. IN
 BLACK ON WHITE BACKGROUND. [NEC
 690.56(C)(1)(A)]

**RAPID SHUTDOWN
 SWITCH FOR SOLAR PV**

A RAPID SHUTDOWN SWITCH SHALL
 HAVE A LABEL LOCATED ON OR NO MORE
 THAN 3 FT FROM THE SWITCH THAT
 INCLUDES THIS WORDING. THE LABEL
 SHALL BE REFLECTIVE, WITH ALL
 LETTERS CAPITALIZED AND HAVING A
 MINIMUM HEIGHT OF 3/8 IN., IN WHITE ON
 RED BACKGROUND. [NEC 690.56(C)(2)]

**CAUTION
 MULTIPLE SOURCES OF POWER**



591 OMAHA DRIVE, BROADWAY, NORTH CAROLINA 27505

LABEL LOCATION: MSP CODE REF: NEC 2020 - 705.10

DESIGN ENGINEER

 76 N. MEADOWBROOK DRIVE
 ALPINE, UTAH 84004
 swysling@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

LANE, MONICA
 591 OMAHA DRIVE
 BROADWAY, NC 27505
 6.320 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1		
2		

**PV
 LABELS**

DATE:	2/5/2024
DRAWN BY:	FBM
REVIEWED BY:	AGO

LABELING NOTES:

1. LABELING REQUIREMENTS BASED ON THE 2020 NATIONAL ELECTRIC CODE, OSHA STANDARD 19010.145, ANSI Z535.
2. MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
3. LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED [NEC 110.21]
4. LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8", WHITE ON RED BACKGROUND; REFLECTIVE, AND PERMANENTLY AFFIXED [IFC 605.11.1.1]



DESIGN ENGINEER



**76 N. MEADOWBROOK DRIVE
ALPINE, UTAH 84004**

swysling@wysslingconsulting.com
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REVISIONS

NO	DATE:	COMMENTS
1		
2		

**SITE
PHOTOS**

DATE: 2/5/2024

DRAWN BY: FBM

REVIEWED BY: AGO

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

PV-4

MSE PERC 66

MISSION SOLAR ENERGY



395W

Class leading power output ±0 to +3%

Positive Power Tolerance



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

- 9 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
- 40mm frame



BAA Compliant for Government Projects

- Buy American Act
- American Recovery & Reinvestment Act

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

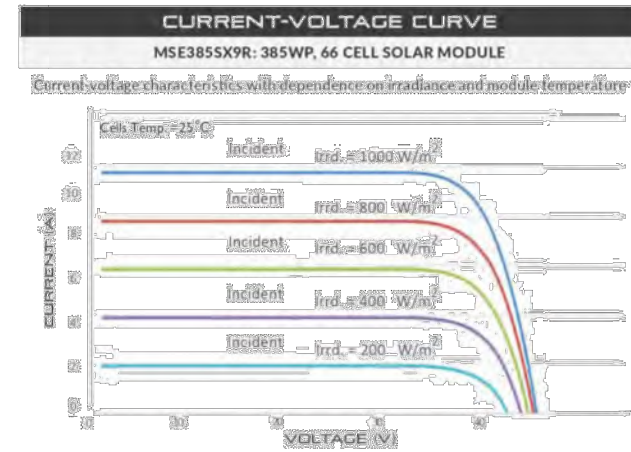
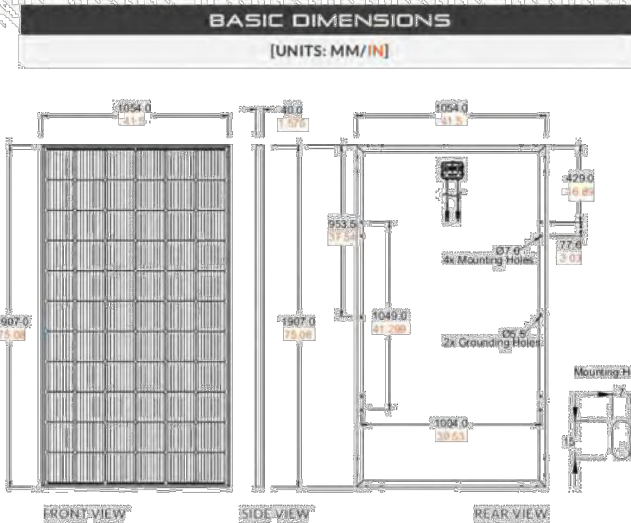


UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

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



Class Leading
390-400W



CERTIFICATIONS AND TESTS	
IEC	61215, 61730, 61701
UL	61730



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. 8303 S. New Braunfels Ave., San Antonio, Texas 78235

MSE PERC 66

ELECTRICAL SPECIFICATION	
PRODUCT TYPE	MSExxx5X9R (xxx = Pmax)
Power Output	P_{max} [W] 390 395 400
Module Efficiency	% 19.4 19.7 19.9
Tolerances	% 0/+3 0/+3 0/+3
Short Circuit Current	I_{sc} [A] 11.19 11.24 11.31
Open Circuit Voltage	V_{oc} [V] 45.04 45.18 45.33
Rated Current	I_{mp} [A] 10.63 10.68 10.79
Rated Voltage	V_{mp} [V] 36.65 36.99 37.07
Fuse Rating	A 20 20 20
System Voltage	V 1,000 1,000 1,000

TEMPERATURE COEFFICIENTS	
Normal Operating Cell Temperature (NOCT)	43.75°C (±3.7%)
Temperature Coefficient of P_{max}	-0.367%/°C
Temperature Coefficient of V_{oc}	-0.259%/°C
Temperature Coefficient of I_{sc}	0.033%/°C

OPERATING CONDITIONS	
Maximum System Voltage	1,000Vdc
Operating Temperature Range	-40°F to 185°F (-40°C to 85°C)
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

*Mission Solar Energy uses quality sourced materials that result in a Type 1 fire rating. Please note the Fire Classification is assigned for the UL standard PV system, which is tested, but not limited to the module, the type of mounting (rod, arch) and roof composition.

MECHANICAL DATA	
Solar Cells	P-type mono-crystalline silicon
Cell Orientation	66 cells (6x11)
Module Dimension	1,907mm x 1,054mm x 40mm
Weight	48.5 lbs (22 kg)
Front Glass	3.2mm tempered, low-iron, anti-reflective
Frame	40mm Anodized
Encapsulant	Ethylene vinyl acetate (EVA)
Junction Box	Protection class IP67 with 3 bypass diodes
Cable	1.2m, Wire 4mm ² (12AWG)
Connector	Stäubli PV-KBT4/6H-UR and PV-KST4/6H-UR, MC4, Renhe 05/8

SHIPPING INFORMATION			
Container Feet	Ship To	Pallet	Panel
53'	Most States	30	780
Double Stack	CA	26	676
Pallet [26 PANELS]			
Weight	Height	Width	Length
1,300 lbs (572 kg)	47.56 in (120.80 cm)	46 in (116.84 cm)	77 in (195.58 cm)

DESIGN ENGINEER



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REVISIONS

NO	DATE	COMMENTS
1		
2		

MODULE SPEC SHEET

DATE: 2/5/2024
DRAWN BY: FBM
REVIEWED BY: AGO

SPECS-1

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA



TESLA

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
- Designed to integrate with Tesla Powerwall and Tesla App
- 3.8 kW and 7.6 kW models available
- Wi-Fi, Ethernet, and cellular connectivity with easy over-the-air updates

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
- 2x the standard number of MPPTs for high production on complex roofs
- No neutral wire simplifies installation



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.

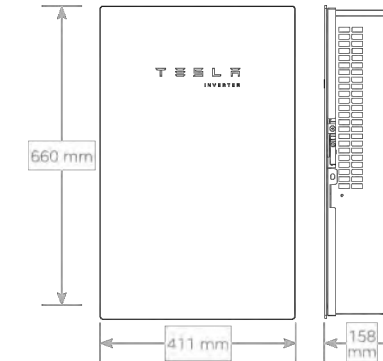
² Expected efficiency pending final CEC listing.

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)

TESLA

NA 2021-1-14

TESLA.COM/ENERGY

DESIGN ENGINEER



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REVISIONS

NO	DATE:	COMMENTS
1		
2		

INVERTER SPEC SHEET

DATE: 2/5/2024

DRAWN BY: FBM

REVIEWED BY: AGO

SPECS-2

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

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_{HP})	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

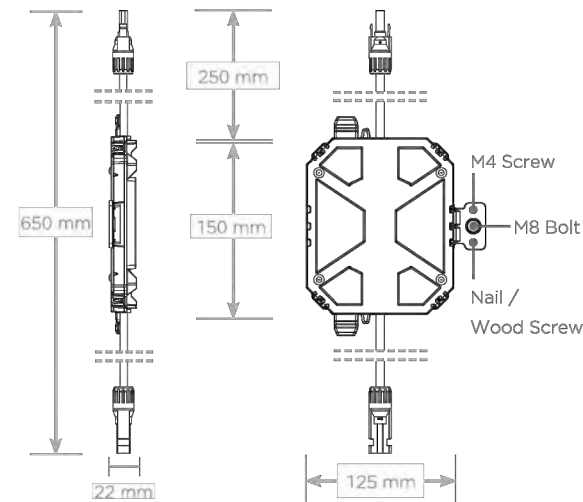
RSD Initiation Method	Loss of AC power
Compatible Equipment	Tesla Solar Inverter

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

DESIGN ENGINEER



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NO	DATE:	COMMENTS
1		
2		

OPTIMIZER SPEC SHEET

DATE:	2/5/2024
DRAWN BY:	FBM
REVIEWED BY:	AGO

SPECS-3



Aire® Flush Mount System

Datasheet



Breathe easy with accelerated installations.

The Aire® racking system has been carefully engineered to streamline every part of the installation process. We've eliminated tiresome hassles, so that you get off the roof and on to your next project faster than ever.

Aire® retains the strength and reliability that IronRidge installers depend on. It also takes wire management to the next level with the first (and only) NEC-compliant rail, formally approved and listed as a cable tray.



Strength Tested

All components have been evaluated for superior structural performance.



PE Certified

Pre-stamped engineering letters are available online for most states.



Class A Fire Rating

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



Approved Cable Tray

Open channel listed to NEMA VE 1, certified to hold PV and DG cables.



UL 2703 Listed System

Entire system and components meet the latest effective UL 2703 standards.



25-Year Warranty

Products are guaranteed to arrive without any impairing defects.

One-Tool System - 1/2" Hex-Head Components

Datasheet

Rails

Aire® A1 Rail



The lighter, open Aire® rail for standard conditions.

- 6' spanning capability
- Wire management tray
- Mill or anodized black

Aire® A2 Rail



The tougher, open Aire® rail for higher load capacity.

- 8' spanning capability
- Wire management tray
- Mill or anodized black

Aire® Rail Ties



Structurally connect and bond Aire™ Rails together.

- Reinstallable, up to 5x
- Internal splice design
- No more splice rules

Aire® Dock



Connects Aire® Rails to attachments with ease.

- Clicks on, slides easily
- Drops into open slots
- Anodized assembly

Clamps & Grounding

Aire® Lock Mids



Securely bond between modules to Aire® Rails.

- Fits 30-40mm modules
- Utilizes UFO® design
- Minimal 1/2" gap

Aire® Lock Ends



Securely bond modules to Aire® Rails along ends.

- Fits 30-40mm modules
- Easy rail engagement
- Clean aesthetics

Aire® Lock Stealth®



Securely bonds modules to rail ends, entirely hidden.

- Angled for easy install
- Robust tether leash
- Fits most modules

Aire® Lug



Bonds Aire® Rails to grounding conductors.

- Simplified with single bolt
- Low-profile form factor
- Works with 10-6 AWG

Accessories

Aire® Caps



Block entry and provide a finished look to Aire® Rails.

- Stay secure on rail ends
- Symmetrical, with drain
- Cover rough-cut ends

Aire® Clip



Keeps wiring contained in open Aire® Rail channels.

- No module interference
- Simple press-in design
- Slot for easy removal

Aire® MLPE Mount



Securely bonds MLPE and accessories to Aire® Rails.

- Glove-friendly installation
- Lays flush in rail channel
- Low profile form factor

Aire® All Tile Hook



Attaches rails to tile roofs, with Aire® Dock included.

- Works on flat, S, & W tiles
- Single-socket installation
- Optional deck flashing

Resources



Design Assistant

Quickly go from rough layout to fully engineered system.

Go to [IronRidge.com/design](https://www.ironridge.com/design)



Approved for FL Hurricane Zones

Aire® has Florida Product Approval. Additional details can be found on the Florida Building Code website.

Learn More at bit.ly/florida-aire

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DESIGN ENGINEER



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2		

RAIL SPEC SHEET

DATE: 2/5/2024

DRAWN BY: FBM

REVIEWED BY: AGO

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

SPECS-4



Tech Brief

QuickMount® HUG

The Respect Your Roof Deserves

When integrating with a home, solar attachments must be dependable for the lifetime of the rooftop. Due to recent innovations, many asphalt shingles have bonded courses. A mount that protects without the need to pry shingles can really speed things up.

Halo UltraGrip®(HUG®) is here to respect the roof. Its Halo is a cast-aluminum barrier that encases the UltraGrip, our industrial-grade, foam-and-mastic seal. This allows HUG to accelerate the installation process and provide the utmost in waterproofing protection. Give your roof a HUG.®



Multi-Tiered Waterproofing
HUG® utilizes a multi-tiered stack of components to provide revolutionary waterproofing protection. The Halo cast-aluminum, raised-perimeter foundation surrounds the UltraGrip base—a foam-backed mastic seal combination that prevents water intrusion by adhering and sealing with the shingle surface.

Halo UltraGrip™ is part of the QuickMount® product line.



UltraGrip® Seal Technology
HUG UltraGrip utilizes a state-of-the-art seal design that uses a unique, foam-and-mastic combination. The foam-backed adhesive provides an entirely new flashing system that conforms and adheres to every nook and cranny of composition shingles, filling gaps and shingle step-downs (up to 1/8" in height).



Rafter & Deck Mounting Options
Mount HUG® to the roof rafters, the roof deck, or both with our custom-engineered RD (rafter-or-deck) Structural Screw. The RD Structural Screw anchors HUG to the roof with an EPDM sealing washer, completing the stack of waterproofing barriers. See backside for more installation information.

ETL Intertek Triple Rated & Certified to Respect the Roof™
UL 2703, 441 (27)
TAS 100(A)-95

Tech Brief

Adaptive, Rafter-Friendly Installation



Hit the rafter? Good to go!
When you find a rafter, you can move on. Only 2 RD Structural Screws are needed.

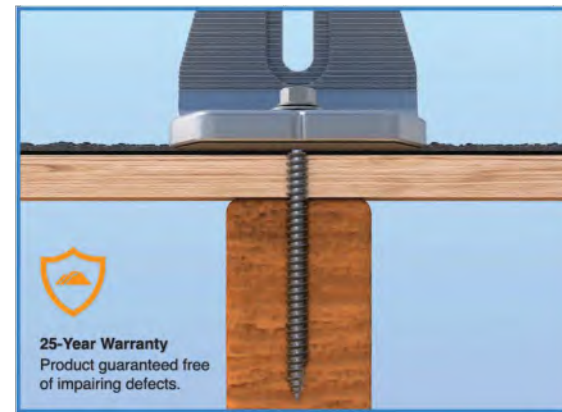


Miss the rafter? Try it again.
Place another screw to the left or right. If rafter is found, install 3rd and final screw.



Still no luck? Install the rest.
If more than 3 screws miss the rafter, secure six screws to deck mount it.

Trusted Strength & Less Hassle



25-Year Warranty
Product guaranteed free of impairing defects.

Structural capacities of HUG® were reviewed in many load directions, with racking rail running cross-slope or up-slope in relation to roof pitch.

For further details, see the HUG certification letters for attaching to rafters and decking.

IronRidge designed the HUG, in combination with the RD Structural Screw to streamline installs, which means the following:

- No prying shingles
- No roof nail interference
- No pilot holes necessary
- No sealant (in most cases)
- No butyl shims needed

Attachment Loading

The rafter-mounted HUG has been tested and rated to support 1004 (lbs) of uplift and 368 (lbs) of lateral load.

Structural Design

Parts are designed and certified for compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings

HUG passed both the UL 441 Section 27 "Rain Test" and TAS 100(A)-95 "Wind Driven Rain Test" by Intertek.

UL 2703 System

Systems conform to UL 2703 mechanical and bonding requirements. See Flush Mount Manual for more info.

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DESIGN ENGINEER



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REVISIONS

NO	DATE:	COMMENTS
1		
2		

MOUNTING SPEC SHEET

DATE: 2/5/2024
DRAWN BY: FBM
REVIEWED BY: AGO

SPECS-5

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA