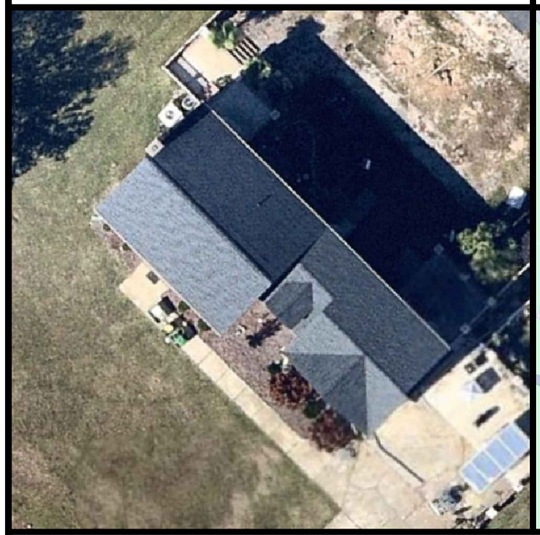
# NEW PV ROOFTOP SYSTEM DESIGN

16 MODULES - 6.320 KW DC & 9.600 KW AC SYSTEM SIZE

TRAVIS FOCHT RESIDENCE - 99 CURTIS DRIVE, ERWIN, NORTH CAROLINA 28339

## AERIAL MAP



## VICINITY MAP


## SHEET INDEX



Gregory Elvestad, PE

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Reason: I am approving this document
Location:
Date: 2024.03.22 12:31:18-06'00'
Foxit PDF Editor Version: 13.0.1

## SCOPE OF WORK

INSTALL 6.320 KW DC ROOF MOUNTED
PV SYSTEM UTILIZING
(16) MISSION SOLAR PERC 66 MSE395SX9R
(6) TESLA OPTIMIZERS
(1) TESLA BACKUP GATEWAY
(1) TESLA POWERWALL+
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

## 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 NATIONAL ELECTRIC CODE (NEC)
2015 INTERNATIONAL BUILDING CODE
2015 INTERNATIONAL RESIDENTIAL CODE

## DESIGN CRITERIA

ASCE 7-10 WIND SPEED: 120 MPH
EXPOSURE CATEGORY C
GROUND SNOW LOAD: 15 PSF

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**ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA**


DESIGN ENGINEER

WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE

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

NORTH CAROLINA COA NO. P-2308


SOLAR COMPANY/CLIENT

BYLD BETTER

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1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

FOCHT, TRAVIS 99
CURTIS DRIVE
ERWIN, NC 28339
6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

## COVER SHEET

NORTH CAROLINA PROFESSIONAL SEAL 053392 ENGINEER GREGORY T. ELVESTAD

Signed 3/21/2024

**GREGORY ELVESTAD , P.E.**

NORTH CAROLINA LICENSE NO. 053392

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| 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

## 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 - 2159 SQ FT

ROOF COVERAGE - 16.0%

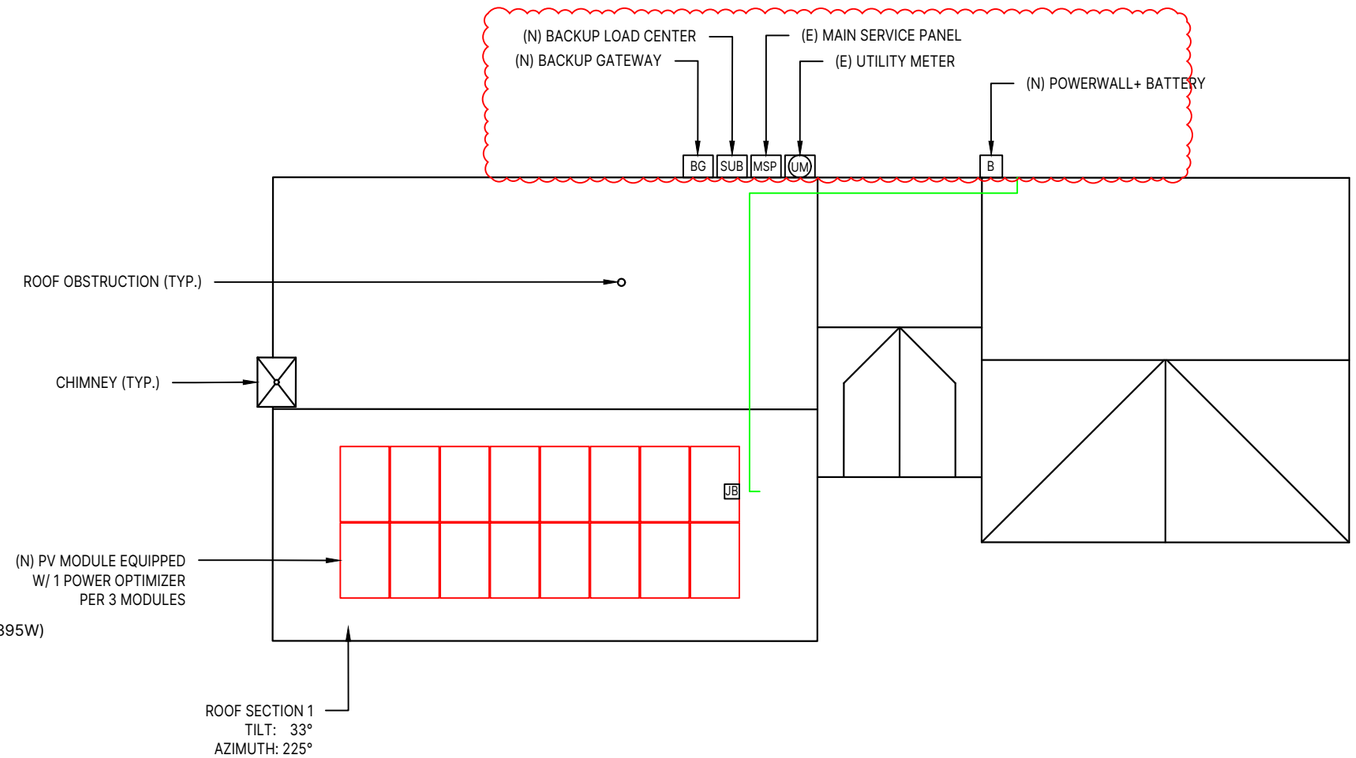
## EQUIPMENT LIST:

(N) (16) MISSION SOLAR PERC 66 MSE395SX9R
(N) (6) TESLA OPTIMIZERS
(1) TESLA BACKUP GATEWAY
(N) (1) TESLA POWERWALL +
(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 |




FRONT OF HOME

CURTIS DRIVE

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

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REVISIONS

| NO | DATE: | COMMENTS |
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| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

# SITE PLAN

NORTH CAROLINA PROFESSIONAL SEAL 053392 ENGINEER GREGORY T. ELVESTAD

Signed 3/21/2024

**GREGORY ELVESTAD , P.E.**
NORTH CAROLINA LICENSE NO. 053392

| | |
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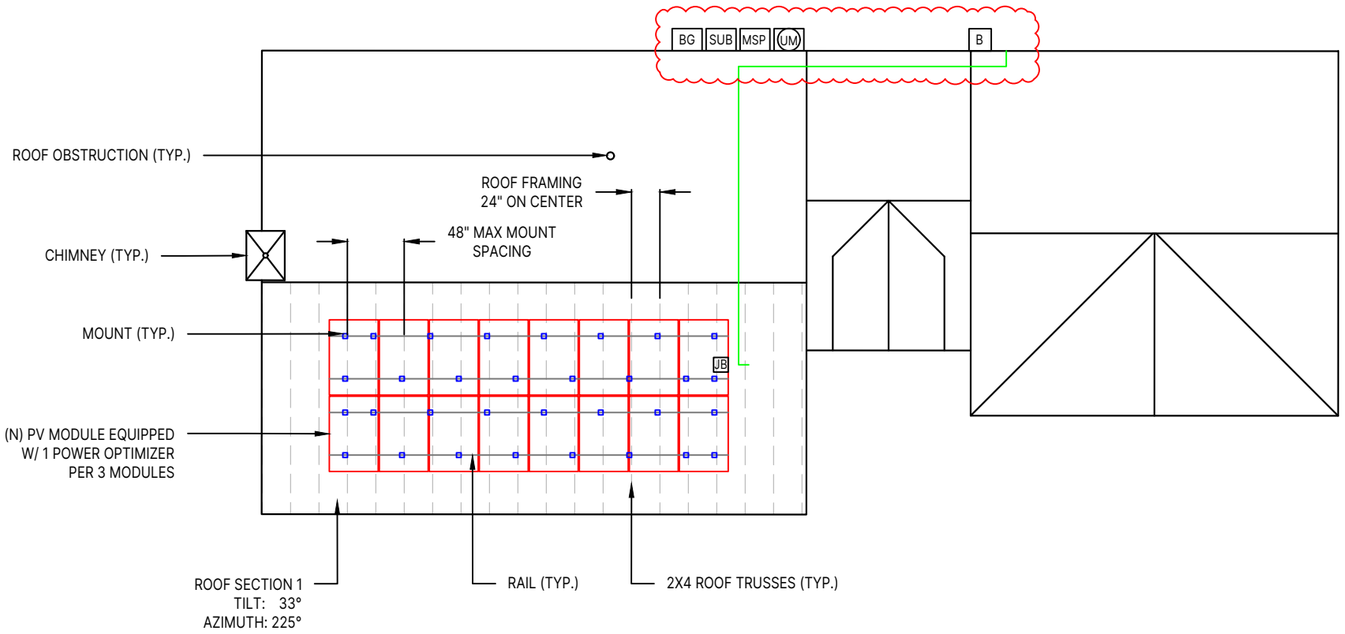
| REVIEWED BY: | SCP |

# 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 |
| FIRE PATHWAY | |
| SATELLITE DISH | |
| PROPERTY LINE | |
| ATTIC RUN CONDUIT | |
| EXTERNAL CONDUIT | |
| RAIL | |
| MOUNT | |
| ROOF FRAMING | |
| CHIMNEY | |
| ROOF OBSTRUCTION (TYP.) | |
| ROOF VENT (TYP.) | |




FRONT OF HOME

CURTIS DRIVE

## 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 TRUSSES (OR SEAM)LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S)INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

## MOUNT QUANTITY:

1. (32) 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 | 33° | 225° | 16 | 2X4 - TRUSSES | 24" | COMP SHINGLE | 48" | IRONRIDGE - HUG |

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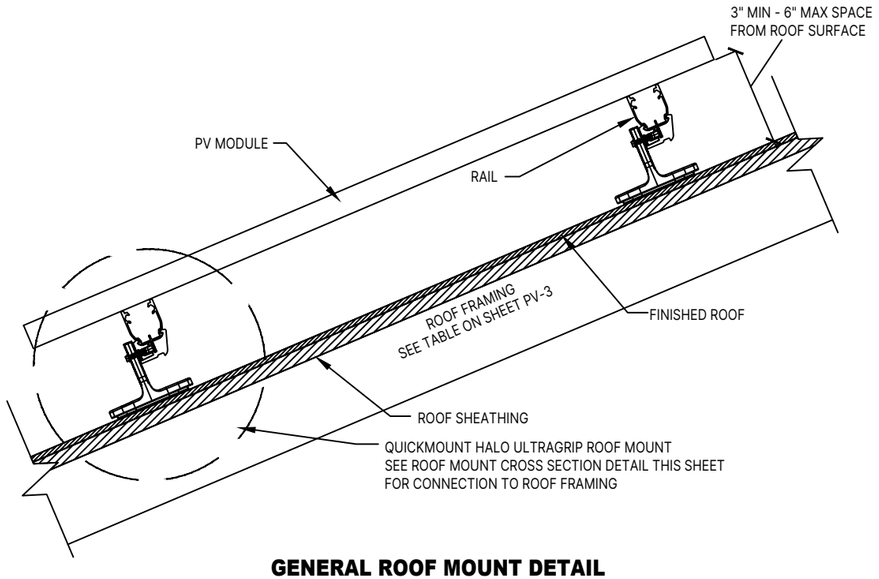
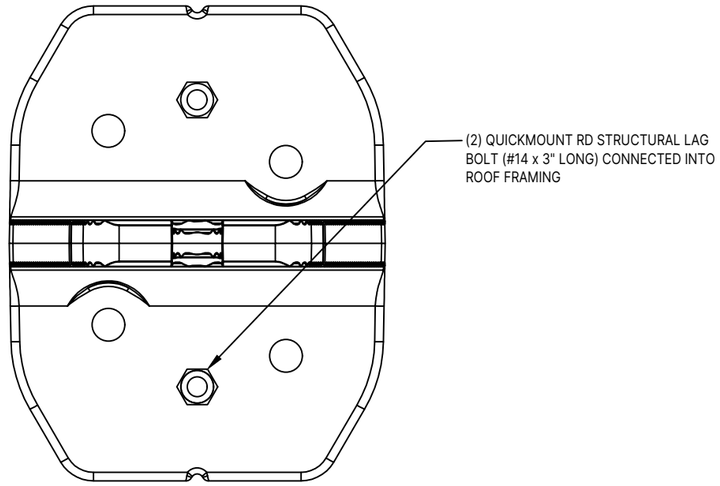
**PV-3**



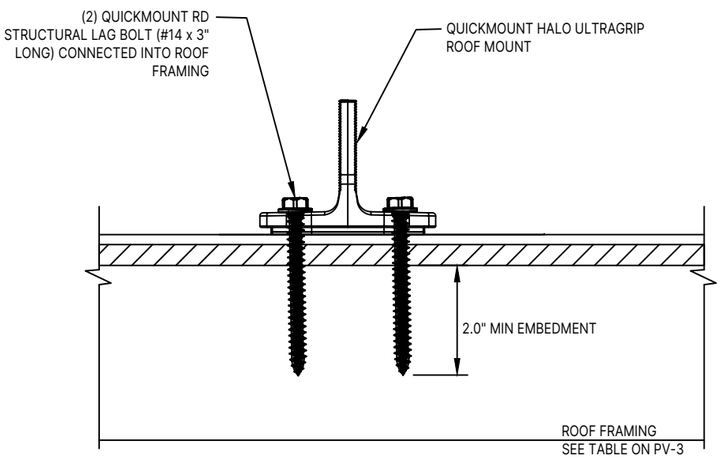

**GENERAL ROOF MOUNT DETAIL**

**NTS**



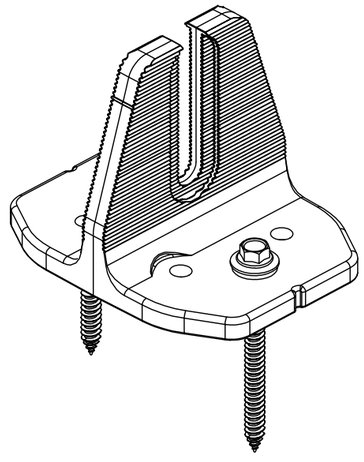

**ROOF MOUNT PLAN VIEW DETAIL**

**NTS**




**ROOF MOUNT CROSS SECTION DETAIL**

**NTS**



**ROOF MOUNT**

**NTS**

## MOUNT INSTALLATION NOTES

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

**ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA**

DESIGN ENGINEER

WYSSLING CONSULTING

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**ALPINE, UTAH 84004**
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NORTH CAROLINA COA NO. P-2308

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FOCHT, TRAVIS 99
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6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
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| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

# STRUCTURAL DETAILS

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

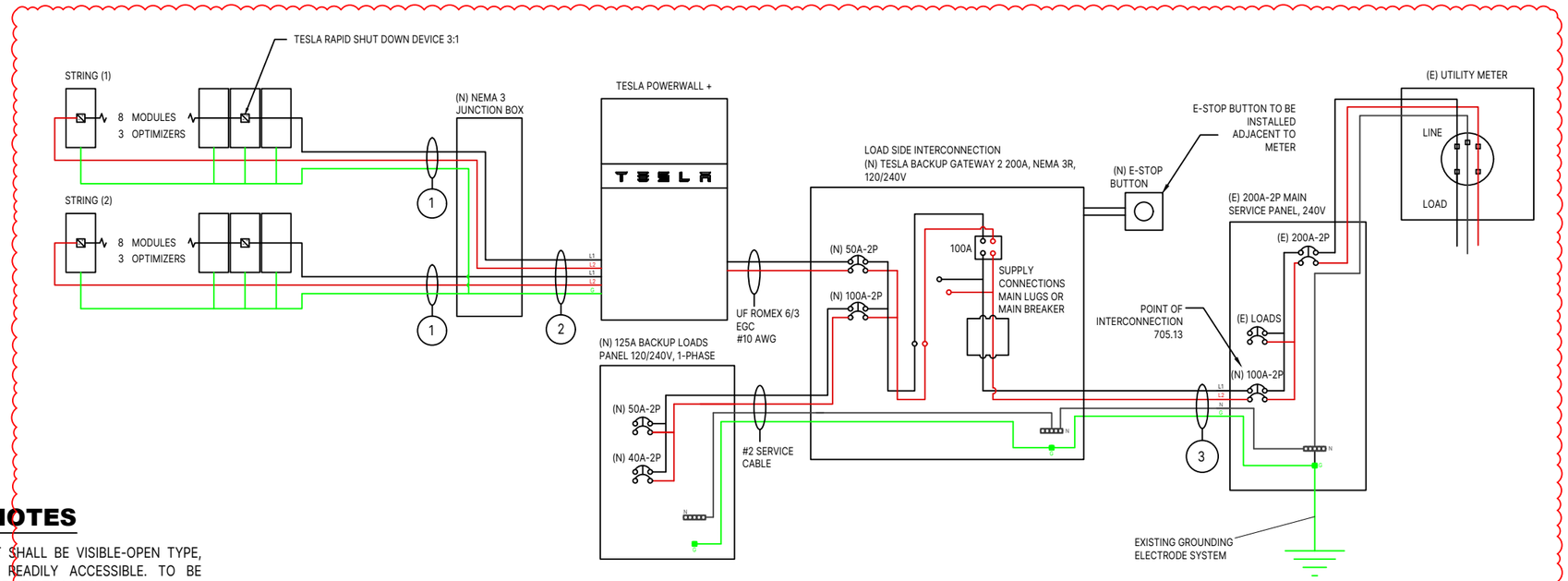
**S-1**

## 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 | #3 AWG | THWN-2, CU | 100 | #8 AWG | THHW, CU | 3/4" CONDUIT |
| | | | | | | | |
| | | | | | | | |

## EQUIPMENT LIST:

(N) (16) MISSION SOLAR PERC 66 MSE395SX9R
(N) (6) TESLA OPTIMIZERS
(1) TESLA BACKUP GATEWAY
(N) (1) TESLA POWERWALL 2
(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

NORTH CAROLINA PROFESSIONAL SEAL 053392 ENGINEER GREGORY T. ELVESTAD
Signed 3/21/2024


**GREGORY ELVESTAD , P.E.**
NORTH CAROLINA LICENSE NO. 053392


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**E-1**

## SYSTEM SIZE

AC SYSTEM SIZE: 9.600 kW
DC SYSTEM SIZE: 6.320 kW

## INTERCONNECTION CALCULATIONS

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

## CONDUCTOR CALCULATIONS

| TAG 1 (SEE E-1) | TAG 2 (SEE E-1) | TAG 3 (SEE E-1) |
|---|---|---|
| UNDER MODULES, NOT IN CONDUIT | #10 AWG MAX CURRENT = 30A | #3 AWG MAX CURRENT = 100A |
| #10 AWG MAX CURRENT = 30A | | |
| | | |
| | | TESLA POWERWALL+ MAX OUTPUT CURRENT = 40A |
| TESLA POWERWALL+ MAX CIRCUIT CURRENT | TESLA POWERWALL+ MAX CIRCUIT CURRENT | 40 x 1.25 = 50A |
| 15 A FOR CIRCUIT 2 | 15 A FOR CIRCUIT 2 | RECOMMENDED OCPD = 100A |
| 15 A FOR CIRCUIT 2 | 15 A FOR CIRCUIT 2 | BACKUP LOADS PANEL OCPD=100A |

## EQUIPMENT INFORMATION

| MODULE | |
|---|---|
| MANUFACTURER/ MODEL | MISSION SOLAR PERC 66 MSE395SX9R |
| PMAX | 395 W |
| VOC | 45.18 V |
| VMP | 36.99 V |
| IMP | 10.68 A |
| ISC | 11.24 A |
| TEMPERATURE COOEFFICIENT OF PMAX | -0.367 %/°C |
| TEMPERATURE COEFFICIENT OF VOC | -0.259 %/°C |

| INVERTER | |
|---|---|
| MANUFACTURER/ MODEL | TESLA POWERWALL+ |
| MAX AC OUTPUT | 40 A |
| AC OUTPUT VOLTAGE | 240 V |
| MAX DC INPUT VOLTAGE | 600 V |
| MAX INPUT CURRENT | 11 A |
| WEIGHTED CEC EFFICIENCY | 98.00% |
| INVERTER WATTAGE | 9600 W |
| | |
| | |

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| REVIEWED BY: | SCP |

**E-2**

**PHOTOVOLTAIC AC DISCONNECT**
MAXIMUM AC OPERATING CURRENT: 80
NOMINAL OPERATING AC VOLTAGE: 240

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

**⚠WARNING** DUAL POWER SOURCE
SECOND SOURCE IS PHTOVOLTAIC 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 NO 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

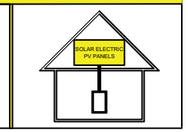
PERMANENT WARNING LABELS SHALL BE APPLIED TO DISTRIBUTION EQUIPMENT

**⚠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**
**TRI POWER SOURCE SECOND SOURCE IS BATTERY THIRD SOURCE IS PHOTOVOLTAIC SYSTEM**

AT EXTERNAL LOCATION NEAR METER AND UTILITY SERVICE DISCONNECT

**ENERGY STORAGE SYSTEM ON SITE LOCATED INSIDE**

PLACE LABEL EXTERNAL AT MAIN SERVICE DISCONNECT

**WARNING**
ELECTRIC SHOCK IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

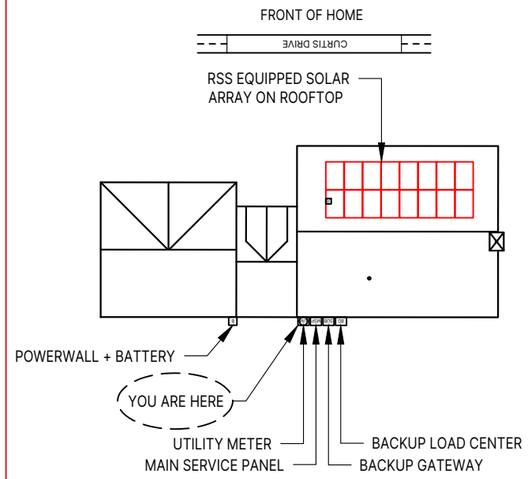
PLACE ESS LABELS AT BATTERY AND/OR CONTROLLER

## 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]

# CAUTION

MULTIPLE SOURCES OF POWER




99 CURTIS DRIVE, ERWIN, NORTH CAROLINA 28339

LABEL LOCATION: MSP CODE REF: NEC 2017 - 705.10

THIS PLAN HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY GREGORY ELVESTAD, 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

**ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA**


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


SOLAR COMPANY/CLIENT
BYLD BETTER
BYLD BETTER
1213 W MOOREHEAD STREET SUITE 500
CHARLOTTE, NC 28208

FOCHT, TRAVIS
99 CURTIS DRIVE
ERWIN, NC 28339
6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

**PV LABELS**

NORTH CAROLINA PROFESSIONAL SEAL 053392 ENGINEER GREGORY T. ELVESTAD

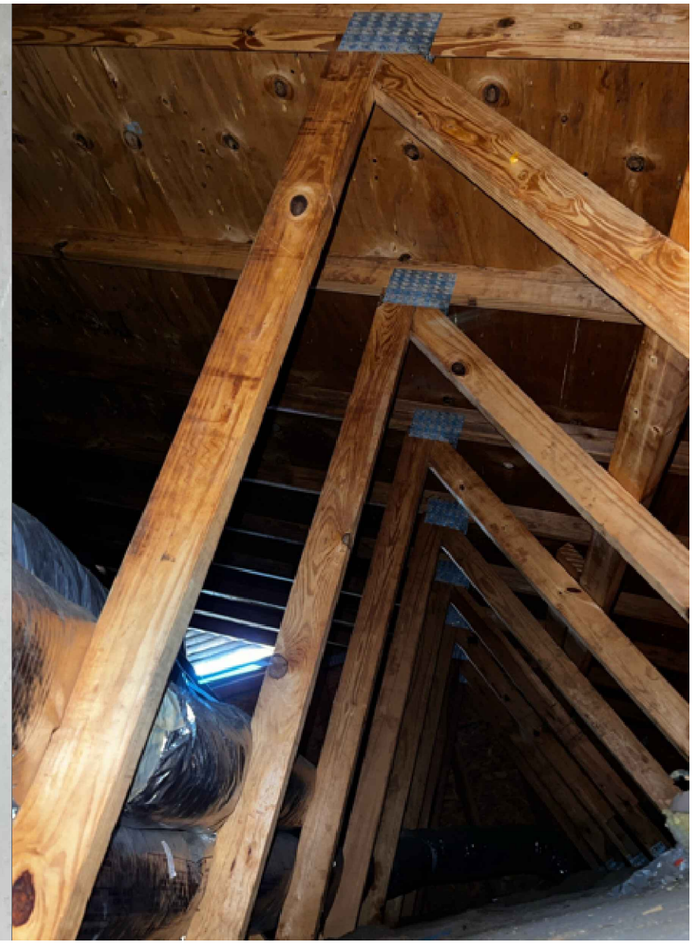
Signed 3/21/2024

**GREGORY ELVESTAD , P.E.**
NORTH CAROLINA LICENSE NO. 053392

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

**E-3**

ELECTRICAL

STRUCTURAL

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DESIGN ENGINEER

WYSSLING CONSULTING

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| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

# SITE PHOTOS

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

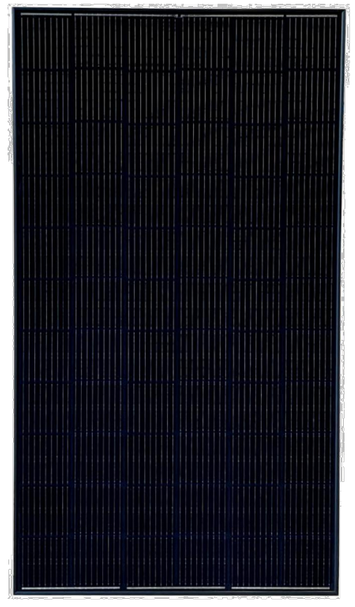
**PV-4**

# MSE PERC 66

MISSION SOLAR ENERGY

**395W** Positive Power Tolerance

Class leading power output -0 to +3%



## FRAME-TO-FRAME WARRANTY

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

## CERTIFICATIONS

CEC TÜV SUD C UL US LISTED

UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

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

# 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
- 40 mm frame

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

MODULES ASSEMBLED DERIVED & ENGINEERED IN THE USA OF U.S. AND NON-U.S. PARTS

25 YEAR FRAME-TO-FRAME WARRANTY

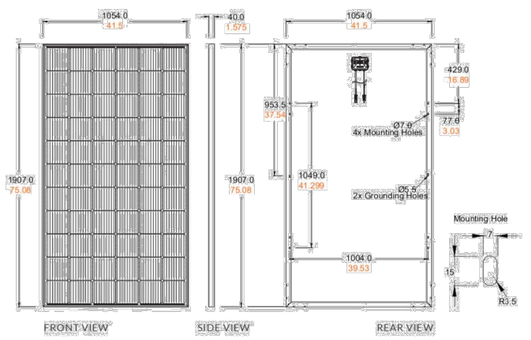


Class Leading
**390-400W**

MSE PERC 66

## BASIC DIMENSIONS

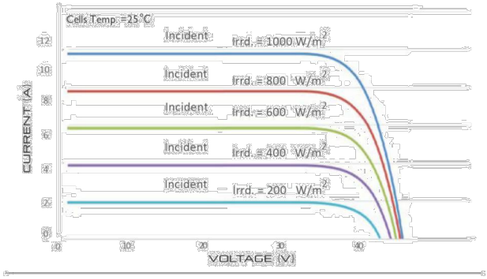
[UNITS: MM/IN]




## CURRENT-VOLTAGE CURVE

MSE385SX9R: 385WP, 66 CELL SOLAR MODULE

Current-voltage characteristics with dependence on irradiance and module temperature




## CERTIFICATIONS AND TESTS

| | |
|---|---|
| IEC | 61215, 61730, 61701 |
| UL | 61730 |

TÜV SUD CEC C UL US LISTED

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.



## ELECTRICAL SPECIFICATION

| PRODUCT TYPE | | MSExxxSX9R (xxx = Pmax) | | |
|---|---|---|---|---|
| Power Output | $P_{max}$ / $W_p$ | 390 | 395 | 400 |
| Module Efficiency | % | 19.4 | 19.7 | 19.9 |
| Tolerance | % | 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 | 36.68 | 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 Pmax | -0.367%/°C |
| Temperature Coefficient of Voc | -0.259%/°C |
| Temperature Coefficient of Isc | 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 Class' Rating is designated for the fully-installed PV system, which includes, but is not limited to: the module, the type of mounting used, pitch 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 4mm2 (12AWG) |
| Connector | Staubli PV-KBT4/6II-UR and PV-KST4/6II-UR, MC4, Renhe 05-8 |

## SHIPPING INFORMATION

| Container Feet | Ship To | Pallet | Panels | 390W Bin |
|---|---|---|---|---|
| 53' | Most States | 30 | 780 | 304.20 kW |
| Double Stack | CA | 26 | 676 | 263.64 kW |

**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) |



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6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

**MODULE SPEC SHEET**

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

**SPECS-1**


## SOLAR INVERTER

**3.8 kW | 7.6 kW**

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

KEY FEATURES

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

## SOLAR INVERTER

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

KEY FEATURES

- Integrated rapid shutdown, arc fault, and ground fault protection
- No neutral wire simplifies installation
- 2x the 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<br>3,840 VA at 240 V | 6,656 VA at 208 V<br>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<br>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) |



**ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA**

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FOCHT, TRAVIS 99
CURTIS DRIVE
ERWIN, NC 28339
6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

# INVERTER SPEC SHEET

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

# SPECS-2

## SOLAR SHUTDOWN DEVICE

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

### ELECTRICAL SPECIFICATIONS

| | |
|---|---|
| **Nominal Input DC Current Rating ($I_{MP}$)** | 12 A |
| **Maximum Input Short Circuit Current ($I_{SC}$)** | 15 A |
| **Maximum System Voltage** | 600 V DC |

### RSD MODULE PERFORMANCE

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

### COMPLIANCE INFORMATION

| | |
|---|---|
| **Certifications** | UL 1741 PVRSS<br>PVRSA (Photovoltaic Rapid Shutdown Array) |

### PVRSS

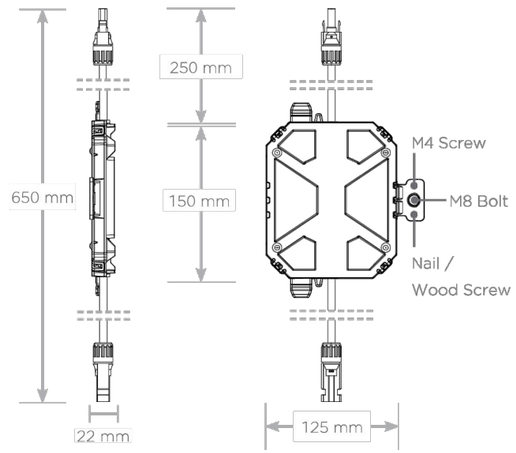
| | |
|---|---|
| **RSD Initiation Method** | Loss of AC power |
| **Compatible Equipment** | Tesla Solar Inverter |

### 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<br>(5 in x 6 in x 1 in) |
| **Weight** | 350 g (0.77 lb) |
| **Mounting Options** | ZEP Home Run Clip<br>M4 Screw (#10)<br>M8 Bolt (5/16")<br>Nail / Wood screw |




### SOLAR SHUTDOWN DEVICE REQUIREMENTS PER MODULE

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

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



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|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

**RAPID SHUTDOWN DEVICE SPEC SHEET**

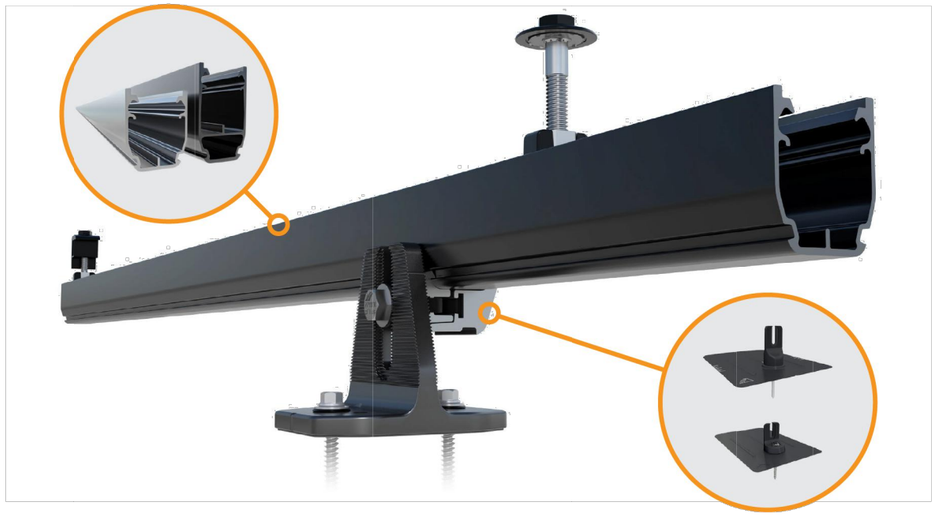
| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

**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.

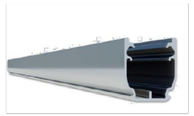
**UL 2703 Listed System**
Entire system and components meet the latest effective UL 2703 standards.

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



## 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
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE

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

NORTH CAROLINA COA NO. P-2308

SOLAR COMPANY/CLIENT

BYLD BETTER

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

FOCHT, TRAVIS 99
CURTIS DRIVE
ERWIN, NC 28339
6.320 KW DC 9.600 KW AC

REVISIONS

| NO | DATE: | COMMENTS |
|---|---|---|
| 1 | 03-21-24 | ELECTRICAL DIAGRAM |
| 2 | | |

# RAIL SPEC SHEET

| | |
|---|---|
| DATE: | 3/21/2024 |
| DRAWN BY: | FBM |
| REVIEWED BY: | SCP |

**SPECS-4**

Tech Brief

IRONRIDGE

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).

Intertek

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


**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.

Tech Brief

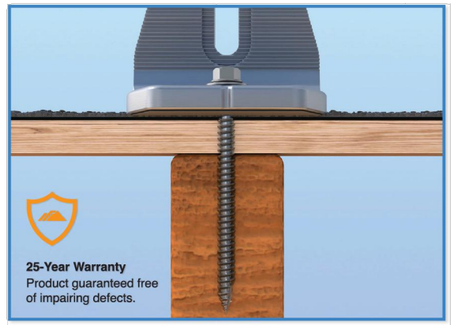
## Adaptive, Rafter-Friendly Installation

**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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# MOUNTING SPEC SHEET

| | |
|---|---|
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| REVIEWED BY: | SCP |

# SPECS-5


POWERWALL+

Powerwall+ is an integrated solar battery system that stores energy from solar production. Powerwall+ has two separate inverters, one for battery and one for solar, that are optimized to work together. Its integrated design and streamlined installation allow for simple connection to any home, and improved surge power capability brings whole home backup in a smaller package. Smart system controls enable owners to customize system behavior to suit their renewable energy needs.

## KEY FEATURES

- Integrated battery, inverter, and system controller for a more compact install
- A suite of application modes, including self-powered, time-based control, and backup modes
- Wi-Fi, Ethernet, and LTE connectivity with easy over-the-air updates





## PHOTOVOLTAIC (PV) AND BATTERY ENERGY STORAGE SYSTEM (BESS) SPECIFICATIONS

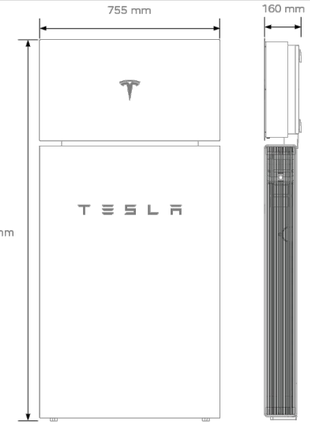
| | |
|---|---|
| **Powerwall+ Model Number** | 1850000-xx-y |
| **Solar Assembly Model Number** | 1538000-xx-y |
| **Nominal Battery Energy** | 13.5 kWh[1] |
| **Nominal Grid Voltage (Input / Output)** | 120/240 VAC |
| **Grid Voltage Range** | 211.2 - 264 VAC |
| **Frequency** | 60 Hz |
| **Phase** | 240 VAC: 2W+N+GND |
| **Maximum Continuous Power On-Grid** | 7.6 kVA full sun / 5.8 kVA no sun[1] |
| **Maximum Continuous Power Off-Grid** | 9.6 kW full sun / 7 kW no sun[1] |
| **Peak Off-Grid Power (10 s)** | 22 kW full sun / 10 kW no sun[1] |
| **Maximum Continuous Current On-Grid** | 32 A output |
| **Maximum Continuous Current Off-Grid** | 40 A output |
| **Load Start Capability** | 98 - 118 A LRA[2] |
| **PV Maximum Input Voltage** | 600 VDC |
| **PV DC Input Voltage Range** | 60 - 550 VDC |
| **PV DC MPPT Voltage Range** | 60 - 480 VDC |
| **MPPTs** | 4 |
| **Input Connectors per MPPT** | 1-2-1-2 |
| **Maximum Current per MPPT ($I_{mp}$)** | 13 A[3] |
| **Maximum Short Circuit Current per MPPT ($I_{sc}$)** | 17 A[3] |
| **Allowable DC/AC Ratio** | 1.7 |
| **Overcurrent Protection Device** | 50 A breaker |
| **Maximum Supply Fault Current** | 10 kA |
| **Output Power Factor Rating** | +/- 0.9 to 1[4] |
| **Round Trip Efficiency** | 90%[1,5] |
| **Solar Generation CEC Efficiency** | 97.5% at 208 V<br>98.0% at 240 V |
| **Customer Interface** | Tesla Mobile App |
| **Internet Connectivity** | Wi-Fi, Ethernet, Cellular LTE/4G)[6] |
| **PV AC Metering** | Revenue grade (+/-0.5%) |
| **Protections** | Integrated arc fault circuit interrupter (AFCI), PV Rapid Shutdown |
| **Warranty** | 10 years |

## COMPLIANCE INFORMATION

| | |
|---|---|
| **PV Certifications** | UL 1699B, UL 1741, UL 3741, UL 1741 SA, UL 1998 (US), IEEE 1547, IEEE 1547.1 |
| **Battery Energy Storage System Certifications** | UL 1642, UL 1741, UL 1741 PCS, UL 1741 SA, UL 1973, UL 9540, IEEE 1547, IEEE 1547.1, UN 38.3 |
| **Grid Connection** | United States |
| **Emissions** | FCC Part 15 Class B |
| **Environmental** | RoHS Directive 2011/65/EU |
| **Seismic** | AC156, IEEE 693-2005 (high) |

## MECHANICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions** | 1596 x 755 x 160 mm (62.8 x 29.7 x 6.3 in) |
| **Total Weight** | 140 kg (310 lb)[7] |
| **Battery Assembly** | 118 kg (261 lb) |
| **Solar Assembly** | 22 kg (49 lb) |
| **Mounting options** | Floor or wall mount |




## ENVIRONMENTAL SPECIFICATIONS

| | |
|---|---|
| **Operating Temperature** | -20°C to 50°C (-4°F to 122°F)[8] |
| **Recommended Temperature** | 0°C to 30°C (32°F to 86°F) |
| **Operating Humidity (RH)** | Up to 100%, condensing |
| **Storage Conditions** | -20°C to 30°C (-4°F to 86°F)<br>Up to 95% RH, non-condensing<br>State of Energy (SoE): 25% initial |
| **Maximum Elevation** | 3000 m (9843 ft) |
| **Environment** | Indoor and outdoor rated |
| **Enclosure Type** | Type 3R |
| **Solar Assembly Ingress Rating** | IP55 (Wiring Compartment) |
| **Battery Assembly Ingress Rating** | IP56 (Wiring Compartment)<br>IP67 (Battery & Power Electronics) |
| **Noise Level @ 1 m** | < 40 db(A) optimal,<br>< 50 db(A) maximum |

[1]Values provided for 25°C (77°F), 3.3 kW charge/discharge power.
[2]Load start capability may vary.
[3]Where the DC input current exceeds an MPPT rating, jumpers can be used to allow a single MPPT to intake additional DC current up to 26 A $I_{mp}$ / 34 A $I_{sc}$.
[4]Power factor rating at max real power.
[5]AC to battery to AC, at beginning of life.
[6]Cellular connectivity subject to network service coverage and signal strength.
[7]The total weight does not include the Powerwall+ bracket, which weighs an additional 9 kg (20 lb).
[8]Performance may be de-rated at operating temperatures below 10°C (50°F) or greater than 43°C (109°F).



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**BATTERY SPEC SHEET**

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| REVIEWED BY: | SCP |

**SPECS-6**

**ENGINEERED PLANS COMPLETED BY ENGINEERS IN THE USA**