WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE
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February 13, 2024
Revised March 18, 2024

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

Scott Wyssling, PE

Digitally signed by Scott Wyssling, PE
DN: C=US, S=Utah, L=Alpine, O=Wyssling Consulting, OU=Owner, CN="Scott Wyssling, PE", E=swyssling@wysslingconsulting.com
Reason: I am the author of this document
Location: your signing location here
Date: 2024.03.18 18:18:25-06'00'
Foxit PDF Editor Version: 11.2.7

Re: Engineering Services
Wheeler Residence
5995 Rosser Pittman Road, Sanford, NC
10.665 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 at 16" on center. All truss members are constructed of 2x4 dimensional lumber.
Roof Material:	Composite Asphalt Shingles
Roof Slope:	42 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 lag bolt 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 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 #14 diameter lag bolt 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

Signed 3/18/2024

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

NEW PV ROOFTOP SYSTEM DESIGN

27 MODULES - 10.530 KW DC & 7.600 KW AC SYSTEM SIZE

MICHAEL WHEELER RESIDENCE - 5995 ROSSER PITTMAN ROAD, SANFORD, NORTH CAROLINA 27332

AERIAL MAP

VICINITY MAP

SHEET INDEX

SCOPE OF WORK

INSTALL 10.530 KW DC ROOF MOUNTED
PV SYSTEM UTILIZING
(27) TRINASOLAR TSM-390DE09.05
(1) TESLA INVERTER 7.6KW
(9) TESLA OPTIMIZERS
(1) 60A UTILITY AC DISCONNECT
IRONRIDGE AIRE RACKING WITH
IRONRIDGE - HUG MOUNTS
EXISTING 225 A BUSBAR WITH 200 A MAIN BREAKER
INTERCONNECTION METHOD: LOAD SIDE BREAKER
ROOF TYPE: COMP SHINGLE
NUMBER OF STORIES: 2

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.

CONTRACTOR

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

CODE REFERENCE

AHJ: HARNETT COUNTY

2017 NORTH CAROLINA ELECTRIC CODE
2018 NORTH CAROLINA BUILDING CODE
2018 NORTH CAROLINA RESIDENTIAL CODE

DESIGN CRITERIA

ASCE 7-10 WIND SPEED: 115 MPH
EXPOSURE CATEGORY C
GROUND SNOW LOAD: 15 PSF

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NORTH CAROLINA COA NO. P-2308

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CHARLOTTE, NC 28208

WHEELER, MICHAEL
5995 ROSSER PITTMAN ROAD
SANFORD, NC 27332
10.530 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1	3-18-24	ASBUILT
2		

COVER SHEET

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

Signed 3/18/2024

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

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

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
IQ SYSTEM CONTROLLER	IQ
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

MODULE SPEC AND ROOF INFO:

PV MODULE TYPE - TRINASOLAR TSM-390DE09.05 (390W)
WEIGHT OF INDIVIDUAL PANEL - 46.30 LBS
INDIVIDUAL SOLAR PANEL AREA - 20.69 SQ FT
ROOF AREA - 1754 SQ FT

ROOF COVERAGE - 31.9%

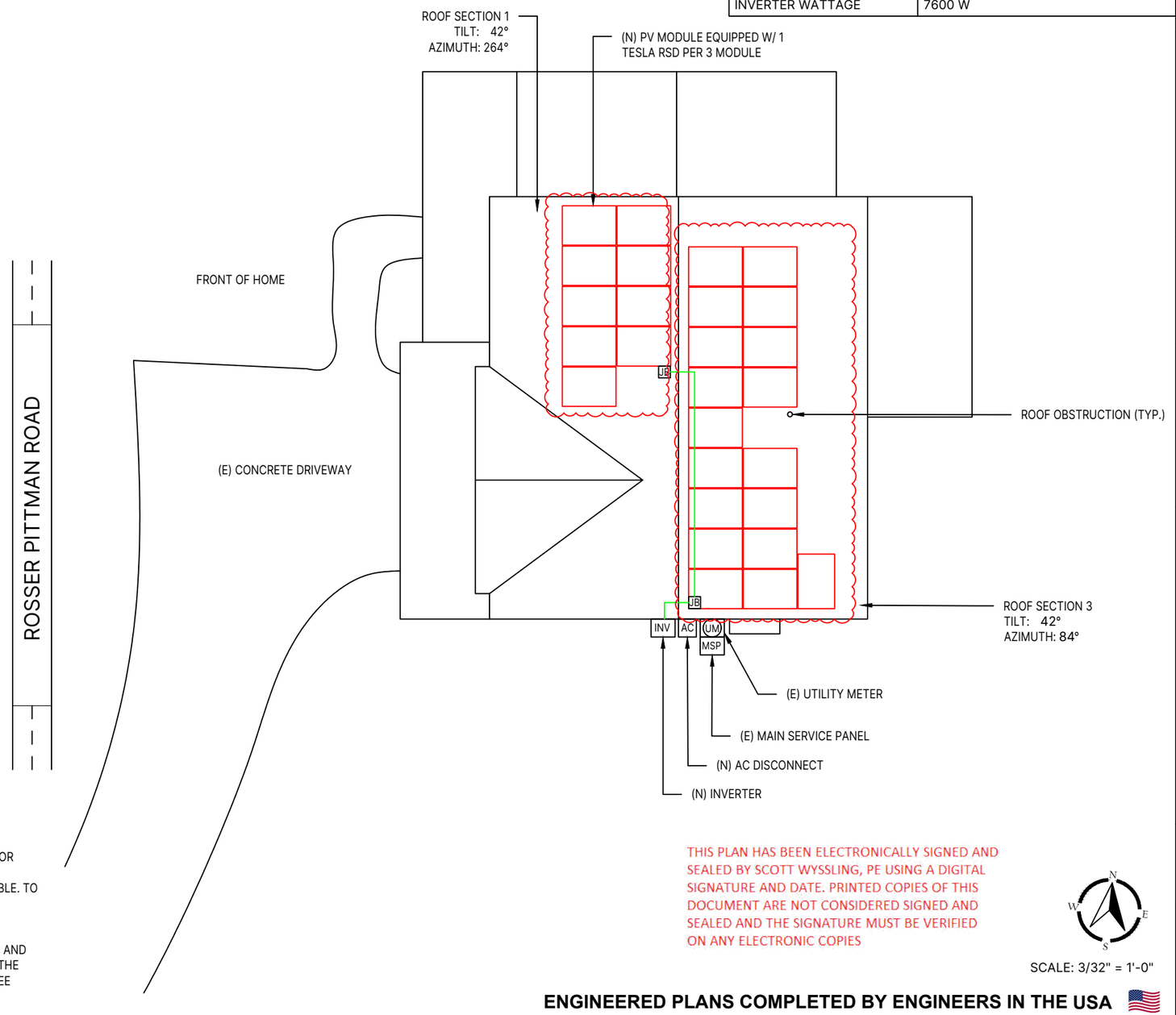
EQUIPMENT LIST:

(N) (27) TRINASOLAR TSM-390DE09.05
(N) (1) TESLA INVERTER 7.6KW
(N) (9) TESLA OPTIMIZERS
(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, LOCAKABLE 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



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

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DESIGN ENGINEER

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SANFORD, NC 27332
10.530 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1	3-18-24	ASBUILT
2		

SITE PLAN

NORTH CAROLINA PROFESSIONAL SEAL 040546 ENGINEER SCOTT E. WYSSLING

Signed 3/18/2024

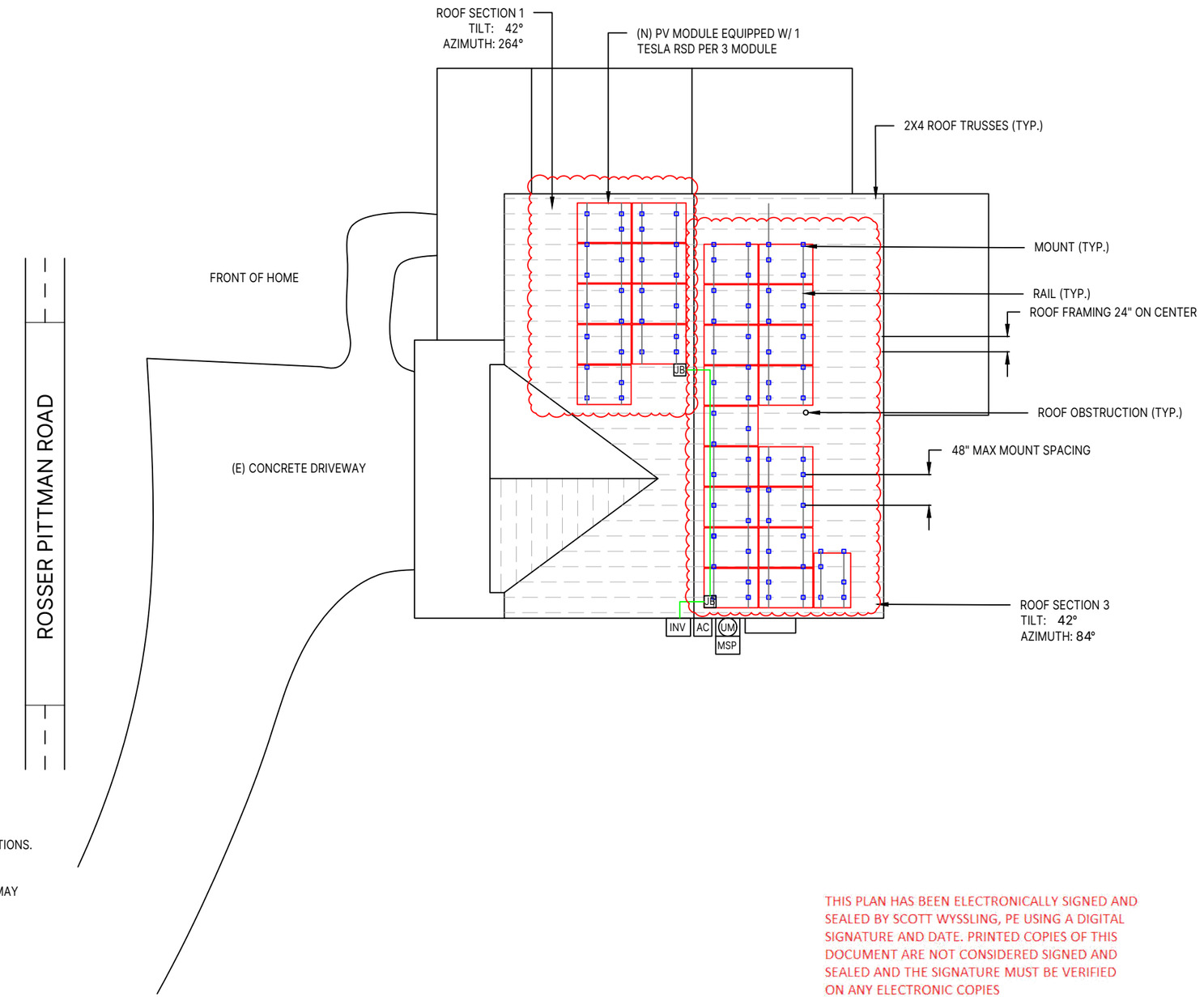
SCOTT E. WYSSLING, P.E.
NORTH CAROLINA LICENSE NO. 46546

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

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
IQ SYSTEM CONTROLLER	IQ
BACKUP INTERFACE	BI
BATTERY	B
PRODUCTION METER	PM
SUBPANEL	SUB
JUNCTION BOX	JB
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. (86)IRONRIDGE - HUG ATTACHMENTS
DISTRIBUTED LOAD - (ARRAY) WEIGHT/AREA = 2.24 lbs/ ft²
TOTAL WEIGHT OF SYSTEM - 1250.1 lbs

	TILT	AZIMUTH	# OF MODULES	ROOF FRAMING	FRAMING SPACING	ROOF TYPE	MAX MOUNT SPACING	MOUNT TYPE
ROOF SECTION 1	42°	264°	9	2X4 - TRUSSES	24	COMP SHINGLE	48"	IRONRIDGE - HUG
ROOF SECTION 2	42°	84°	18	2X4 - TRUSSES	24	COMP SHINGLE	48"	IRONRIDGE - HUG

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MOUNTING PLAN

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

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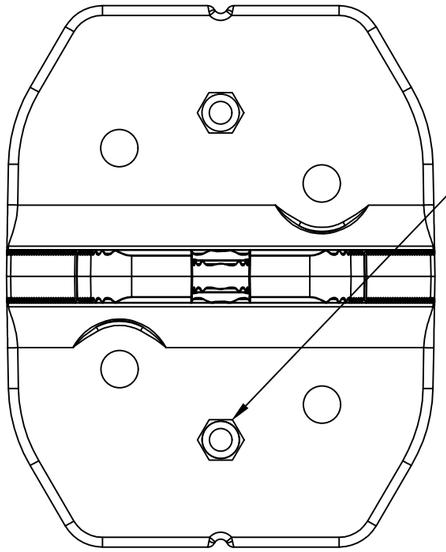
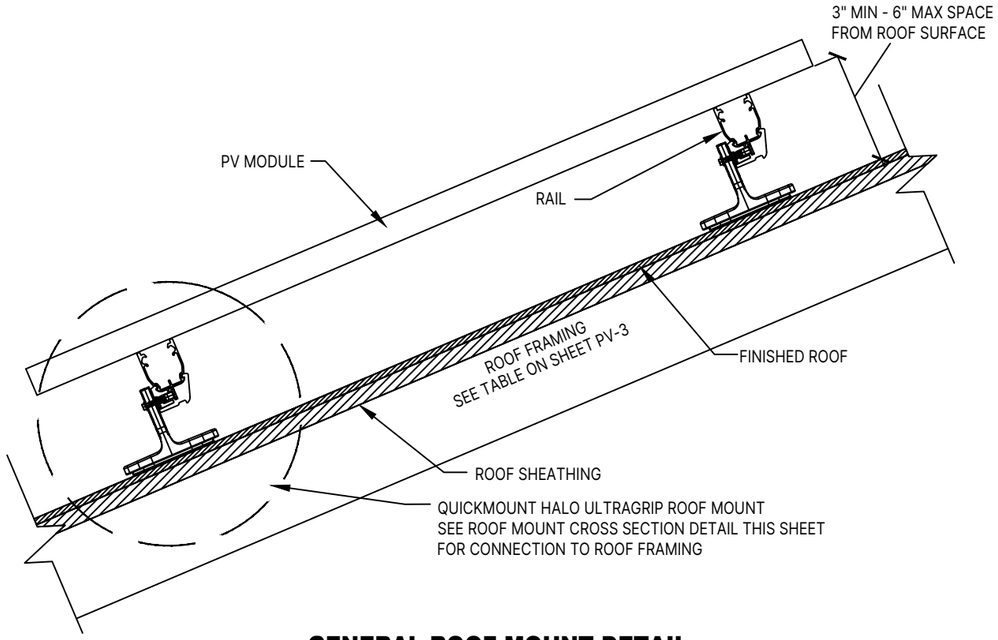
DRAWN BY:	JTV
REVIEWED BY:	AGO

PV-3



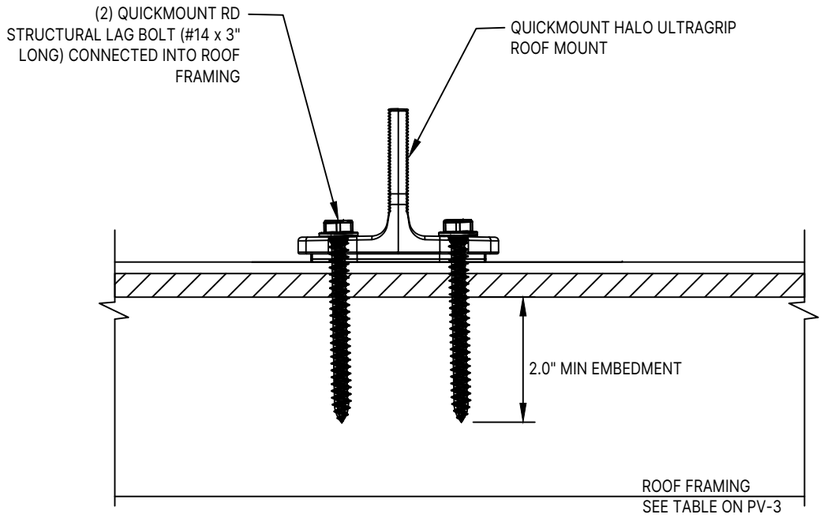
ROOF MOUNT PLAN VIEW DETAIL

NTS



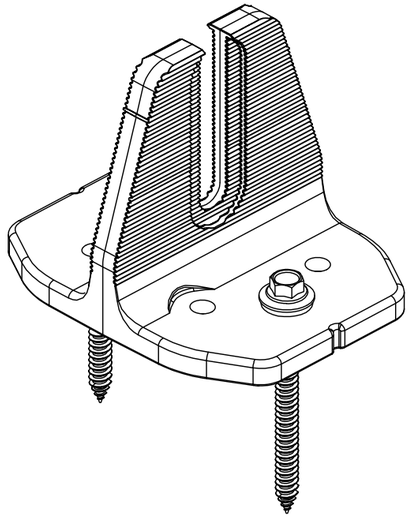
GENERAL ROOF MOUNT DETAIL

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.

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STRUCTURAL DETAILS

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

Signed 3/18/2024

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NORTH CAROLINA LICENSE NO. 46546

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

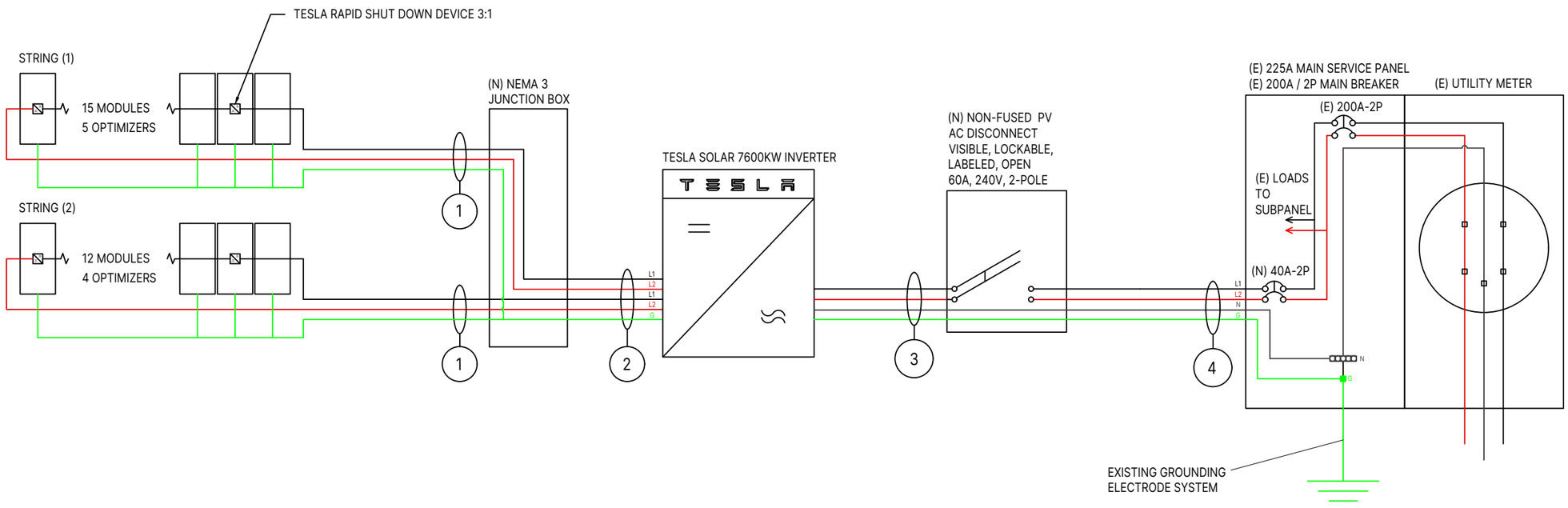
S-1

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:

(N) (27) TRINASOLAR TSM-390DE09.05
(N) (1) TESLA INVERTER 7.6KW
(N) (27) 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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2		

ELECTRICAL DIAGRAM

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

E-1

INTERCONNECTION CALCULATIONS

ITEM	UNIT	PANEL
BUS RATING	AMPS	225A
MAIN OCPD	AMPS	200A
ALLOWED PV PER NEC	AMPS	70A

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 OUTPUT = 32 A	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	32 A * 1.25 A = 40
15 A FOR CIRCUIT 2	15 A FOR CIRCUIT 2	RECOMMENDED OCPD = 40	RECOMMENDED OCPD = 40
15 A FOR CIRCUIT 2	15 A FOR CIRCUIT 2		

EQUIPMENT INFORMATION

MODULE	
MANUFACTURER/ MODEL	TRINASOLAR TSM-390DE09.05
PMAX	390 W
VOC	40.8 V
VMP	33.8 V
IMP	11.54 A
ISC	12.14 A
TEMPERATURE COOEFFICIENT OF PMAX	-0.34 %/°C
TEMPERATURE COEFFICIENT OF VOC	-0.25 %/°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 COMPLETED BY ENGINEERS IN THE USA

DESIGN ENGINEER

WYSSLING CONSULTING

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

WHEELER, MICHAEL
5995 ROSSER PITTMAN ROAD
SANFORD, NC 27332
10.530 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1	3-18-24	ASBUILT
2		

EQUIPMENT INFORMATION

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

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
600 VDC

MAXIMUM CIRCUIT CURRENT
12.0 AMPS

MAXIMUM RATED
DC TO DC CONVERTER OUTPUT
AMPS

AT EACH DC DISCONNECTING MEANS [NEC 690.53]

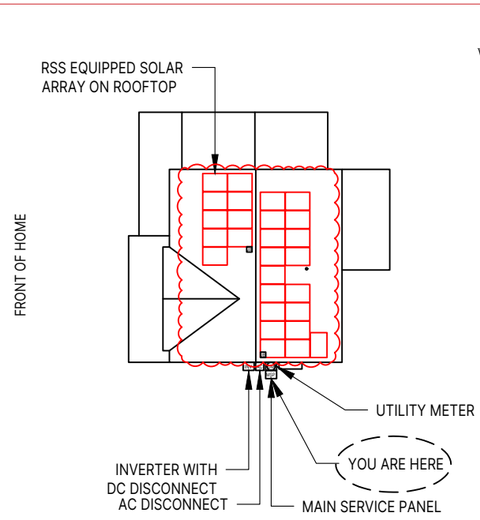
⚠ WARNING

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)

CAUTION

MULTIPLE SOURCES OF POWER



5995 ROSSER PITTMAN ROAD, SANFORD, NORTH CAROLINA 27332

LABEL LOCATION: MSP CODE REF: NEC 2017 - 705.10

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]

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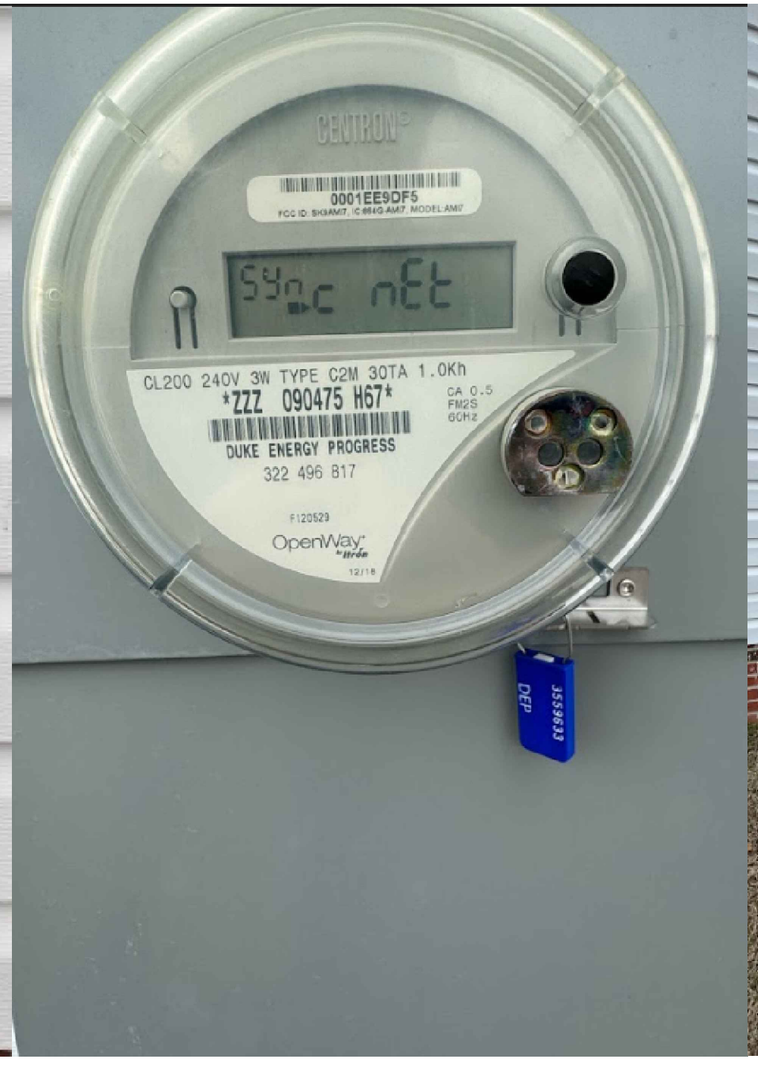
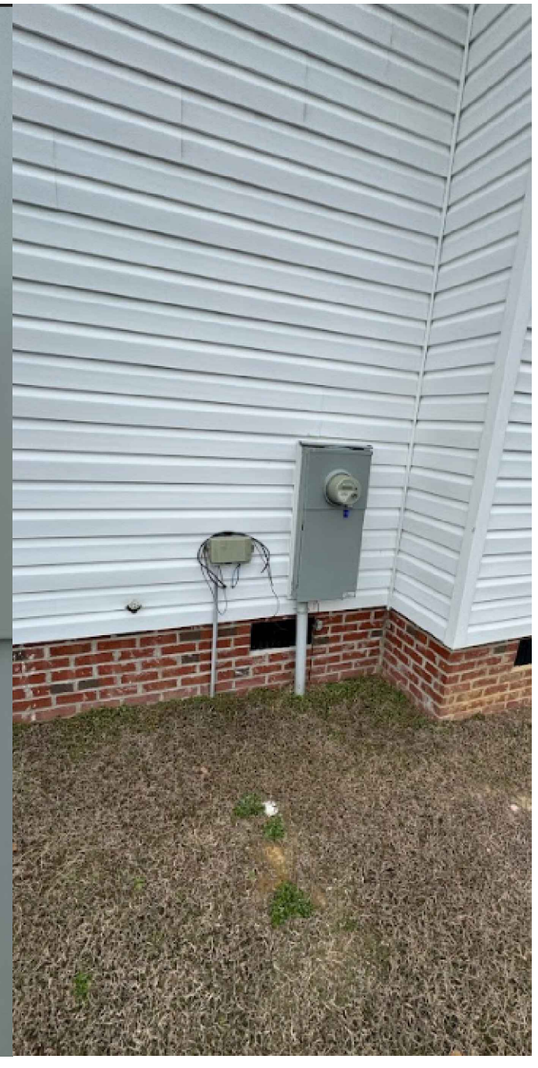
PV LABELS

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

E-3





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SITE PHOTOS

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

PV-4

Vertex S

BACKSHEET MONOCRYSTALLINE MODULE

PRODUCT: TSM-DE09.05
POWER RANGE: 380-395 W

395 W+	0/+5 W	20.5 %
MAXIMUM POWER OUTPUT	POSITIVE POWER TOLERANCE	MAXIMUM EFFICIENCY

Outstanding Visual Appearance
- Designed with aesthetics in mind
- Ultra-thin, virtually invisible busbars
- Excellent cell color control by machine selection

Small in size, big on power
- Generates up to 395 W, 20.5 % module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping, lower series resistance, improved current collection and enhanced reliability
- Excellent low light performance (IAM) with cell process and module material optimization

Universal solution for residential and C&I rooftops
- Designed for compatibility with existing mainstream inverters, optimizers and mounting systems
- Perfect size and low weight for easy handling. Optimized transportation cost
- Reduces installation cost with higher power bin and efficiency
- Flexible installation solutions for system deployment

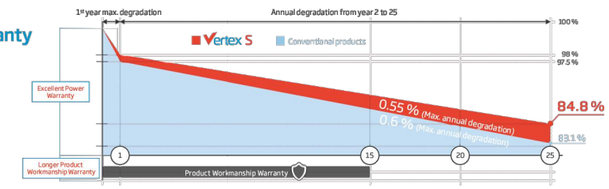
High Reliability
- 6,000 Pa snow load (test load)
- 4,000 Pa wind load (test load)

Extended Vertex S Warranty

2 %
1st year max. degradation

0.55 %
Max. annual degradation from year 2 to 25

15 Years
Product Workmanship Warranty



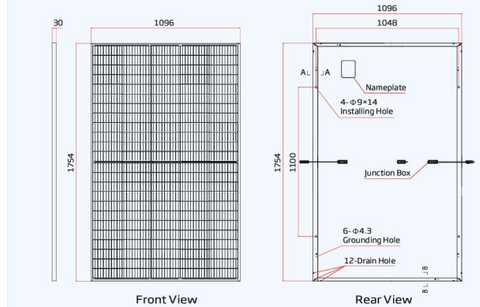
Comprehensive Product and System Certificates

IEC61215/IEC61730/IEC61701/IEC62716
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
ISO45001: Occupational Health and Safety Management System

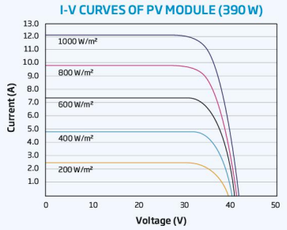
Trinasolar

Vertex S

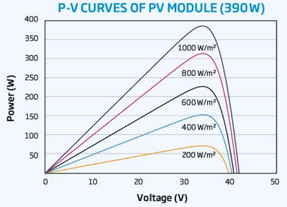
DIMENSIONS OF PV MODULE (mm)



I-V CURVES OF PV MODULE (390 W)



P-V CURVES OF PV MODULE (390 W)



ELECTRICAL DATA (STC)

	TSM-380 DE09.05	TSM-385 DE09.05	TSM-390 DE09.05	TSM-395 DE09.05
Peak Power Watts-PMAX (Wp)*	380	385	390	395
Power Tolerance-PMAX (W)	0/+5	0/+5	0/+5	0/+5
Maximum Power Voltage-VMPP (V)	33.4	33.6	33.8	34.0
Maximum Power Current-IMPP (A)	11.38	11.46	11.54	11.62
Open Circuit Voltage-Voc (V)	40.4	40.6	40.8	41.0
Short Circuit Current-Isc (A)	12.00	12.07	12.14	12.21
Module Efficiency η m (%)	19.8	20.0	20.3	20.5

STC: Irradiance 1,000 W/m², Cell Temperature 25 °C, Air Mass AM1.5 *Measuring tolerance: ±3%

ELECTRICAL DATA (NOCT)

	TSM-380 DE09.05	TSM-385 DE09.05	TSM-390 DE09.05	TSM-395 DE09.05
Maximum Power-PMAX (Wp)	286	290	294	298
Maximum Power Voltage-VMPP (V)	31.4	31.6	31.8	31.9
Maximum Power Current-IMPP (A)	9.12	9.18	9.24	9.32
Open Circuit Voltage-Voc (V)	38.0	38.2	38.4	38.6
Short Circuit Current-Isc (A)	9.67	9.73	9.78	9.84

NOCT: Irradiance at 800 W/m², Ambient Temperature 20 °C, Wind Speed 1 m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	120 cells
Module Dimensions	1754×1096×30 mm
Weight	21.0 kg
Glass	3.2 mm, High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Backsheet	Black-White
Frame	30 mm Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0 mm² Landscape: 1100/1100 mm Portrait: 280/280 mm*
Connector	TS4/MC4 EVO2*

*Special order only

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43 °C (±2 K)
Temperature Coefficient of PMAX	-0.34 %/K
Temperature Coefficient of Voc	-0.25 %/K
Temperature Coefficient of Isc	0.04 %/K

MAXIMUM RATINGS

Operational Temperature	-40 to +85 °C
Maximum System Voltage	1500 V DC (IEC)
Max Series Fuse Rating	20 A

WARRANTY

15 Year product workmanship warranty
25 Year power warranty
2% First year degradation
0.55% Annual power degradation
(Please refer to the applicable limited warranty for details)

PACKAGING CONFIGURATION

Modules per box	36 pieces
Modules per 40' container	936 pieces

Trinasolar

Version number: TSM_EN_2021_B

www.trinasolar.com

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1	3-18-24	ASBUILT
2		

MODULE SPEC SHEET

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

SPECS-1

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

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 standard 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	

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.

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.

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

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REVIEWED BY:	SCP

SPECS-2

SOLAR SHUTDOWN DEVICE

The Tesla Solar Shutdown Device is a Mid-Circuit Interrupter (MCI) and is part of the PV system rapid shutdown (RSD) function in accordance with Article 690 of the applicable NEC. When paired with Powerwall+, solar array shutdown is initiated by pushing the System Shutdown Switch if one is present.

ELECTRICAL SPECIFICATIONS

Model Number	MCI-1
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

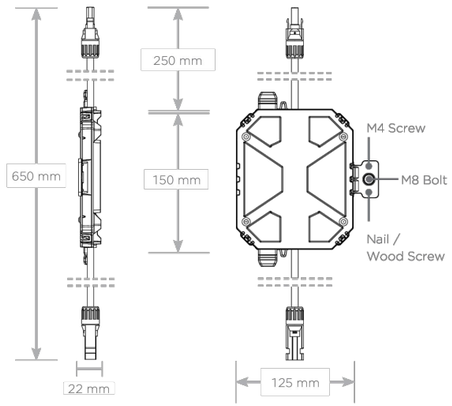
Certifications	UL 1741 PVRSE, UL 3741, PVRSA (Photovoltaic Rapid Shutdown Array)
RSD Initiation Method	External System Shutdown Switch
Compatible Equipment	*See Compatibility Table below*

ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-30°C to 60°C (-22°F to 140°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



UL 3741 PV HAZARD CONTROL (AND PVRSA) COMPATIBILITY

Tesla Solar Roof and Tesla/Zep ZS Arrays using the following modules are certified to UL 3741 and UL 1741 PVRSA when installed with the Powerwall+ and Solar Shutdown Devices. See Powerwall+ Rapid Shutdown: Module Selection Based on PV Hazard Control System Listing for guidance on installing Powerwall+ and Solar Shutdown Devices with other modules.

Brand	Model	Required Solar Shutdown Devices
Tesla	Solar Roof V3	1 Solar Shutdown Device per 10 modules
Tesla	Tesla TxxxS (where xxx = 405 to 450 W, increments of 5) or Tesla TxxxH (where xxx = 395 to 415 W, increments of 5)	1 Solar Shutdown Device per 3 modules[1]
Hanwha	Q.PEAK DUO BLK-G5 or Q.PEAK DUO BLK-G6+	1 Solar Shutdown Device per 3 modules

[1]**Exception**: Tesla solar modules installed in locations where the max Voc for three modules at low design temperatures exceeds 165 V shall be limited to two modules between Solar Shutdown Devices.

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OPTIMIZER SPEC SHEET

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SPECS-3

Datasheet

IRONRIDGE

Aire® Flush Mount System

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.

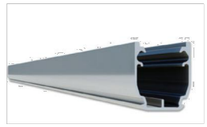
25-Year Warranty
Products are guaranteed to arrive without any impairing defects.

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

Datasheet

Rails

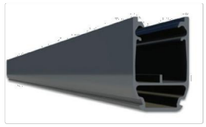
Aire® A1 Rail



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.

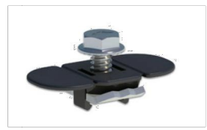
- Stay secure on rail ends
- Symmetrical, with drain
- Cover rough-cut ends

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

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

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

DESIGN ENGINEER
WYSSLING CONSULTING
76 N. MEADOWBROOK DRIVE
ALPINE, UTAH 84004
swyssling@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

WHEELER, MICHAEL
5995 ROSSER PITTMAN ROAD
SANFORD, NC 27332
10.530 KW DC 7.600 KW AC

REVISIONS

NO	DATE:	COMMENTS
1	3-18-24	ASBUILT
2		

RAIL SPEC SHEET

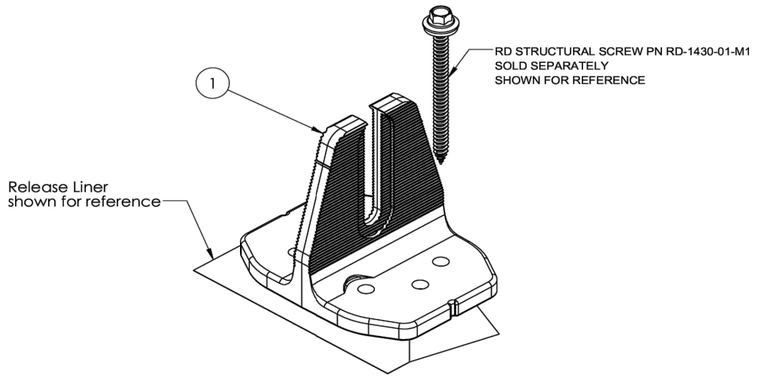
DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

SPECS-4

Cut Sheet

IRONRIDGE

QuickMount® Halo UltraGrip®

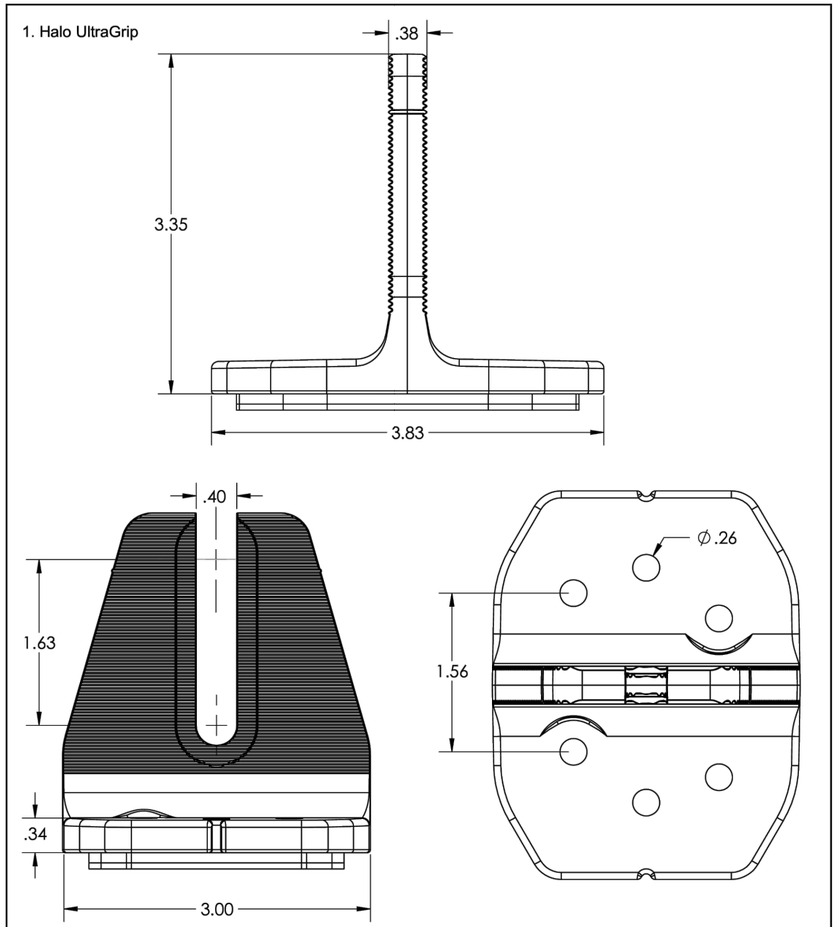


ITEM NO	DESCRIPTION	QTY IN KIT
1	QM Halo UltraGrip(Mill or Black)	1

PART NUMBER	DESCRIPTION
QM-HUG-01-M1	Halo UltraGrip - Mill
QM-HUG-01-B1	Halo UltraGrip - Black

Cut Sheet

1. Halo UltraGrip



Property	Value
Material	300 Series Aluminium
Finish	Mill or Black

ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA

DESIGN ENGINEER

WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE

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REVISIONS

NO	DATE:	COMMENTS
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2		

MOUNTING SPEC SHEET

DATE:	3/18/2024
DRAWN BY:	JTV
REVIEWED BY:	SCP

SPECS-5