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November 13, 2023

Current Insight
2852 W. Amini Way
South Jordan, UT 84095

Re: Engineering Services
Monahan Residence
187 Advance Drive, Lillington 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: Prefabricated wood trusses at 24" on center. All truss members are constructed of 2x4 dimensional lumber.

Roof Material: Composite Asphalt Shingles

Roof Slope: 22 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 = 117 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.

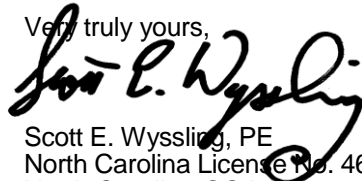
D. Solar Panel Anchorage

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 $2\frac{1}{2}$ ", 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 one $5/16$ " diameter lag screw with a minimum of $2\frac{1}{2}$ " 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



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

TOM MONAHAN RESIDENCE

NEW PHOTOVOLTAIC ROOF MOUNT SYSTEM PROJECT - 6.320 KW DC / 7.600 KW AC

PROJECT INFORMATION

PROPERTY OWNER

NAME: TOM MONAHAN

CONTRACTOR

NAME: BYLD

DESIGN SPECIFICATIONS

OCCUPANCY: R-3
 CONSTRUCTION TYPE: SINGLE FAMILY RESIDENCE
 ZONING: RESIDENTIAL
 WIND EXPOSURE: B
 AHJ: HARNETT COUNTY
 UTILITY: SOUTH RIVER EMC

APPLICABLE CODES & STANDARDS

NORTH CAROLINA RESIDENTIAL CODE 2018 (NCRC 2018)
 NORTH CAROLINA BUILDING CODE 2018 (NCBC 2018)
 NORTH CAROLINA FIRE CODE 2018 (NCFC 2018)
 NATIONAL ELECTRICAL CODE, NEC 2020 CODE BOOK, NFPA 70

TYPE OF INTERCONNECTION:

SUPPLY SIDE BREAKER IN THE MSF 76 N Meadowbrook Drive Alpine UT 84004
 North Carolina COA # P-2308
 Signed 11/13/2023

SCOPE OF WORK

TYPE OF SYSTEM: ROOF MOUNT

SYSTEM SIZE:

STC: 16 X 395W = 6.320kW
 PTC: 16 X 372W = 5.952kW
 (16) TRINA SOLAR TSM-395DE09.05 [BLK] (395W) MODULES
 (1) TESLA 7.6 KW INVERTER
 (1) 60A KNIFE AC DICONNECT

MSP UPGRADE: NO
 MAIN BREAKER DERATE: NO

RACKING & MOUNTING

PV ATTACHMENT TYPE: IRONRIDGE FLASHVUE FOR COMP SHINGLE ROOF

RACKING TYPE: IRONRIDGE XR10 RAIL ROOF MOUNT RACKING HARDWARE



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COORDINATES:
 35.303524, -78.973961

SHEET #	SHEET NAME
T-1	COVER SHEET
T-2	PLAN NOTES
PV-1	SITE PLAN LAYOUT
PV-2	ATTACHMENT DETAILS
PV-3	MOUNTING DETAILS
E-1	ELECTRICAL DIAGRAM
E-2	WARNING LABELS
S-1	SPEC SHEET
S-2	SPEC SHEET
S-3	SPEC SHEET
S-4	SPEC SHEET

BYLD BETTER

CONTRACTOR

BYLD

ADDRESS: 1213W MOOREHEAD ST, STE 500 CHARLOTTE, NC 28208
LICENSE #:

DESIGNER: OGY

TOM MONAHAN RESIDENCE

187 ADVANCE DR,
 LILLINGTON,
 NC 27546

APN: 01053604002833

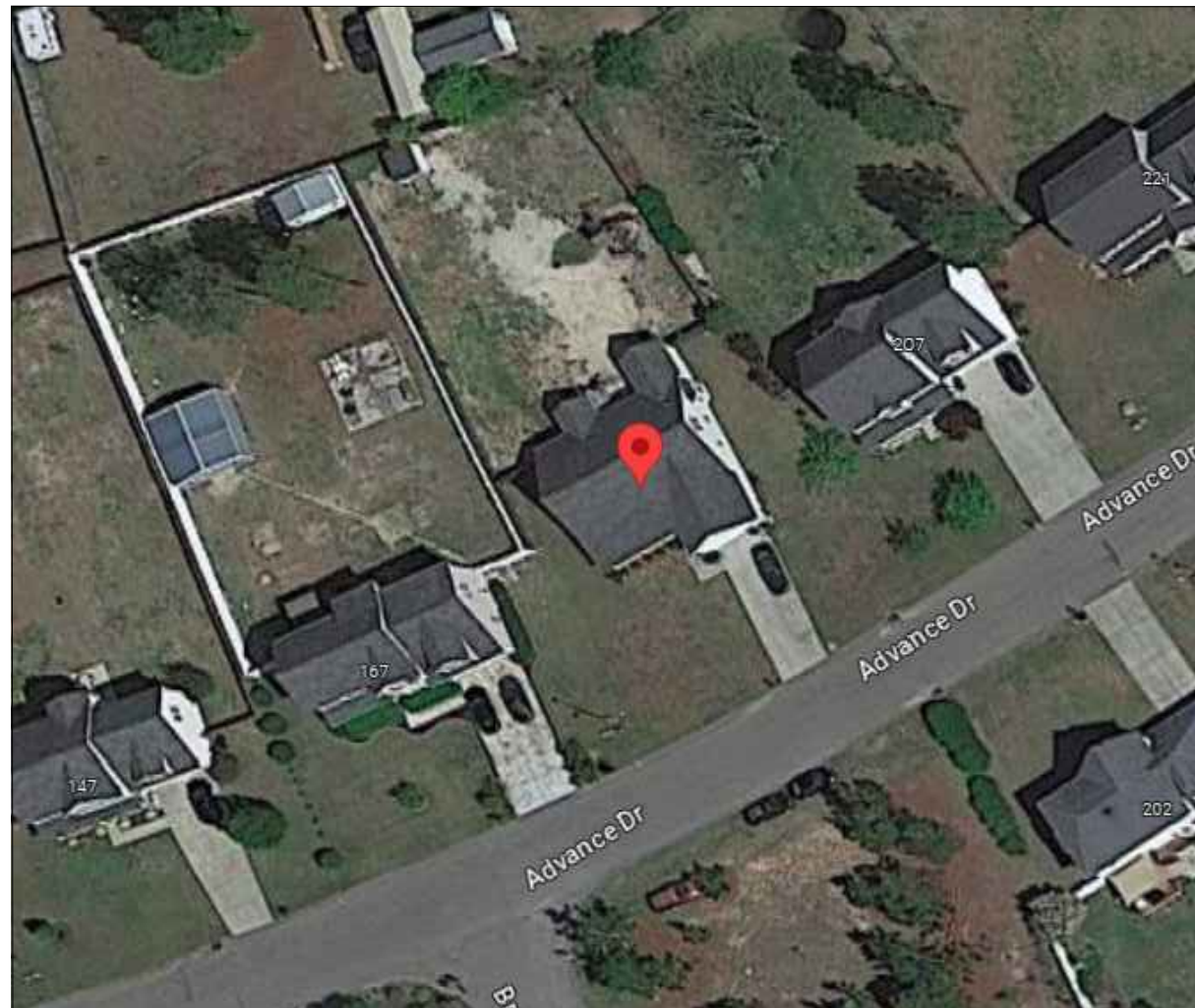
DATE: 11/10/2023

DESIGN BY

Complete Solar
 A Brighter Way.

SHEET
 T-1
 COVER SHEET

AERIAL VIEW



1.1. PROJECT NOTES:

- 1.2. THIS PHOTOVOLTAIC (PV) SYSTEM SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 690, ALL MANUFACTURER'S LISTING AND INSTALLATION INSTRUCTIONS, AND THE RELEVANT CODES AS SPECIFIED BY THE AUTHORITY HAVING JURISDICTION'S (AHJ) APPLICABLE CODES.
- 1.3. THE UTILITY INTERCONNECTION APPLICATION MUST BE APPROVED AND PV SYSTEM INSPECTED PRIOR TO PARALLEL OPERATION
- 1.4. GROUND FAULT DETECTION AND INTERRUPTION (GFDI) DEVICE IS INTEGRATED WITH THE INVERTER IN ACCORDANCE WITH NEC 690.5(A)
- 1.5. ALL PV SYSTEM COMPONENTS; MODULES, UTILITY-INTERACTIVE INVERTERS, AND SOURCE CIRCUIT COMBINER BOXES ARE IDENTIFIED AND LISTED FOR USE IN PHOTOVOLTAIC SYSTEMS AS REQUIRED BY NEC 690.4 & NEC 690.60: PV MODULES: UL1703, IEC61730, AND IEC61215, AND NFPA 70 CLASS C FIRE INVERTERS: UL 1741 CERTIFIED, IEEE 1547, 929, 519 COMBINER BOX(ES): UL 1703 OR UL 1741 ACCESSORY
- 1.6. MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC. IF UNAVAILABLE, MAX DC VOLTAGE CALCULATED ACCORDING TO NEC 690.7.
- 1.7. ALL INVERTERS, PHOTOVOLTAIC MODULES, PHOTOVOLTAIC PANELS, AND SOURCE CIRCUIT COMBINERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER 690.4 (D). SHALL BE INSTALLED ACCORDING TO ANY INSTRUCTIONS FROM LISTING OR LABELING [NEC 110.3].
- 1.8. ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE. IF EXPOSED TO SUNLIGHT, IT SHALL BE UV RESISTANT. ALL PLAQUES AND SIGNAGE WILL BE INSTALLED AS REQUIRED BY THE NEC AND AHJ.

1.9. SCOPE OF WORK:

- 1.10. PRIME CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND SPECIFICATIONS OF THE GRID-TIED PHOTOVOLTAIC SYSTEM RETROFIT. PRIME CONTRACTOR WILL BE RESPONSIBLE FOR COLLECTING EXISTING ONSITE REQUIREMENTS TO DESIGN, SPECIFY, AND INSTALL THE EXTERIOR ROOF-MOUNTED PORTION OF THE PHOTOVOLTAIC SYSTEMS DETAILED IN THIS DOCUMENT.

1.11. WORK INCLUDES:

- 1.12. PV ROOF ATTACHMENTS - IRONRIDGE FLASHVUE FOR COMP SHINGLE
- 1.13. PV RACKING SYSTEM INSTALLATION - IRONRIDGE XR10 RAIL ROOF MOUNT RACKING HARDWARE
- 1.14. PV MODULE AND INVERTER INSTALLATION - TRINA SOLAR TSM-395DE09.05 [BLK](395W) MODULES/ TESLA 7.6 KW INVERTER.
- 1.15. PV EQUIPMENT GROUNDING
- 1.16. PV SYSTEM WIRING TO A ROOF-MOUNTED JUNCTION BOX
- 1.17. PV LOAD CENTERS (IF INCLUDED)
- 1.18. PV METERING/MONITORING (IF INCLUDED)
- 1.19. PV DISCONNECTS
- 1.20. PV GROUNDING ELECTRODE & BONDING TO (E) GEC
- 1.21. PV FINAL COMMISSIONING
- 1.22. (E) ELECTRICAL EQUIPMENT RETROFIT FOR PV
- 1.23. SIGNAGE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE

1.24. SITE NOTES:

- 1.25. A LADDER WILL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
- 1.26. THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM WITH NO STORAGE BATTERIES.
- 1.27. THE SOLAR PV INSTALLATION WILL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
- 1.28. PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION NEC 110.26.
- 1.29. ROOF COVERINGS SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THIS CODE AND THE APPROVED MANUFACTURER'S INSTRUCTIONS SUCH THAT THE ROOF COVERING SERVES TO PROTECT THE BUILDING OR STRUCTURE.

1.30. EQUIPMENT LOCATIONS:

- 1.31. ALL EQUIPMENT SHALL MEET MINIMUM SETBACKS AS REQUIRED BY NEC 110.26.
- 1.32. WIRING SYSTEMS INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC 690.31 (A),(C) AND NEC TABLES 310.15 (B)(2)(A) AND 310.15 (B)(3)(C)
- 1.33. JUNCTION AND PULL BOXES PERMITTED INSTALLED UNDER PV MODULES ACCORDING TO NEC 690.34.
- 1.34. ADDITIONAL AC DISCONNECT(S) SHALL BE PROVIDED WHERE THE INVERTER IS NOT WITHIN SIGHT OF THE AC SERVICING DISCONNECT.
- 1.35. ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.
- 1.36. ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.

1.37. STRUCTURAL NOTES:

- 1.38. RACKING SYSTEM
- 1.39. PV ARRAY WILL BE INSTALLED ACCORDING TO CODE-COMPLIANT INSTALLATION MANUAL. TOP CLAMPS REQUIRE A DESIGNATED SPACE BETWEEN MODULES, AND RAILS MUST ALSO EXTEND
- 1.40. A MINIMUM DISTANCE BEYOND EITHER EDGE OF THE ARRAY/SUBARRAY, ACCORDING TO RAI MANUFACTURER'S INSTRUCTIONS.
- 1.41. JUNCTION BOX WILL BE INSTALLED PER MANUFACTURERS' SPECIFICATIONS. IF ROOF-PENETRATING TYPE, IT SHALL BE FLASHED SEALED PER LOCAL REQUIREMENTS.
- 1.42. ROOFTOP PENETRATIONS FOR PV RACEWAY WILL BE COMPLETED AND SEALED W/ APPROVED CHEMICAL SEALANT PER CODE BY A LICENSED CONTRACTOR.
- 1.43. ALL PV RELATED ROOF ATTACHMENTS TO BE SPACED NO GREATER THAN THE SPAN DISTANCE SPECIFIED BY THE RACKING MANUFACTURER.
- 1.44. WHEN POSSIBLE, ALL PV RELATED RACKING ATTACHMENTS WILL BE STAGGERED AMONGST THE ROOF FRAMING MEMBERS.

1.45. WIRING & CONDUIT NOTES:

- 1.46. ALL CONDUIT AND WIRE WILL BE LISTED AND APPROVED FOR THEIR PURPOSE. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING.
- 1.47. CONDUCTORS SIZED ACCORDING TO NEC 690.8, NEC 690.7.
- 1.48. VOLTAGE DROP LIMITED TO 2%.
- 1.49. DC WIRING LIMITED TO MODULE FOOTPRINT. INVERTER WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY W/ SUITABLE WIRING CLIPS.
- 1.50. AC CONDUCTORS COLORED OR MARKED AS FOLLOWS: PHASE A OR L1- BLACK PHASE B OR L2- RED, OR OTHER CONVENTION IF THREE PHASE PHASE C OR L3- BLUE, YELLOW, ORANGE**, OR OTHER CONVENTION NEUTRAL- WHITE OR GREY IN 4-WIRE DELTA CONNECTED SYSTEMS THE PHASE WITH HIGHER VOLTAGE TO BE MARKED ORANGE [NEC 110.15

1.51. GROUNDING NOTES:

- 1.52. GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVICES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR SUCH USE.
- 1.53. PV EQUIPMENT SHALL BE GROUNDED ACCORDING TO NEC 690.43 AND MINIMUM NEC TABLE 250.122.
- 1.54. METAL PARTS OF MODULE FRAMES, MODULE RACKING, AND ENCLOSURES CONSIDERED GROUNDED IN ACCORD WITH 250.134 AND 250.136(A).
- 1.55. EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO NEC 690.45 AND INVERTER MANUFACTURER'S INSTRUCTIONS.

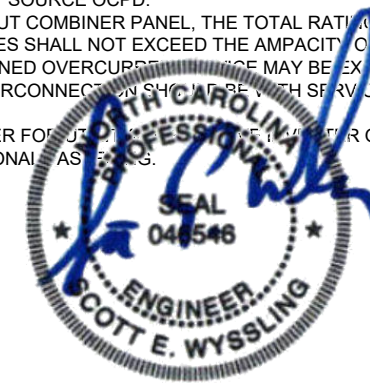
- 1.56. EACH MODULE WILL BE GROUNDED USING WEEB GROUNDING CLIPS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ. IF WEEBS ARE NOT USED, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE SPECIFIED GROUNDING LUG HOLES PER THE MANUFACTURER'S INSTALLATION REQUIREMENTS.
- 1.57. THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDING CONDUCTOR TO ANOTHER MODULE.
- 1.58. GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLORED GREEN OR MARKED GREEN IF #4 AWG OR LARGER [NEC 250.119]
- 1.59. THE GROUNDING ELECTRODE SYSTEM COMPLIES WITH NEC 690.47 AND NEC 250.50 THROUGH 250.106. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, A GROUNDING ELECTRODE SYSTEM PROVIDED ACCORDING TO NEC 250, NEC 690.47 AND AHJ.
- 1.60. GROUND-FAULT DETECTION SHALL COMPLY WITH NEC 690.5 IN GENERAL AND NEC 690.5 (A)(1) SPECIFICALLY.

1.61. DISCONNECTION AND OVER-CURRENT PROTECTION NOTES:

- 1.62. DISCONNECTING SWITCHES SHALL BE WIRED SUCH THAT WHEN THE SWITCH IS OPENED THE CONDUCTORS REMAINING ENERGIZED ARE CONNECTED TO THE TERMINALS MARKED "LINE SIDE" (TYPICALLY THE UPPER TERMINALS).
- 1.63. DISCONNECTS TO BE ACCESSIBLE TO QUALIFIED UTILITY PERSONNEL, BE LOCKABLE, AND BE A VISIBLE-BREAK SWITCH
- 1.64. RAPID SHUTDOWN OF ENERGIZED CONDUCTORS BEYOND 10 FT OF PV ARRAY OR 5 FT INSIDE A BUILDING WITHIN 10 SECONDS. CONTROLLED CONDUCTORS ≤30V AND ≤240VA [NEC 690.12]. LOCATION OF LABEL ACCORDING TO AHJ
- 1.65. ALL OCPD RATINGS AND TYPES SPECIFIED ACCORDING TO NEC 690.8, 690.9, AND 240.
- 1.66. INVERTER BRANCHES CONNECTED TO A SINGLE BREAKER OR GROUPED FUSES IN ACCORDANCE WITH NEC 110.3(B).
- 1.67. IF REQUIRED BY AHJ, SYSTEM WILL INCLUDE ARC-FAULT CIRCUIT PROTECTION ACCORDING TO NEC 690.11 AND UL1699B.

1.68. ELECTRICAL INTERCONNECTION NOTES:

- 1.69. THE SUM OF THE UTILITY OCPD AND INVERTER CONTINUOUS OUTPUT MAY NOT EXCEED 120% OF THE BUSBAR RATING.
- 1.70. WHEN THE SUM OF THE PV SOURCES EQUALS >100% OF THE BUSBAR RATING, PV DEDICATED BACKFEED BREAKERS MUST BE LOCATED OPPOSITE END OF THE BUS FROM THE UTILITY SOURCE OCPD.
- 1.71. AT MULTIPLE PV OUTPUT COMBINER PANEL, THE TOTAL RATING OF ALL OVERCURRENT DEVICES SHALL NOT EXCEED THE AMPACITY OF THE BUSBAR. HOWEVER, THE COMBINED OVERCURRENT RATING MAY BE EXCLUDED.
- 1.72. SUPPLY-SIDE TAP INTERCONNECTION SHALL BE WITH SERVICE ENTRANCE CONDUCTORS.
- 1.73. BACKFEEDING BREAKER FOR UTILITY SERVICE ENTRANCE WITH PV OUTPUT IS EXEMPT FROM ADDITIONAL ASSESSMENT.



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 76 N Meadowbrook Drive Alpine UT 84004
 North Carolina COA # P-2308

Signed 11/13/2023

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BYLD BETTER

CONTRACTOR

BYLD
ADDRESS:1213W
MOOREHEAD ST,
STE500 CHARLOTTE,
NC 28208
LICENSE #:

DESIGNER: OGY

TOM MONAHAN
RESIDENCE

187 ADVANCE DR,
 LILLINGTON,
 NC 27546

APN: 01053604002833

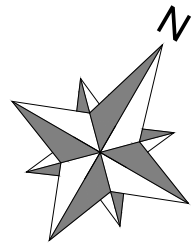
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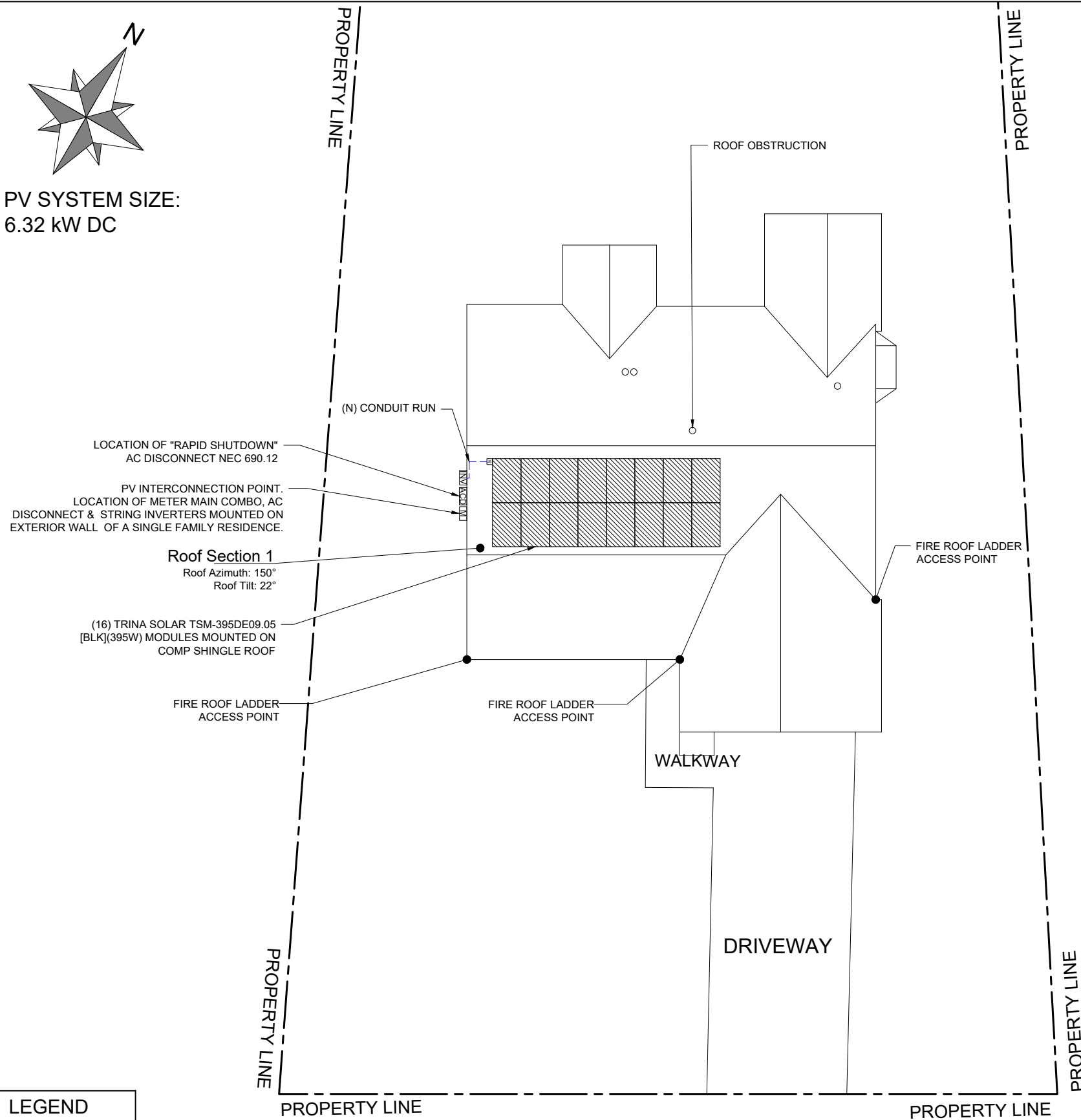
CompleteSolar

A Brighter Way.

SHEET
 T-2
 PLAN NOTES



PV SYSTEM SIZE:
6.32 kW DC



LOCATION OF "RAPID SHUTDOWN"
AC DISCONNECT NEC 690.12

PV INTERCONNECTION POINT.
LOCATION OF METER MAIN COMBO, AC
DISCONNECT & STRING INVERTERS MOUNTED ON
EXTERIOR WALL OF A SINGLE FAMILY RESIDENCE.

Roof Section 1
Roof Azimuth: 150°
Roof Tilt: 22°

(16) TRINA SOLAR TSM-395DE09.05
[BLK](395W) MODULES MOUNTED ON
COMP SHINGLE ROOF

FIRE ROOF LADDER
ACCESS POINT

FIRE ROOF LADDER
ACCESS POINT

WALKWAY

DRIVEWAY

PROPERTY LINE

187 ADVANCE DR

CONSTRUCTION NOTES

1. SOLAR PHOTOVOLTAIC SYSTEM TO BE INSTALLED ON RESIDENTIAL STRUCTURE.
2. THIS PROJECT HAS BEEN DESIGNED IN COMPLIANCE WITH THE IBC SECTION 1609 TO WITHSTAND A BASIC WIND EXPOSURE B.
3. THE ROOF MEMBERS ARE 2"x4" TRUSSES AT 24" ON CENTER. CONNECTION TO STRUCTURE SHALL NOT BE WITHIN 11" OF NAILING PLATES.
4. THE SOLAR PHOTOVOLTAIC INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
5. ALL CONDUCTORS AND CONDUITS MOUNTED ON ROOF SHALL BE MINIMUM 7/8" ABOVE ROOF SURFACE (INCLUDING CABLES UNDERNEATH MODULES AND RACKING).
6. ROOF ACCESS POINTS SHALL BE PROVIDED PER THE FOLLOWING
 - 6.1. LOCATED IN AREAS NOT REQUIRING PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS DOORS OR WINDOWS.
 - 6.2. LOCATED AT STRONG POINTS OF CONSTRUCTION IN LOCATIONS WHERE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS: TREES, WIRES, OR SIGNS.



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CONTRACTOR

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NC 28208**
LICENSE #:

DESIGNER: OGY

**TOM MONAHAN
RESIDENCE**

187 ADVANCE DR,
LILLINGTON,
NC 27546

APN: 01053604002833

DATE: 11/10/2023

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SHEET
PV-1
SITE PLAN LAYOUT

LEGEND

	NEW SOLAR PANELS
	AC DISCONNECT
	METER MAIN COMBO
	STRING INVERTER

PV SYSTEM SITE PLAN

SCALE: 1/16" = 1'-0"

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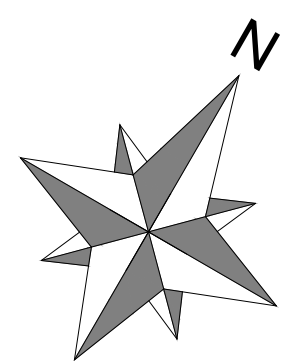
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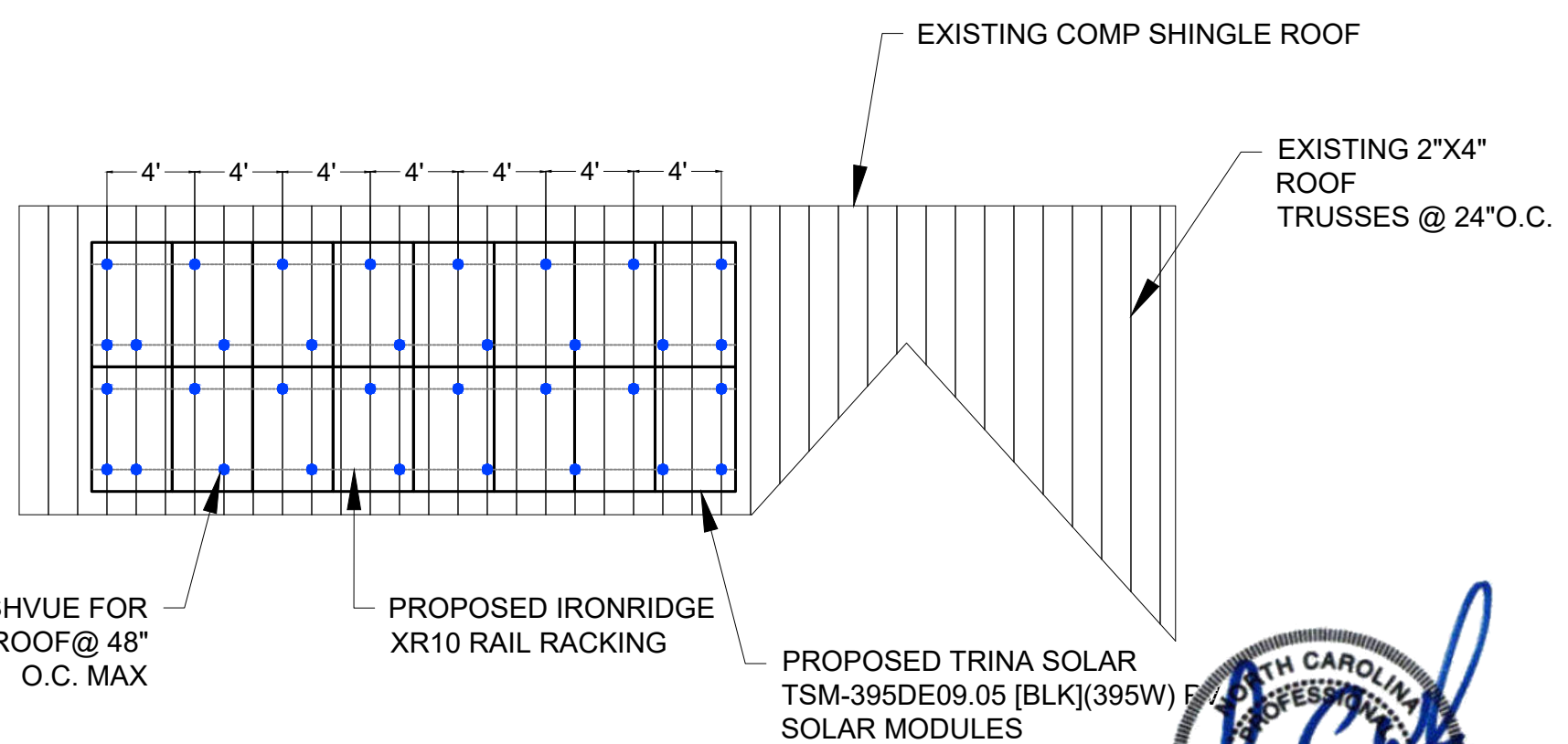
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**SHEET
PV-2
ATTACHMENT DETAILS**



Roof Section 1
Roof Azimuth: 150°
Roof Tilt: 22°



IRONRIDGE FLASHVUE FOR
COMP SHINGLE ROOF @ 48"
O.C. MAX

PROPOSED IRONRIDGE
XR10 RAIL RACKING

PROPOSED TRINA SOLAR
TSM-395DE09.05 [BLK](395W) PV
SOLAR MODULES

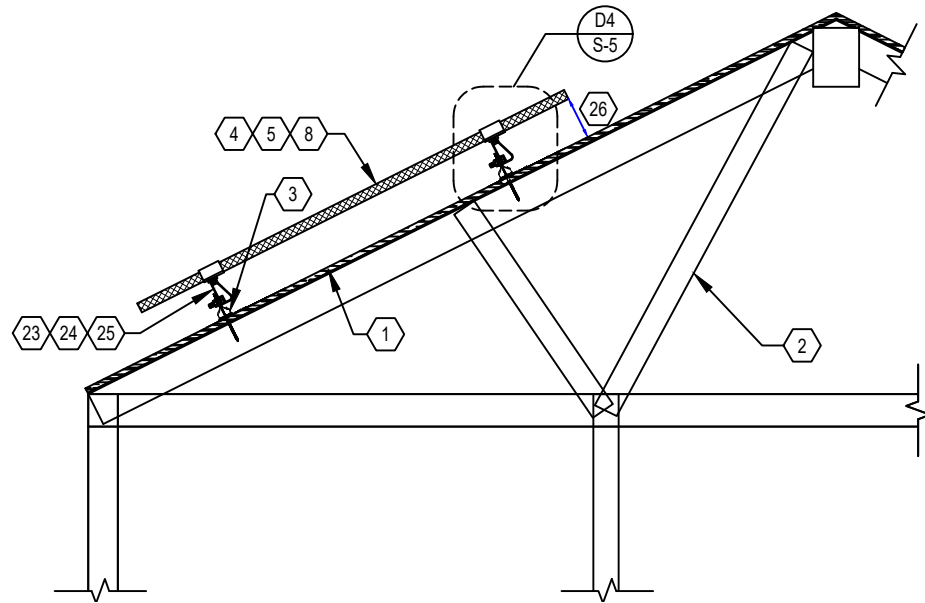


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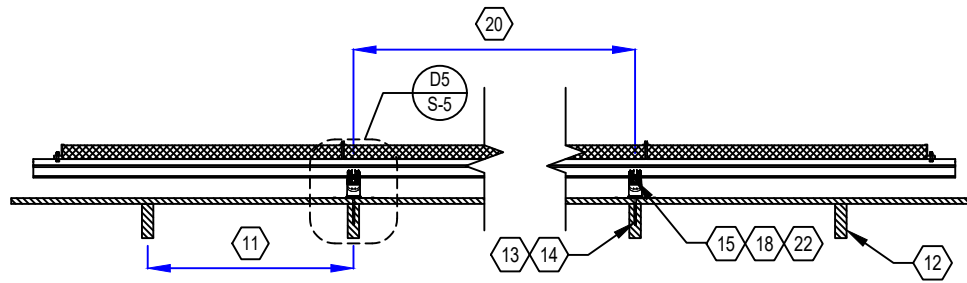
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PV SYSTEM MOUNTING DETAILS

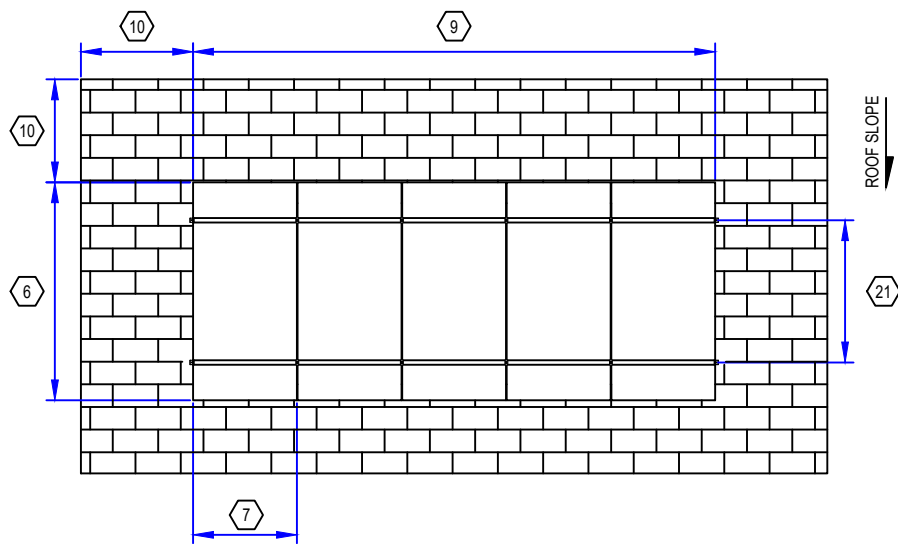
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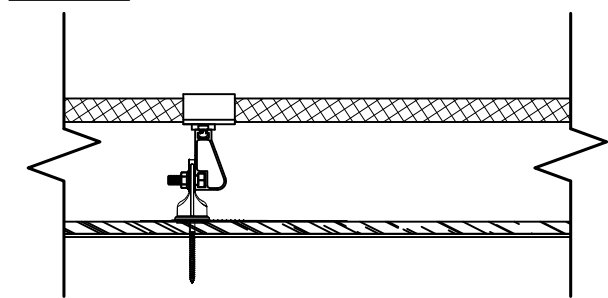
D1 RACKING DETAIL (TRANSVERSE)
NOT TO SCALE



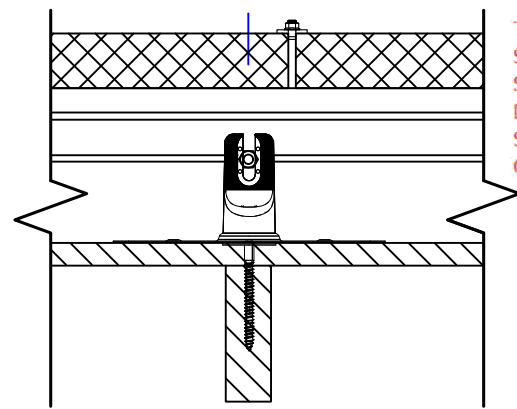
D2 RACKING DETAIL (LONGITUDINAL)
NOT TO SCALE



D3 RACKING DETAIL (TOP)
NOT TO SCALE



D4 DETAIL (TRANSVERSE)
NOT TO SCALE



D5 DETAIL (LONGITUDINAL)
NOT TO SCALE

1. ROOF MATERIAL: COMP SHINGLE
2. ROOF STRUCTURE: TRUSSES
3. ATTACHMENT TYPE: IRONRIDGE FLASHVUE
4. MODULE MANUFACTURER: TRINA SOLAR
5. MODULE MODEL: TSM-395DE09.05 [BLK](395W)
6. MODULE LENGTH: 69.05"
7. MODULE WIDTH: 43.14"
8. MODULE WEIGHT: 46.29 LBS.
9. SEE SHEET S-1 FOR DIMENSION(S)
10. MIN. FIRE OFFSET
11. TRUSSES SPACING: 24" O.C.
12. TRUSSES SIZE: 2"X4" NOMINAL
13. LAG BOLT DIAMETER: 5/16 IN.
14. LAG BOLT EMBEDMENT: 2.5 IN.
15. TOTAL # OF ATTACHMENTS: 34
16. TOTAL AREA: 330.98 SQ. FT.
17. TOTAL WEIGHT: 740.64LBS.
18. WEIGHT PER ATTACHMENT: 21.78 LBS.
19. DISTRIBUTED LOAD: 2.24 PSF
20. MAX. HORIZONTAL STANDOFF: 48 IN.
21. MAX. VERTICAL STANDOFF:
LANDSCAPE: 26 IN., PORTRAIT: 45 IN.
22. STANDOFF STAGGERING: YES
23. RAIL MANUFACTURER AND MODEL
(OR EQUIV.):IRONRIDGE XR10 RAIL
24. RAIL WEIGHT: 0.436 PLF.
25. MAX. TRUSSES SPAN: 12 FT.
26. MODULE CLEARANCE: 3 IN. MIN., 6 IN. MAX.



Wyssling Consulting, PLLC
76 N Meadowbrook Drive Alpine UT 84004
North Carolina CDA # P-2308
Signed 11/13/2023

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



CONTRACTOR

BYLD
ADDRESS:1213W MOOREHEAD ST, STE500 CHARLOTTE, NC 28208
LICENSE #:

DESIGNER: OGY

TOM MONAHAN RESIDENCE

187 ADVANCE DR,
LILLINGTON,
NC 27546

APN: 01053604002833

DATE:11/10/2023

DESIGN BY



SHEET
PV-3
MOUNTING DETAILS

PV Module Ratings @ STC	
Module Make/Model	TRINA SOLAR TSM-395DE09.05 [BLK](395W)
Max Power-Point Current (Imp)	11.62A
Max Power-Point Voltage (Vmp)	34.0V
Open-Circuit Voltage (Voc)	41.0V
Short-Circuit Current (Isc)	12.21A
Max Series Fuse (OCPD)	20A
Nominal Maximum Power at STC (Pmax)	395W
Maximum System Voltage	1500V
Voc Temperature Coefficient	-0.25 %/K

SYSTEM SUMMARY		
	BRANCH #1	BRANCH #2
MODULES PER BRANCH	8	8
SHORT-CIRCUIT CURRENT (ISC)	12.21A	12.21A
ARRAY STC POWER	6320W	
ARRAY PTC POWER	5952.0W	
MAX CONTINUOUS OUTPUT CURRENT	32.00A	
MAX CONTINUOUS OUTPUT POWER	7600W	
DERATED (CEC) AC POWER	5803.20W	

Inverter Ratings	
Inverter Make/Model	TESLA 7.6 KW INVERTER
Max DC Volt Rating	600V
Max Continuous Output Power	7600W
Max Nominal Voltage	240V
Max Continuous output Current	32A
Max OCPD Rating	40A
DESIGN TEMPERATURES	
ASHRAE EXTREME LOW	-10°C
ASHRAE 2% HIGH	36°C



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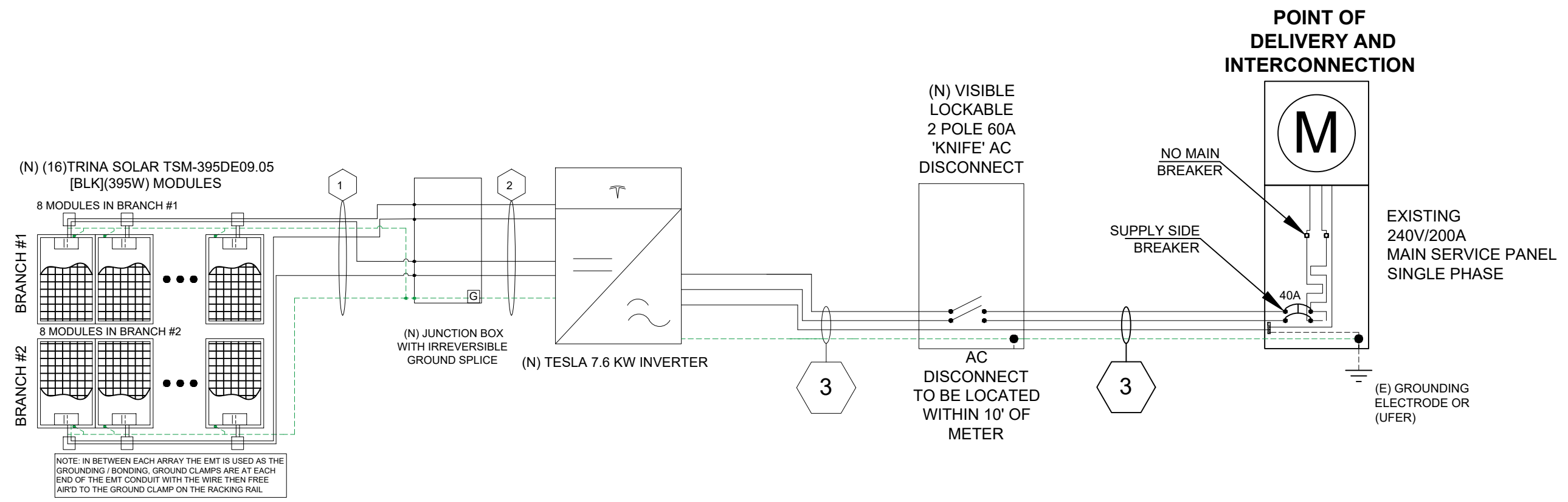


SHEET
E-1
ELECTRICAL DIAGRAM

Conduit and Conductor Schedule

Tag	Description	Wire Gauge	# of Conductors	Conduit Type	Conduit Size
1	PV Cable	10 AWG	4(2V+, 2V-)	N/A - Free Air	N/A - Free Air
1	Bare Copper Ground (EGC/GEC)	6 AWG	1	N/A - Free Air	N/A - Free Air
2	THWN-2	10 AWG	4(2V+, 2V-)	EMT	3/4"
2	THWN-2 - Ground	10 AWG	1	EMT	3/4"
3	THWN-2	8 AWG	3(L1, L2, N)	EMT	3/4"
3	THWN-2 - Ground	10 AWG	1	EMT	3/4"

METER # 16779987
MAIN SERVICE PANEL
SUPPLY SIDE BREAKER
NEC 705. 11 SUPPLY SIDE.
POWER PRODUCTION SOURCES



POINT OF DELIVERY AND INTERCONNECTION

! WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL LOCATION:
INVERTER(S), AC DISCONNECT(S), AC COMBINER PANEL (IF APPLICABLE).
PER CODE(S): NEC : 690.13(B), NEC : 690.17(E), NEC : 690.17(4)

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL LOCATION:
UTILITY SERVICE ENTRANCE/METER, INVERTER/DC DISCONNECT IF REQUIRED BY LOCAL AHJ, OR OTHER LOCATIONS AS REQUIRED BY LOCAL AHJ.
PER CODE(S): NEC : 690.56(C)(3), NEC : 690.12, NEC 690.56, IFC: 605.11.1, IFC : 1204.5.3

! WARNING
POWER SOURCE OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:
ADJACENT TO PV BREAKER (IF APPLICABLE).
PER CODE(S): NEC : 705.12(B)(3)(2), NEC : 705.12(B)(2)(3)(b), NEC : 705.12(D)(2)(3)(b)

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

LABEL LOCATION:
AC DISCONNECT(S), PHOTOVOLTAIC SYSTEM POINT OF INTERCONNECTION.
PER CODE(S): NEC : 690.54, NEC : 690.54, NEC : 690.54

MAIN PHOTOVOLTAIC SYSTEM DISCONNECT

LABEL LOCATION: PV SYSTEM DISCONNECT
PER CODE(S): NEC 690.13(B)

! WARNING
DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

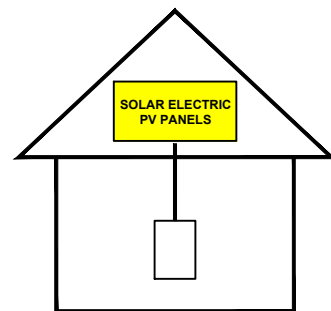
LABEL LOCATION:
MAIN SERVICE PANEL (IF APPLICABLE).
PER CODE(S): NEC : 705.12(C) & 690.59

GENERATION DISCONNECT SWITCH
MAXIMUM AC OPERATING CURRENT: 32.00 AMPS
NOMINAL OPERATING AC VOLTAGE: 240.0 VAC

LABEL LOCATION:
AC DISCONNECT(S), PHOTOVOLTAIC SYSTEM POINT OF INTERCONNECTION.
PER CODE(S): NEC : 690.54

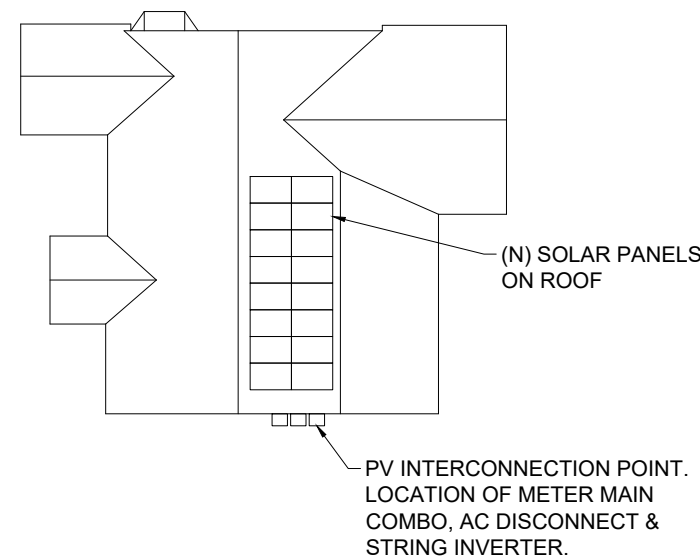
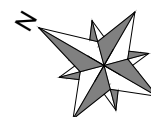
SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

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



LABEL LOCATION:
ON OR NO MORE THAT 3 M (10 FT) FROM THE SERVICE DISCONNECTING MEANS TO WHICH THE PV SYSTEMS ARE CONNECTED.
PER CODE(S): NEC : 690.56(C)(1)(a)

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



PERMANENT SIGNAGE NOTES:

1. NOT ALL PLACARDS SHOWN MAY BE REQUIRED BY LOCAL AHJ. CONTRACTOR TO VERIFY PLACARD REQUIREMENTS WITH LOCAL AHJ BEFORE INSTALLATION.
2. ALL PLAQUES AND SIGNAGE REQUIRED BY THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE
3. ALTERNATE POWER SOURCE PLACARD SHALL BE METALLIC OR MACHINE PRINTED LETTERS IN A CONTRASTING COLOR TO THE PLAQUE. THIS PLAQUE WILL BE ATTACHED BY POP RIVETS OR SCREWS OR OTHER APPROVED METHOD.
4. DIRECTORY PLACARD MARKING CONTENT AND FORMAT: RED BACKGROUND, WHITE LETTERING, MINIMUM 3/8" LETTER HIEGHT, ALL CAPITAL LETTERS, ARIAL OR SIMILAR FONT, NON BOLD, REFLECTIVE WEATHER RESISTANT MATERIAL SUITABLE FOR THE ENVIRONMENT.



CONTRACTOR

BYLD

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NC 28208
LICENSE #:

DESIGNER: OGY

**TOM MONAHAN
RESIDENCE**

187 ADVANCE DR,
LILLINGTON,
NC 27546

APN: 01053604002833

DATE:11/10/2023

DESIGN BY



SHEET
E-2
WARNING LABELS

Vertex S

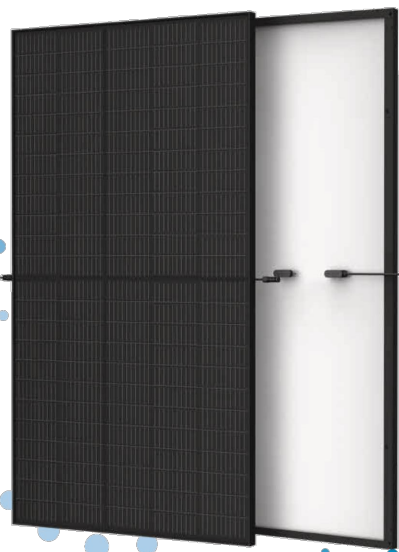
BACKSHEET MONOCRYSTALLINE MODULE

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

395 W+
MAXIMUM POWER OUTPUT

0/+5 W
POSITIVE POWER TOLERANCE

20.5 %
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

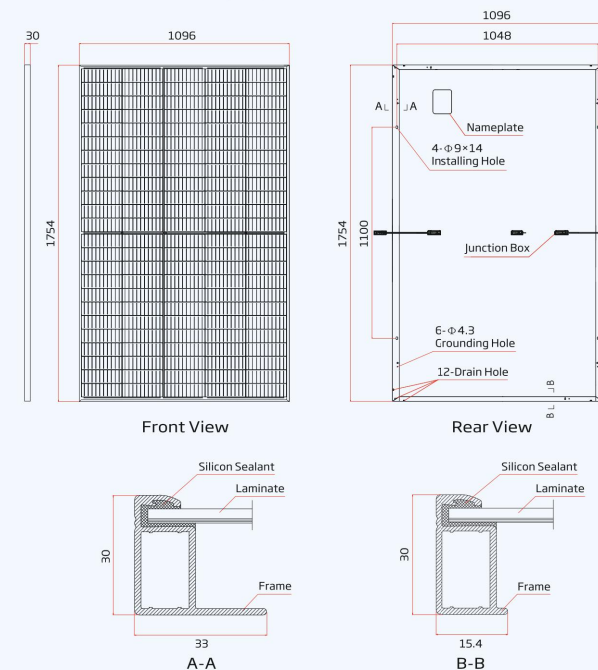
- Designed for compatibility with existing mainstream inverters, optimizers and mounting systems
- Perfect size and low weight for easy handling. Optimized transportation cost
- Reduces installation cost with higher power bin and efficiency
- Flexible installation solutions for system deployment

High Reliability

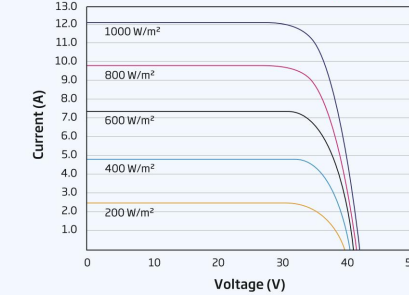
- 6,000 Pa snow load (test load)
- 4,000 Pa wind load (test load)

Vertex S

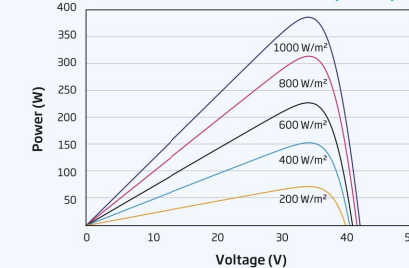
DIMENSIONS OF PV MODULE (mm)



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-P _{max} (Wp)*	380	385	390	395
Power Tolerance-P _{max} (W)	0/+5	0/+5	0/+5	0/+5
Maximum Power Voltage-V _{MPP} (V)	33.4	33.6	33.8	34.0
Maximum Power Current-I _{MPP} (A)	11.38	11.46	11.54	11.62
Open Circuit Voltage-V _{oc} (V)	40.4	40.6	40.8	41.0
Short Circuit Current-I _{sc} (A)	12.00	12.07	12.14	12.21
Module Efficiency η _m (%)	19.8	20.0	20.3	20.5

STC: Irradiance 1000 W/m², Cell Temperature 25 °C, Air Mass AM1.5 *Measuring tolerance: ±3%

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	IP68 rated
Cables	Photovoltaic Technology Cable 4.0 mm² Landscape: 1100/1100 mm Portrait: 280/280 mm*
Connector	TS4/MC4 EVO2*

*Special order only

ELECTRICAL DATA (NOCT)	TSM-380 DE09.05	TSM-385 DE09.05	TSM-390 DE09.05	TSM-395 DE09.05
Maximum Power-P _{max} (Wp)	286	290	294	298
Maximum Power Voltage-V _{MPP} (V)	31.4	31.6	31.8	31.9
Maximum Power Current-I _{MPP} (A)	9.12	9.18	9.24	9.32
Open Circuit Voltage-V _{oc} (V)	38.0	38.2	38.4	38.6
Short Circuit Current-I _{sc} (A)	9.67	9.73	9.78	9.84

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

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43 °C (±2 K)
Temperature Coefficient of P _{max}	-0.34 %/K
Temperature Coefficient of V _{oc}	-0.25 %/K
Temperature Coefficient of I _{sc}	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

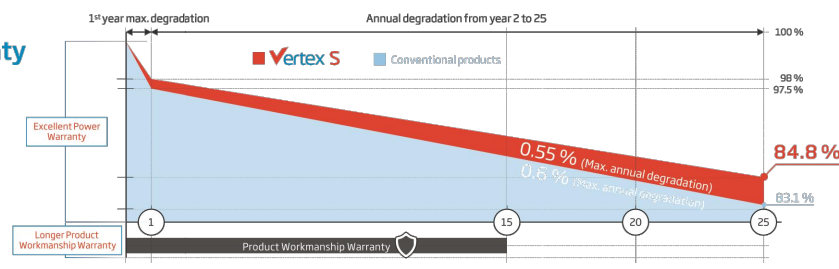
Modules per box	36 pieces
Modules per 40' container	936 pieces

Extended Vertex S Warranty

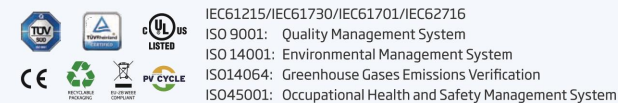
2 %
1st year max. degradation

0.55 %
Max. annual degradation from year 2 to 25

15 Years
Product Workmanship Warranty



Comprehensive Product and System Certificates



Trinasolar

Trinasolar

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.
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Version number: TSM_EN_2021_B

www.trinasolar.com

BYLD BETTER

CONTRACTOR

BYLD

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LICENSE #:

DESIGNER: OGY

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NC 27546

APN: 01053604002833

DATE: 11/10/2023

DESIGN BY

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SHEET
S-1
SPEC SHEET



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SHEET S-2 SPEC SHEET



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.

- 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.

- 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.

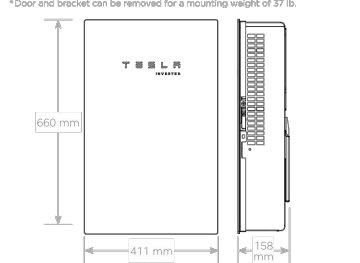


ELECTRICAL SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Output (AC), Nominal Power, Maximum Apparent Power, Maximum Continuous Current, Breaker, Nominal Power Factor, THD, MPPT, Input Connectors, Maximum Input Voltage, DC Input Voltage Range, DC MPPT Voltage Range, Maximum Current per MPPT, and Maximum Short Circuit Current per MPPT.

MECHANICAL SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Dimensions, Weight, and Mounting options.



PERFORMANCE SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Peak Efficiency, CEC Efficiency, and Allowable DC/AC Ratio.

Table with 2 columns: Specification Name and Value. Includes Customer Interface, Internet Connectivity, and AC Remote Metering Support.

Table with 2 columns: Specification Name and Value. Includes Protections and Supported Grid Types.

Table with 2 columns: Specification Name and Value. Includes Required Number of Tesla Solar Shutdown Devices per Solar Module and Warranty.

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

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.



ELECTRICAL SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Nominal Input DC Current Rating, Maximum Input Short Circuit Current, and Maximum System Voltage.

RSD MODULE PERFORMANCE

Table with 2 columns: Specification Name and Value. Includes Maximum Number of Devices per String, Control, Passive State, Maximum Power Consumption, and Warranty.

COMPLIANCE INFORMATION

Table with 2 columns: Specification Name and Value. Includes Certifications (UL 1741 PVRSS, PVRSA) and Compatible Equipment (Tesla Solar Inverter).

PVRSS

Table with 2 columns: Specification Name and Value. Includes RSD Initiation Method and Compatible Equipment.

ENVIRONMENTAL SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Ambient Temperature, Storage Temperature, and Enclosure Rating.

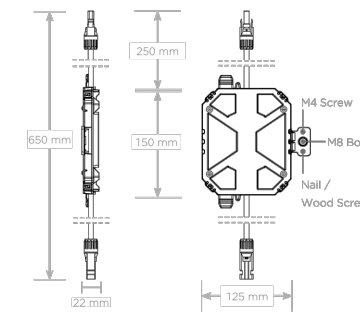
SOLAR SHUTDOWN DEVICE REQUIREMENTS PER MODULE

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.

Table with 3 columns: Brand, Model, and Required Solar Shutdown Devices. Lists Tesla Solar Roof V3, Hanwha Q-PEAK DUO BLK-G5, and Hanwha Q-PEAK DUO BLK-G6+.

MECHANICAL SPECIFICATIONS

Table with 2 columns: Specification Name and Value. Includes Electrical Connections, Housing, Dimensions, Weight, and Mounting Options.





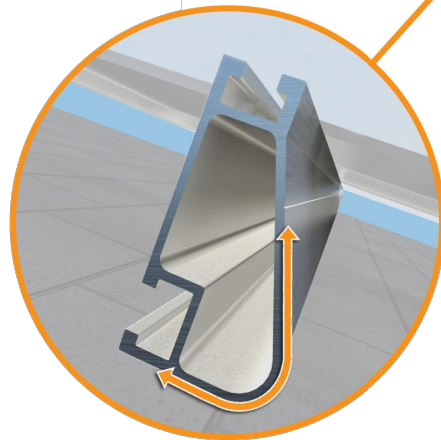
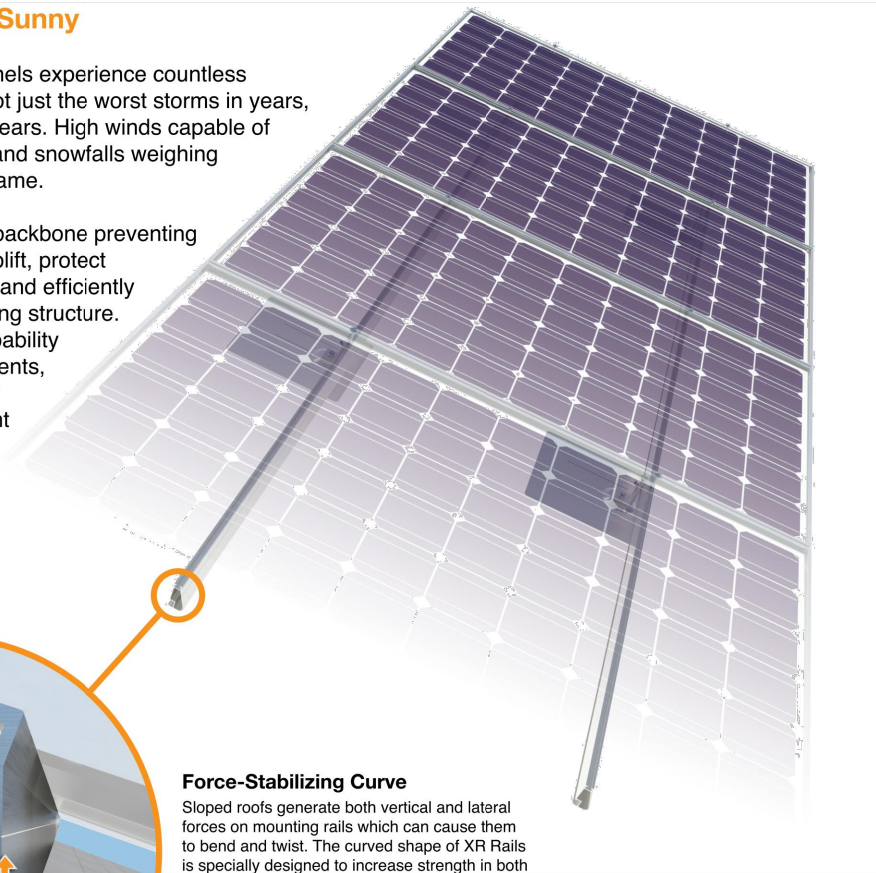
Tech Brief

XR Rail Family

Solar Is Not Always Sunny

Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



Force-Stabilizing Curve

Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.

Compatible with Flat & Pitched Roofs



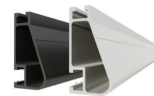
XR Rails are compatible with FlashFoot and other pitched roof attachments.



IronRidge offers a range of tilt leg options for flat roof mounting applications.

Corrosion-Resistant Materials

All XR Rails are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.



Tech Brief

XR Rail Family

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



XR10

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

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



XR100

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 10 feet.

- 10' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



XR1000

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme climates and spans up to 12 feet for commercial applications.

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

Rail Selection

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

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

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

BYLD BETTER

CONTRACTOR

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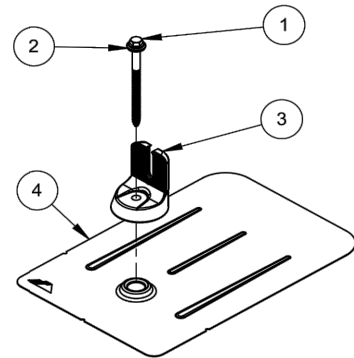
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SHEET

S-3

SPEC SHEET

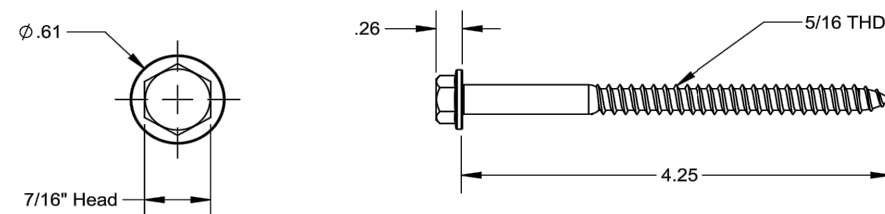


ITEM NO	DESCRIPTION	QTY IN KIT
1	BOLT, LAG 5/16 X 4.25"	1
2	WASHER, EPDM BACKED	1
3	FM FLASHING, MILL OR BLACK	1
4	GRIP CAP, MILL OR BLACK	1

FLASHVUE

PART NUMBER	DESCRIPTION
FV-01-M1	FLASHING, FLASHFOOT, MILL
FV-01-B1	FLASHING, FLASHFOOT, BLACK

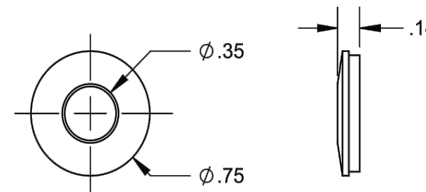
1) BOLT, LAG 5/16 x 4.25"



Property	Value
Material	300 Series Stainless Steel
Finish	Clear

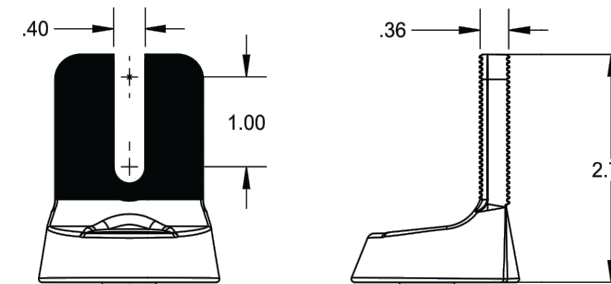
v1.0

2) Washer, EPDM Backed



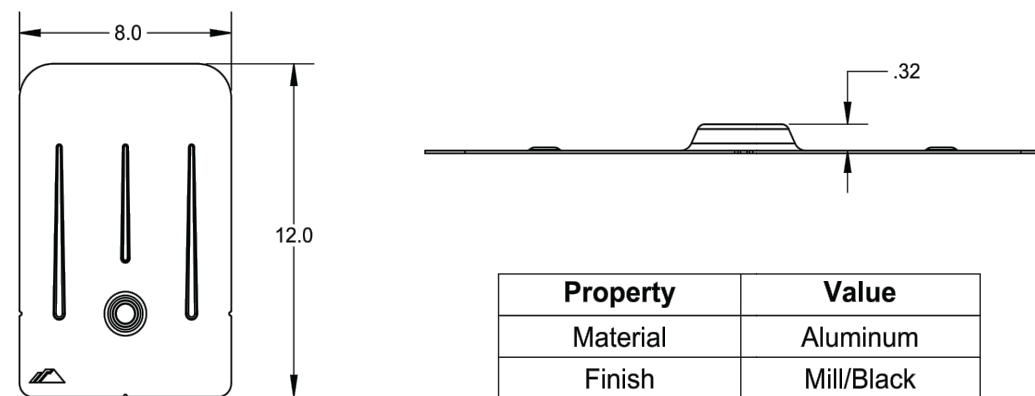
Property	Value
Material	300 Series Stainless Steel
Finish	Clear

3) Grip Cap



Property	Value
Material	Aluminum
Finish	Mill/Black

4) FM Flashing



Property	Value
Material	Aluminum
Finish	Mill/Black

v1.0

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SHEET
S-4
SPEC SHEET