

PHOTOVOLTAIC ROOF MOUNT SYSTEM

29 MODULES - SYSTEM SIZE STC (11.165 KW DC / 8.41 KW AC)
 125 LETCHER LANE, LILLINGTON, NC 27546, USA (35.3894293, -78.951915)

SYSTEM SUMMARY STC DC/AC (11.165 KW DC / 8.41 KW AC)

- 2X CIRCUITS OF 10 CONNECTED IN PARALLEL
- 1X CIRCUIT OF 9 CONNECTED IN PARALLEL
- (29) MISSION SOLAR ENERGY MSE385SX5R 385W MODULES
- (29) ENPHASE IQ8PLUS-72-2-US MICROINVERTERS
- STC DC: (29) 385 = 11.165 KW
- STC AC: (29) 290 = 8.41 KW

GOVERNING CODES

- 2018 NORTH CAROLINA STATE BUILDING CODE
- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL RESIDENTIAL CODE
- 2018 INTERNATIONAL FIRE CODE
- 2020 NATIONAL ELECTRICAL CODE

GENERAL NOTES

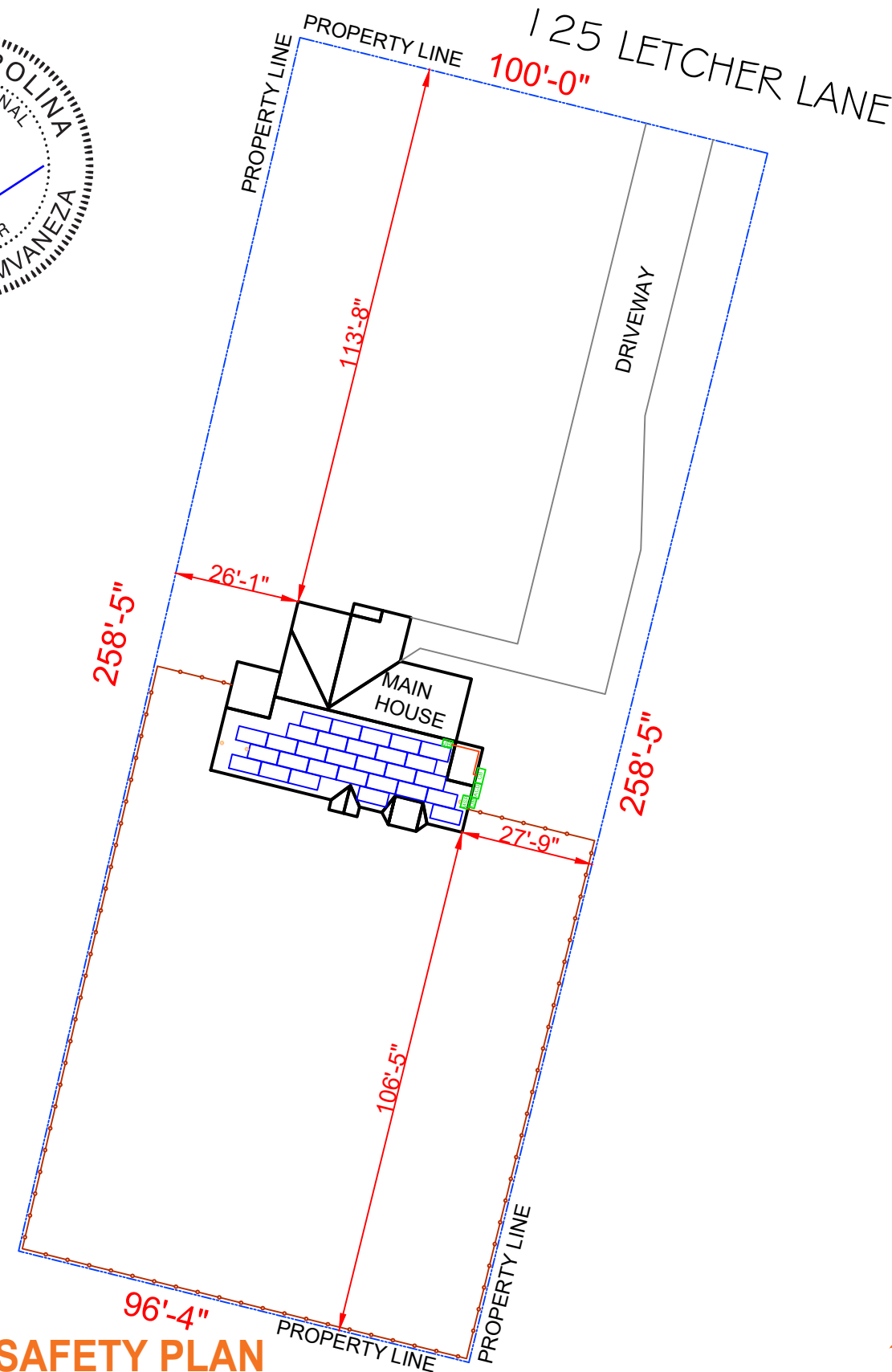
- 1) ALL PANELS, SWITCHES, ETC. SHALL HAVE SUFFICIENT GUTTER SPACE AND LUGS IN COMPLIANCE WITH UL REQUIREMENTS TO ACCOMMODATE CONDUCTORS SHOWN.
- 2) THIS SYSTEM WILL NOT BE INTERCONNECTED UNTIL APPROVAL FROM THE LOCAL JURISDICTION AND UTILITY IS OBTAINED.
- 3) ALL EXTERIOR ELECTRICAL DEVICES AND EQUIPMENT INCLUDING THOSE THAT ARE EXPOSED TO OUTSIDE ENVIRONMENT SHALL BE WEATHERPROOF AND SHALL BE LISTED BY 'UL' FOR THE TYPE OF APPLICATION AND 'UL' LABEL SHALL APPEAR ON ALL ELECTRICAL EQUIPMENT.
- 4) WIRING METHOD SHALL BE EMT ABOVE GROUND MOUNTED IN CONCEALED SPACES (UNLESS APPROVED OTHERWISE) AND SCHEDULE-40 PVC FOR BELOW GROUND INSTALLATIONS UNLESS NOTED OTHERWISE.
- 5) AN OSHA APPROVED LADDER PROVIDING ACCESS TO ALL PORTIONS OF THE ARRAY SHALL BE SECURED IN PRIOR TO REQUESTING INSPECTION.
- 6) IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL A SUPPLEMENTAL GROUNDING ELECTRODE CONDUCTOR IF NECESSARY.

SAFETY PLAN NOTES

- INSTALLERS SHALL DRAW IN DESIGNATED SAFETY AREA AROUND HOME.
- INSTALLERS SHALL UPDATE NAME, ADDRESS AND PHONE NUMBER OF NEAREST URGENT CARE FACILITY RELATIVE TO THE SITE BEFORE STARTING WORK.

LOCATION OF NEAREST URGENT CARE FACILITY

- (FOR INSTALLER USE ONLY)
- NAME:
 - ADDRESS:
 - PHONE NUMBER:



SITE PLAN & SAFETY PLAN
 SCALE: 1/32" = 1'

| LEGEND | |
|--------|-------------------------------------|
| | PV MODULE |
| | DIMENSIONS |
| | CONDUIT |
| | PROPERTY LINE |
| | DRIVEWAY |
| | FENCE |
| | MAIN SERVICE PANEL (EXISTING, 200A) |
| | UTILITY METER (EXISTING) |
| | PRODUCTION METER (N/A) |
| | BATTERY (N/A) |
| | (0) INVERTER (N/A) |
| | COMBINER BOX (NEW) |
| | SOLAREGE METER (N/A) |
| | BACKUP LOAD PANEL (N/A) |
| | AC DISCONNECT UNFUSED (NEW) |
| | AC DISCONNECT FUSED (N/A) |
| | JUNCTION BOX (NEW) |
| | AUTO TRANSFORMER (N/A) |
| | SUBPANEL (N/A) |
| | DC DISCONNECT (N/A) |
| | DC COMBINER (N/A) |
| | EXISTING EQUIPMENT |

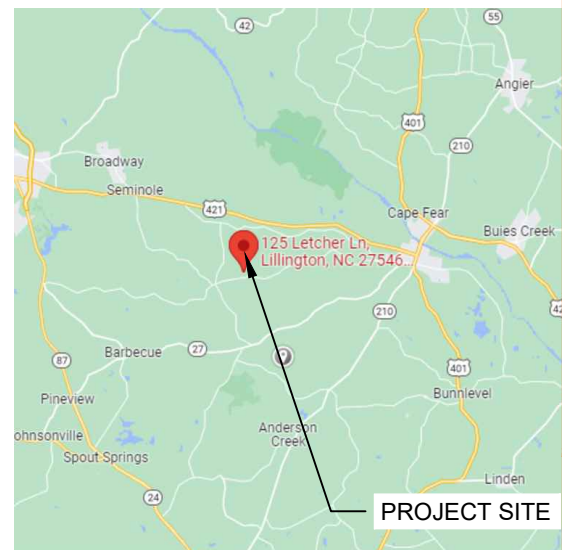
SHEET INDEX

- PV-1 COVER PAGE
- PV-2 ROOF PLAN WITH MODULES
- PV-3 ATTACHMENT DETAIL
- PV-4 SINGLE LINE DIAGRAM
- PV-5 WIRING CALCULATION
- PV-6 PLACARDS
- PV-7+ EQUIPMENT SPECIFICATION

AHJ: HARNETT (COUNTY OF),
 NORTH CAROLINA
 UTILITY: DUKE ENERGY
 (PROGRESS ENERGY CAROLINAS INC)



HOUSE PHOTO
 SCALE: NTS



VICINITY MAP
 SCALE: NTS



CONTRACTOR

NAME: TOP TIER SOLAR SOLUTIONS
 ADDRESS: 1530 CENTER PARK DR,
 CHARLOTTE, NC 28217, USA
 PHONE: 855-997-1213
 LICENSE #: SC - CLG.123883
 ELECTRICAL LICENSE #: NC - 87345
 EMAIL ID:
 BDUNFORD@TOPTIERSOLARSOLUTIONS.COM

REVISIONS

| DESCRIPTION | DATE | REV |
|-------------|------|-----|
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| | | |
| | | |

SIGNATURE & SEAL

HOMEOWNER INFO

MATTHEW RIDGLEY
 125 LETCHER LN, LILLINGTON,
 NC 27546, USA

APN: 7272873
 EMAIL: -
 PHONE: -

SHEET NAME

COVER PAGE

SHEET SIZE

ANSI B
 11" X 17"

SHEET NUMBER

PV-1



MODULE AREA & WEIGHT CALCULATIONS

PANEL TYPES (COUNT, AREA, WEIGHT):
 - (29X) MISSION SOLAR ENERGY MSE385SX5R 385W (75.1" X 41.1", 49 LBS)
 MICRO-INVERTER TYPES (COUNT, WEIGHT):
 - (29X) ENPHASE IQ8PLUS-72-2-US (2.38 LBS)
 ATTACHMENT COUNT: 104
 MOUNTING SYSTEM WEIGHT/MODULE: 1.5 LBS
 TOTAL ROOF AREA: 2030 SF
 TOTAL ARRAY AREA: (29) 75.1" X 41.1" = 621.61 SF
 TOTAL ARRAY WEIGHT: (29) 49.0 + (29) 2.4 + (29) 1.5 = 1534 LBS
 WEIGHT AT EACH CONNECTION: 1534 LBS / 104 = 14.75 LBS
 DISTRIBUTED LOAD: 1534 LBS / 621.61 SF = 2.47 PSF
 ROOF AREA COVERED BY ARRAY: 621.61 SF / 2030 SF = 31.97%

| BILL OF MATERIALS | | |
|-------------------|-----|---|
| SOLAR PV MODULES | 29 | MISSION SOLAR ENERGY MSE385SX5R 385W |
| MICRO INVERTERS | 29 | ENPHASE IQ8PLUS-72-2-US |
| LOAD CENTER | 01 | AC COMBINER PANEL (MIN RATING 35A) |
| AC DISCONNECT | 01 | PV VISIBLE LOCKABLE LABELED DISCONNECT (60A UNFUSED 1PH 240VAC) |
| ATTACHMENTS | 104 | IRONRIDGE - SLOTTED L-FEET |
| RAIL | 20 | IRONRIDGE RESOURCES - XR10 |
| RAIL SPLICE | 22 | RAIL SPLICE |
| MID CLAMP | 44 | MID CLAMP |
| END CLAMP | 28 | END CLAMP |
| GROUNDING LUG | 07 | GROUNDING LUG |

| ROOF DESCRIPTION TABLE | | | | | | |
|------------------------|------------|---------------|--------------|------------|---------|-------------------------|
| ROOF PLANE | TRUSS SIZE | TRUSS SPACING | MODULE COUNT | ARRAY TILT | AZIMUTH | MAX. ATTACHMENT SPACING |
| #1 | 2" x 4" | 24" O.C. | 29 | 30° | 196° | 48" |

DESIGN CRITERIA

EXPOSURE CATEGORY = C
 WIND SPEED = 117 MPH
 SNOW LOAD = 15 PSF



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Signed : 10/17/2022

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SHEET NAME

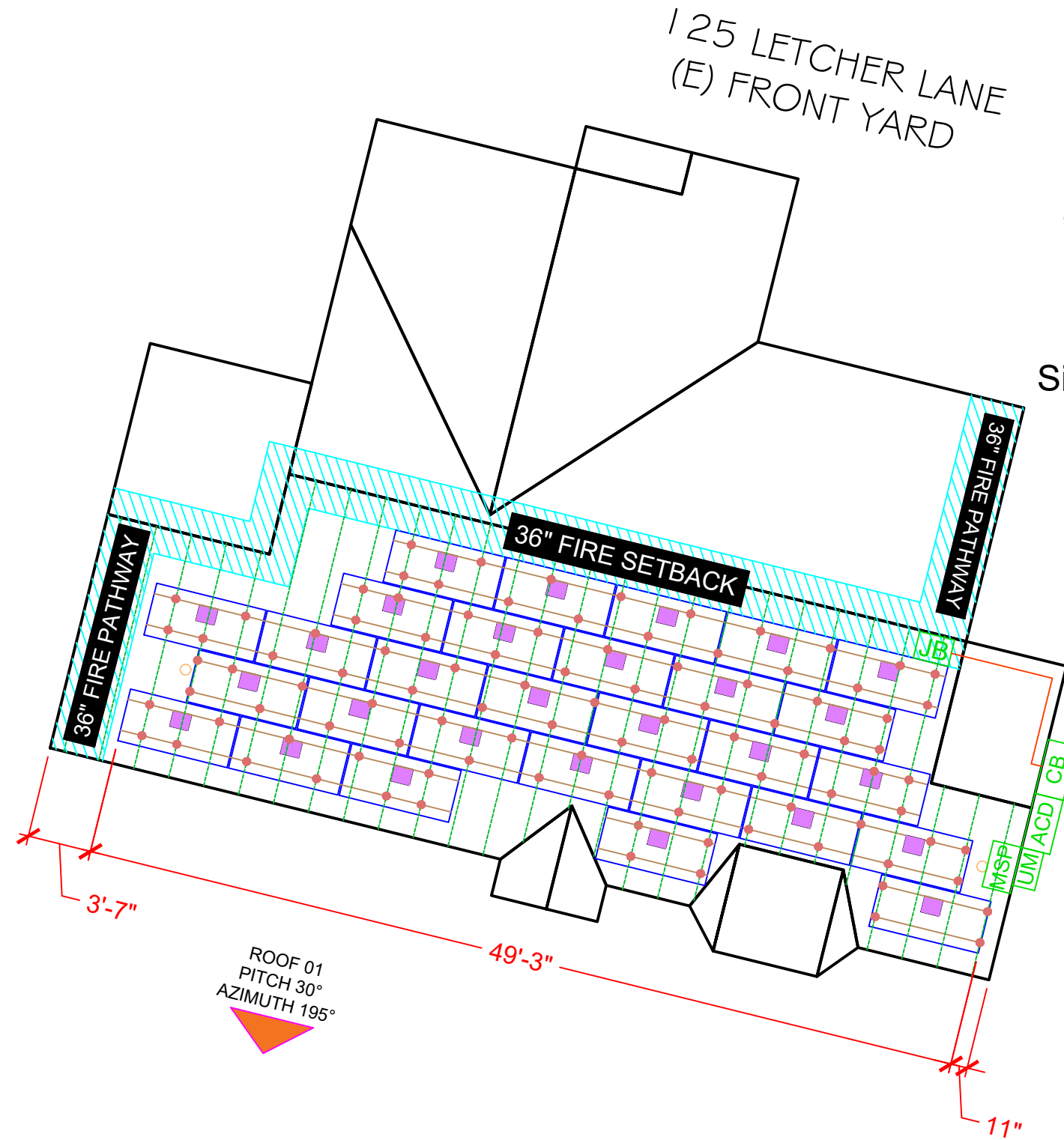
ROOF PLAN WITH MODULES

SHEET SIZE

ANSI B
 11" X 17"

SHEET NUMBER

PV-2



LEGEND

- PV MODULE
- MICRO-INVERTER
- ROOF ATTACHMENT
- // DIMENSIONS
- RAFTER
- RAIL
- CONDUIT

| | |
|---|---|
| <ul style="list-style-type: none"> MSP MAIN SERVICE PANEL (EXISTING, 200A) UM UTILITY METER (EXISTING) PM PRODUCTION METER (N/A) BAT BATTERY (N/A) INV (0) INVERTER (N/A) CB COMBINER BOX (NEW) SM SOLAREGE METER (N/A) BLP BACKUP LOAD PANEL (N/A) | <ul style="list-style-type: none"> ACD AC DISCONNECT UNFUSED (NEW) ACF AC DISCONNECT FUSED (N/A) JB JUNCTION BOX (NEW) AT AUTO TRANSFORMER (N/A) SUB SUBPANEL (N/A) DCD DC DISCONNECT (N/A) DCC DC COMBINER (N/A) EE EXISTING EQUIPMENT |
|---|---|

ROOF PLAN WITH MODULES
 SCALE: 1/8" = 1'-0"





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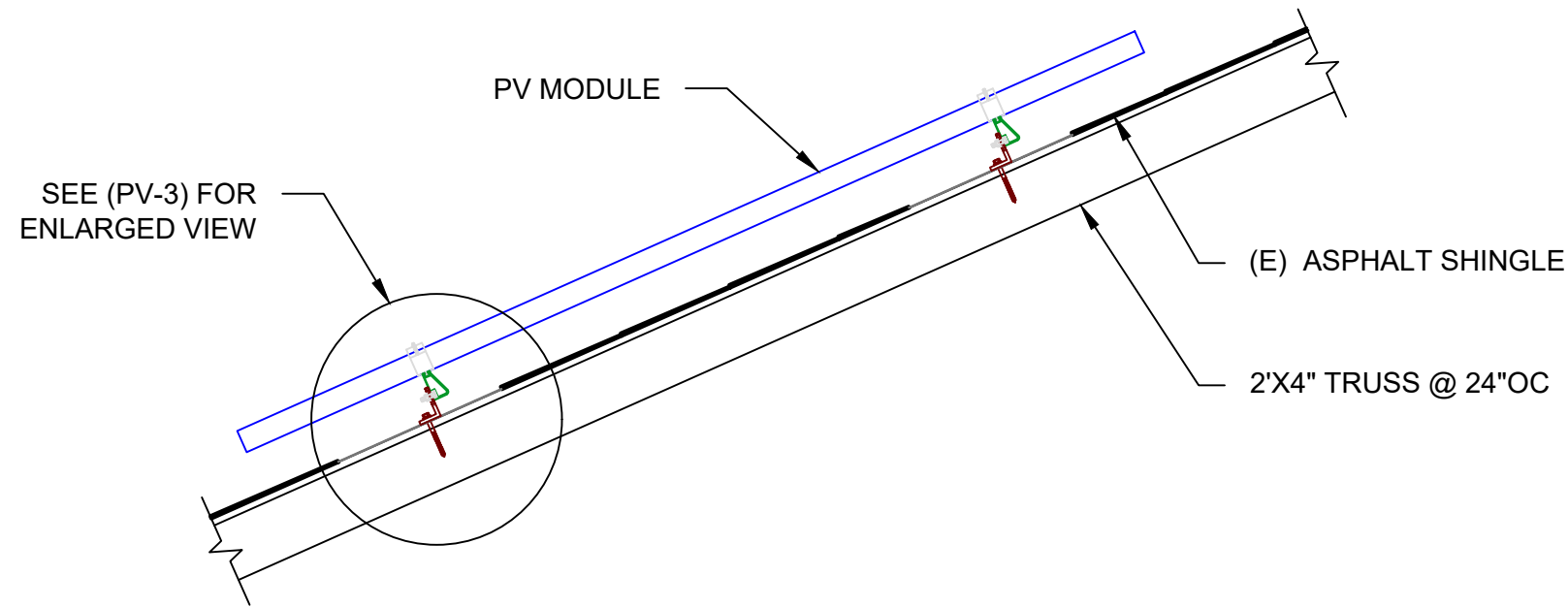
ATTACHMENT
DETAIL

SHEET SIZE

ANSI B
11" X 17"

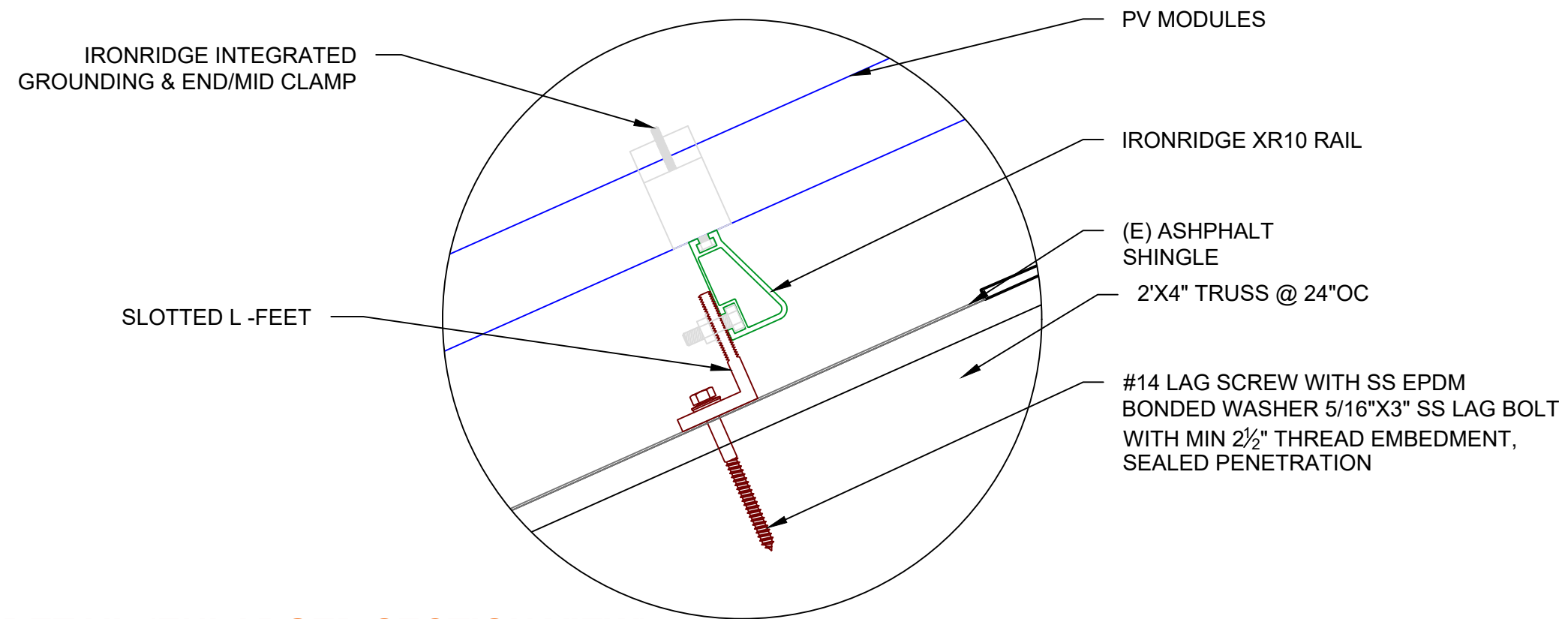
SHEET NUMBER

PV-3



Signed : 10/17/2022

ATTACHMENT DETAIL
SCALE: NTS



ATTACHMENT DETAIL (ENLARGED SECTION VIEW)
SCALE: NTS

SYSTEM SUMMARY STC DC/AC (11.165 kW DC / 8.41 kW AC)

- 2x CIRCUITS OF 10 CONNECTED IN PARALLEL
- 1x CIRCUIT OF 9 CONNECTED IN PARALLEL
- (29) MISSION SOLAR ENERGY MSE385SX5R 385W MODULES
- (29) ENPHASE IQ8PLUS-72-2-US MICROINVERTERS
- STC DC: (29) 385 = 11.165 kW
- STC AC: (29) 290 = 8.41 kW

NOTE:

- ALL GROUNDING TO COMPLY WITH NEC 690.47.
- ROOF TOP CONDUIT SHALL BE LOCATED MIN. 7/8" ABOVE ROOF SURFACE.
- ALL TERMINALS SHALL BE MIN. 75 DEG. C RATED.



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SHEET NAME

SINGLE LINE DIAGRAM

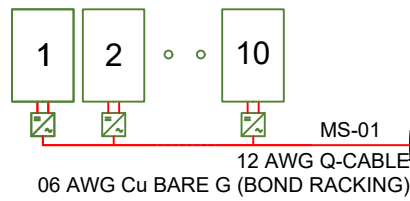
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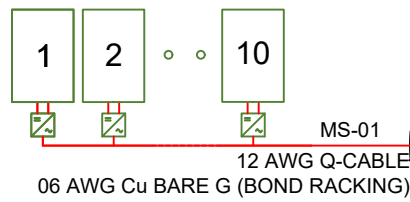
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PV-4

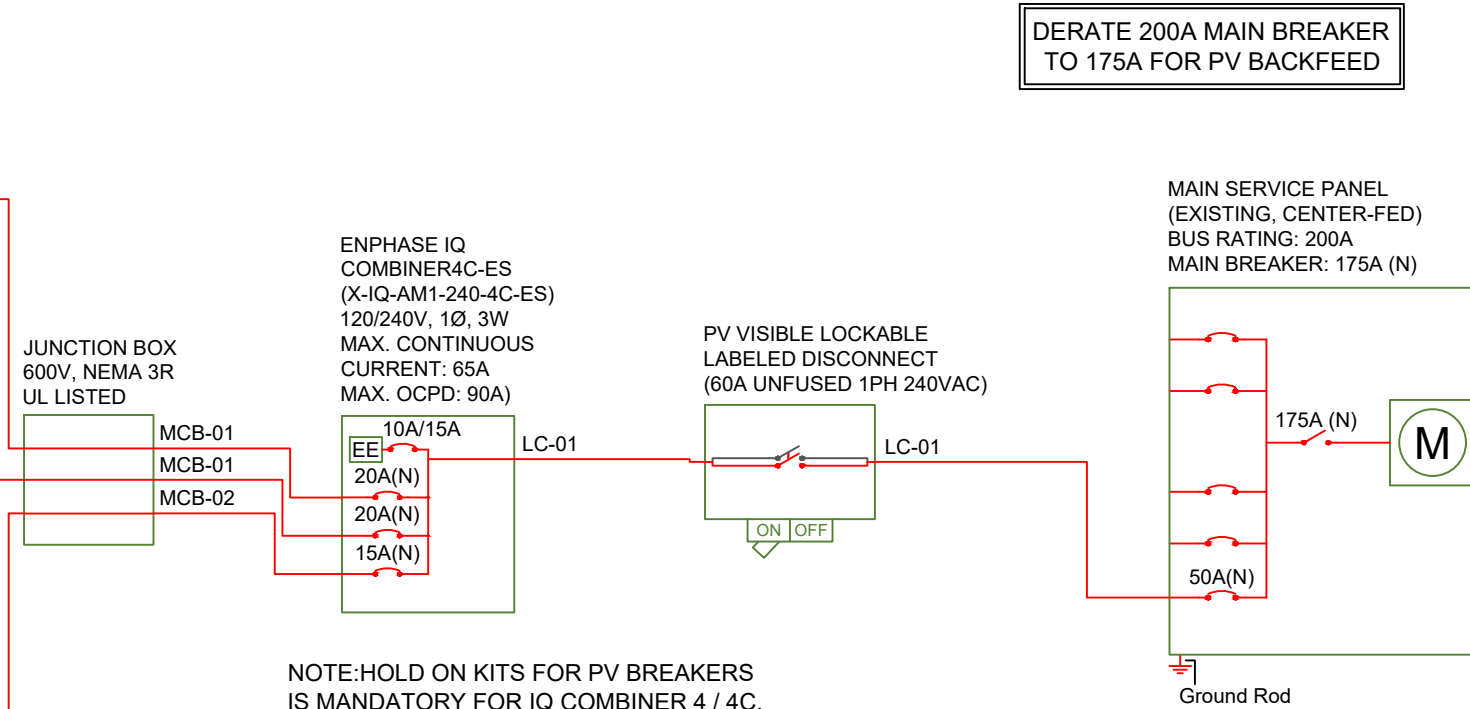
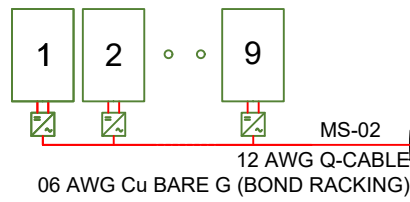
MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 CIRCUIT X 10 MICRO-INV)



MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 CIRCUIT X 10 MICRO-INV)



MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 CIRCUIT X 9 MICRO-INV)



DERATE 200A MAIN BREAKER TO 175A FOR PV BACKFEED

ENPHASE IQ COMBINER4C-ES (X-IQ-AM1-240-4C-ES)
 120/240V, 1Ø, 3W
 MAX. CONTINUOUS CURRENT: 65A
 MAX. OCPD: 90A

JUNCTION BOX 600V, NEMA 3R UL LISTED

PV VISIBLE LOCKABLE LABELED DISCONNECT (60A UNFUSED 1PH 240VAC)

MAIN SERVICE PANEL (EXISTING, CENTER-FED)
 BUS RATING: 200A
 MAIN BREAKER: 175A (N)

UTILITY METER
 UTILITY: DUKE ENERGY (PROGRESS ENERGY CAROLINAS INC)
 SERVICE: 240V 60HZ 1P
 TO UTILITY GRID

NOTE:HOLD ON KITS FOR PV BREAKERS IS MANDATORY FOR IQ COMBINER 4 / 4C.

NOTE:HOLD DOWN KIT BRHDK125 IS NEEDED PER NEC 710.15 FOR PV BREAKER FOR ALL IQ 8 SERIES MIRCO INVERTERS FAMILY

| AC wire details | | | | | | | |
|-----------------|--------------|-------------------|---------------|------------------------------|---------|---------|---------|
| Wire | Min Ampacity | Live | Neutral | Ground | Min EMT | Min PVC | Min RMC |
| MS-01 | 15.13A | 12 AWG (Q-Cable) | - | 06 AWG BARE (NOT IN CONDUIT) | - | - | - |
| MS-02 | 13.61A | 12 AWG (Q-Cable) | - | 06 AWG BARE (NOT IN CONDUIT) | - | - | - |
| MCB-01 | 15.13A | (2) 10 AWG THWN-2 | 10 AWG THWN-2 | 10 AWG THWN-2 | 0.50 in | 0.50 in | 0.50 in |
| MCB-02 | 13.61A | (2) 10 AWG THWN-2 | 10 AWG THWN-2 | 10 AWG THWN-2 | 0.50 in | 0.50 in | 0.50 in |
| LC-01 | 43.86A | (2) 06 AWG THWN-2 | 06 AWG THWN-2 | 10 AWG THWN-2 | 0.75 in | 0.75 in | 0.75 in |

INTERCONNECTION 120% RULE (MAIN PANEL)

UTILITY FEED + TOTAL BACKFEED
 175A + 50A = 225A
 LESS OR EQUAL TO
 BUS RATING x 120%
 200A x 120% = 240A

CALCULATION ENSURES BUS IS SAFE REGARDLESS OF LOADS

EXTREME CASE MODULE OUTPUT (MISSION SOLAR ENERGY MSE385SX5R 385W)

Isc(25°C) = 10.97A, Tisc = 0.039%/°C
 Isc(T) = Isc(25°C) x [1 + Tisc x (T-25°C)]
 Isc(-11°C) = 10.82A, Isc(34°C) = 11.01A
 Voc(25°C) = 45.03V, Tvoc = -0.262%/°C
 Voc(T) = Voc(25°C) x [1 + Tvoc x (T-25°C)]
 Voc(-11°C) = 49.28V, Voc(34°C) = 43.97V

ELECTRICAL SINGLE LINE DIAGRAM

SCALE: NTS

SYSTEM SUMMARY STC DC/AC

(11.165 kW DC / 8.41 kW AC)

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SHEET NAME

WIRING
CALCULATION

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-5

AC wire details

| WireID | #Modules | Nominal Voltage | Backfeed *1.25 /cond. set | Min OCPD | Total Power | Conductor sets | ccConductors /conduit | Expected max temp | Adjusted ampacity (ampacity x temp derate x conduit fill derate) | Conductor & neutral size | EGC size (Cu) | Conductor metal | Max length | V drop | Min EMT size | Min PVC size | Min RMC size |
|--------|----------|-----------------|---------------------------|----------|-------------|----------------|-----------------------|-------------------|--|--------------------------|------------------------------|-----------------|------------|--------|--------------|--------------|--------------|
| MS-01 | 10 | 240 V | 15.13 A | 20 A | 2.9 kW | 1 | 2 | 34 | 25 x 0.94 x 1.00 = 23.50 A | 12 AWG (Q-Cable) | 06 AWG BARE (NOT IN CONDUIT) | Cu | 50 ft | 0.87 % | - | - | - |
| MS-02 | 9 | 240 V | 13.61 A | 15 A | 2.6 kW | 1 | 2 | 34 | 25 x 0.94 x - = 23.50 A | 12 AWG (Q-Cable) | 06 AWG BARE (NOT IN CONDUIT) | Cu | 50 ft | 0.79 % | - | - | - |
| MCB-01 | 10 | 240 V | 15.13 A | 20 A | 2.9 kW | 1 | 2 | 34 | 35 x 0.94 x 1.00 = 32.90 A | 10 AWG THWN-2 | 10 AWG THWN-2 | Cu | 50 ft | 0.52 % | 0.50 in | 0.50 in | 0.50 in |
| MCB-02 | 9 | 240 V | 13.61 A | 15 A | 2.6 kW | 1 | 2 | 34 | 35 x 0.94 x 1.00 = 32.90 A | 10 AWG THWN-2 | 10 AWG THWN-2 | Cu | 50 ft | 0.47 % | 0.50 in | 0.50 in | 0.50 in |
| LC-01 | 29 | 240 V | 43.86 A | 50 A | 8.4 kW | 1 | 2 | 34 | 65 x 0.94 x 1.00 = 61.10 A | 06 AWG THWN-2 | 10 AWG THWN-2 | Cu | 10 ft | 0.12 % | 0.75 in | 0.75 in | 0.75 in |

INTERCONNECTION 120% RULE (MAIN PANEL)

UTILITY FEED + TOTAL BACKFEED
175A + 50A = 225A

LESS OR EQUAL TO
BUS RATING x 120%
200A x 120% = 240A

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Voc(25°C) = 45.03V, Tvoc = -0.262%/°C
Voc(T) = Voc(25°C) x [1 + Tvoc x (T-25°C)]
Voc(-11°C) = 49.28V, Voc(34°C) = 43.97V

ELECTRICAL NOTES

- 1) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- 2) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT.
- 3) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
- 4) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- 5) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- 6) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- 7) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- 8) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- 9) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C.VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
- 10) PV EQUIPMENT SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH NEC 690.
- 11) EXACT LOCATION OF AUXILIARY GROUNDING TO BE DETERMINED AT TIME OF INSTALL.
- 12) EXISTING WIRES MUST BE REPLACED IF SMALLER THAN LISTED MINIMUM SIZES PER NEC 310.15(B)(16).
- 13) AC DISCONNECT LOCATED WITHIN 10' OR LESS FROM UTILITY METER
- 14) IF ENVOY PRESENT, ENVOY BREAKER DETERMINED AT FACTORY BY MANUFACTURER.
- 15) IF ENVOY PRESENT, FOR IQ COMBINER USE SINGLE CT ON L1. AT SYSTEM CONTROLLER MAIN USE DOUBLE CT ON L1 AND L2.

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

LABEL LOCATION: INVERTERS, AC DISCONNECTS, AC COMBINER BOXES, AC JUNCTION BOXES
CODE REF: NEC 2020 - 690.13(B)

2 **WARNING**
ELECTRICAL SHOCK HAZARD
IF GROUND FAULT IS INDICATED ALL NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

LABEL LOCATION: AC DISCONNECTS, AC COMBINER BOXES, SERVICE PANELS
CODE REF: NEC 2020 - 690.5(C)

3 **PV SYSTEM DISCONNECT**
MAXIMUM AC OPERATING CURRENT: 35.09 AMPS
NOMINAL OPERATING AC VOLTAGE: 240.0 VAC

LABEL LOCATION: INTERCONNECTION Placard (MSP BACKFEED BREAKER OR TAP BOX IF LINE SIDE TAP), AC DISCONNECTS
CODE REF: NEC 2020 - 690.54

4 **DO NOT UPSIZE MAIN BREAKER**
BREAKER HAS BEEN DOWNSIZED FOR PV SOLAR SYSTEM CONNECTION

LABEL LOCATION: AC DISCONNECTS FOR UTILITY ACCESS
CODE REF: UTILITY

5 **PHOTOVOLTAIC SYSTEM METER**

LABEL LOCATION: PV PRODUCTION METER
CODE REF: NEC 2020 - 690.4(B)

6 **WARNING**
PHOTOVOLTAIC SYSTEM COMBINER PANEL
DO NOT ADD LOADS

LABEL LOCATION: AC COMBINER BOX
CODE REF: NEC 2020 - 690.12(B)

7 **CAUTION**
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LABEL LOCATION: INTERCONNECTION Placard (MSP BACKFEED BREAKER OR TAP BOX IF LINE SIDE TAP)
CODE REF: NEC 2020 - 705.2(4)

8 **RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

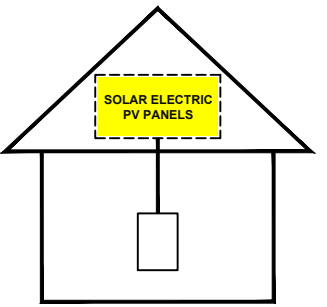
LABEL LOCATION: MSP
CODE REF: NEC 2020 - 690.56(C)(3)

9 **CAUTION**
DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC

LABEL LOCATION: MSP, UTILITY METER (IF SEPARATE)
CODE REF: UTILITY

10 **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.

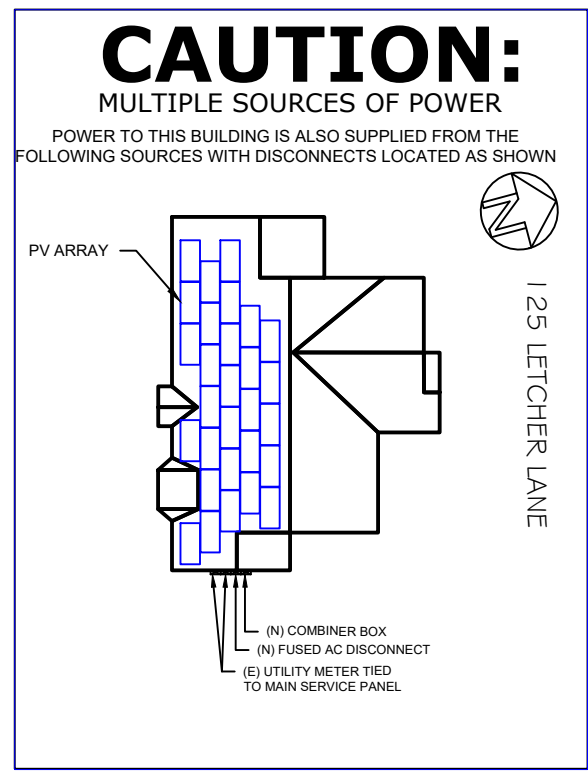


LABEL LOCATION: INTERCONNECTION POINT (MSP OR AC DISCONNECT IF LINE SIDE TAP)
CODE REF: NEC 2020 - 690.12, NEC 2020 - 690.56(C)

11 **DO NOT UPSIZE MAIN BREAKER**
BREAKER HAS BEEN DOWNSIZED FOR PV SOLAR SYSTEM CONNECTION

LABEL LOCATION: MAIN BREAKER DERATE
CODE REF: NEC 2020 - 690.4(B)

NOTES AND SPECIFICATIONS:
SIGNS AND LABELS SHALL MEET THE REQUIREMENTS OF NEC 110.21(B), UNLESS SPECIFIC INSTRUCTIONS ARE REQUIRED BY SECTION 690, OR IF REQUESTED BY THE LOCAL AHJ.
SIGNS AND LABELS SHALL ADEQUATELY WARN OF HAZARDS USING EFFECTIVE WORDS, COLORS AND SYMBOLS.
LABELS SHALL BE PERMANENTLY AFFIXED TO THE EQUIPMENT OR WIRING METHOD AND SHALL NOT BE HAND WRITTEN.
LABEL SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
SIGNS AND LABELS SHALL COMPLY WITH ANSI Z535.4 - 2011, PRODUCT SAFETY SIGNS AND LABELS, UNLESS OTHERWISE SPECIFIED.
DO NOT COVER EXISTING MANUFACTURER LABELS.



12
LABEL LOCATION: MSP
CODE REF: NEC 2020 - 705.10



CONTRACTOR
NAME: TOP TIER SOLAR SOLUTIONS
ADDRESS: 1530 CENTER PARK DR, CHARLOTTE, NC 28217, USA
PHONE: 855-997-1213
LICENSE #: SC - CLG.123883
ELECTRICAL LICENSE #: NC - 87345
EMAIL ID: BDUNFORD@TOPTIERSOLARSOLUTIONS.COM

REVISIONS

| DESCRIPTION | DATE | REV |
|-------------|------|-----|
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SIGNATURE & SEAL

HOMEOWNER INFO
MATTHEW RIDGLEY
125 LETCHER LN, LILLINGTON, NC 27546, USA

APN: 7272873
EMAIL: -
PHONE: -

SHEET NAME
PLACARDS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-6

MSE PERC 66

MISSION SOLAR ENERGY

385W

Class leading power output -0 to +3%

Positive Power Tolerance

True American Quality True American Brand

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

Demand the best. Demand Mission Solar Energy.



Certified Reliability

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



Advanced Technology

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



Extreme Weather Resilience

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



BAA Compliant for Government Projects

- Buy American Act
- American Recovery & Reinvestment Act

FRAME-TO-FRAME WARRANTY

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

CERTIFICATIONS



UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

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

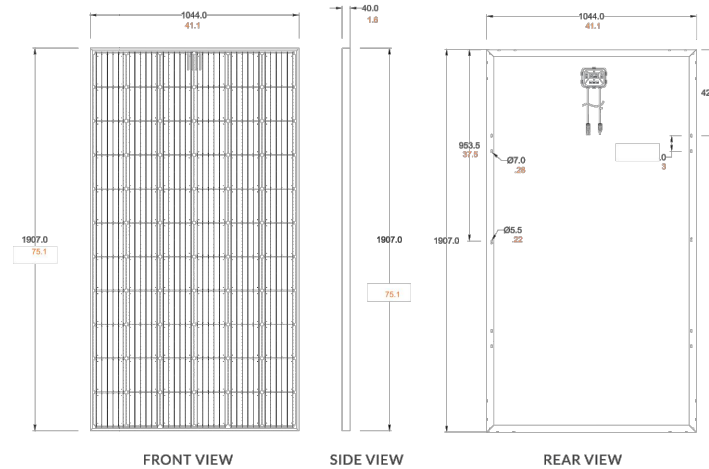


Class Leading
375-385W

MSE PERC 66

BASIC DIMENSIONS

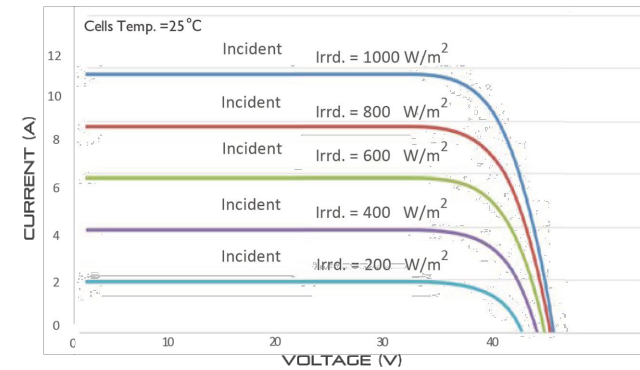
[UNITS: MM/IN]



CURRENT-VOLTAGE CURVE

MSE385SX5R: 385WP, 66 CELL SOLAR MODULE

Current-voltage characteristics with dependence on irradiance and module temperature



CERTIFICATIONS AND TESTS

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



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.
C-SA2-MKTG-0027 REV 2 05/05/2021

ELECTRICAL SPECIFICATION

| PRODUCT TYPE | MSE _{xxx} SX5R (xxx = P _{max}) | | |
|-----------------------|---|----------------|-------------------|
| Power Output | P _{max} | W _p | 375 380 385 |
| Module Efficiency | % | | 18.8 19.1 19.3 |
| Tolerance | % | | 0/+3 0/+3 0/+3 |
| Short Circuit Current | I _{sc} | V | 10.85 10.91 10.97 |
| Open Circuit Voltage | V _{oc} | A | 44.64 44.84 45.03 |
| Rated Current | I _{mp} | V | 10.26 10.34 10.42 |
| Rated Voltage | V _{mp} | V | 36.56 36.75 36.93 |
| Fuse Rating | A | | 20 20 20 |
| System Voltage | V | | 1,000 1,000 1,000 |

TEMPERATURE COEFFICIENTS

| | |
|---|-----------------|
| Normal Operating Cell Temperature (NOCT) | 44.43°C (±3.7%) |
| Temperature Coefficient of P _{max} | -0.361%/°C |
| Temperature Coefficient of V _{oc} | -0.262%/°C |
| Temperature Coefficient of I _{sc} | 0.039%/°C |

OPERATING CONDITIONS

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

MECHANICAL DATA

| | |
|------------------|--|
| Solar Cells | P-type mono-crystalline silicon |
| Cell Orientation | 66 cells (6x11) |
| Module Dimension | 1,907mm x 1,044mm x 40mm |
| Weight | 22 kg (49 lbs.) |
| Front Glass | 3.2mm, tempered, low-iron, anti-reflective |
| Frame | Anodized |
| Encapsulant | Ethylene vinyl acetate (EVA) |
| Junction Box | Protection class IP67 with 3 bypass-diodes |
| Cable | 1.0m, Wire 4mm ² (12AWG) |
| Connector | Staubli PV-KBT4/6II-UR and PV-KST4/6II-UR, MC4, Renhe 05-8 |

SHIPPING INFORMATION

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

PALLET [26 PANELS]

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

TOP TIER SOLAR SOLUTIONS

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SHEET NUMBER

PV-7



IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.



Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.



IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.



Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.



IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer's instructions.

Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produce power even when the grid is down
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

IQ8 and IQ8+ Microinverters

| INPUT DATA (DC) | | IQ8 - 60 - 2 - US | IQ8PLUS-72-2-US |
|--|----|---|---|
| Commonly used module pairings ¹ | W | 235 – 350 | 235 – 440 |
| Module compatibility | | 60-cell/120 half-cell | 60-cell/120 half-cell and 72-cell/144 half-cell |
| MPPT voltage range | V | 27 – 37 | 29 – 45 |
| Operating range | V | 25 – 48 | 25 – 58 |
| Min/max start voltage | V | 30 / 48 | 30 / 58 |
| Max input DC voltage | V | 50 | 60 |
| Max DC current ² [module Isc] | A | | 15 |
| Overvoltage class DC port | | | II |
| DC port backfeed current | mA | | 0 |
| PV array configuration | | 1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit | |
| OUTPUT DATA (AC) | | IQ8 - 60 - 2 - US | IQ8PLUS-72-2-US |
| Peak output power | VA | 245 | 300 |
| Max continuous output power | VA | 240 | 290 |
| Nominal (L-L) voltage/range ³ | V | 240 / 211 – 264 | |
| Max continuous output current | A | 10 | 1.21 |
| Nominal frequency | Hz | 60 | |
| Extended frequency range | Hz | 50 – 68 | |
| Max units per 20 A (L-L) branch circuit ⁴ | | 16 | 13 |
| Total harmonic distortion | | <5% | |
| Overvoltage class AC port | | III | |
| AC port backfeed current | mA | 30 | |
| Power factor setting | | 1.0 | |
| Grid-tied power factor (adjustable) | | 0.85 leading – 0.85 lagging | |
| Peak efficiency | % | 97.5 | 97.6 |
| CEC weighted efficiency | % | 97 | 97 |
| Night-time power consumption | mW | 60 | |
| MECHANICAL DATA | | | |
| Ambient temperature range | | -40°C to +60°C (-40°F to +140°F) | |
| Relative humidity range | | 4% to 100% (condensing) | |
| DC Connector type | | MC4 | |
| Dimensions (HxWxD) | | 212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2") | |
| Weight | | 1.08 kg (2.38 lbs) | |
| Cooling | | Natural convection – no fans | |
| Approved for wet locations | | Yes | |
| Acoustic noise at 1m | | <60 dBA | |
| Pollution degree | | PD3 | |
| Enclosure | | Class II double-insulated, corrosion resistant polymeric enclosure | |
| Environ. category / UV exposure rating | | NEMA Type 6 / outdoor | |
| COMPLIANCE | | | |
| Certifications | | CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 | |
| | | This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions. | |

(1) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

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ANSI B 11" X 17"

SHEET NUMBER

PV-8

Enphase IQ Combiner 4/4C

X-IQ-AM1-240-4
X-IQ-AM1-240-4C



The **Enphase IQ Combiner 4/4C** with IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure and streamlines IQ microinverters and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

Smart

- Includes IQ Gateway for communication and control
- Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), included only with IQ Combiner 4C
- Includes solar shield to match Enphase IQ Battery aesthetics and deflect heat
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

Simple

- Centered mounting brackets support single stud mounting
- Supports bottom, back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80A total PV or storage branch circuits

Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the IQ Combiner SKU's
- UL listed

Enphase IQ Combiner 4/4C

| MODEL NUMBER | |
|---|--|
| IQ Combiner 4 (X-IQ-AM1-240-4) | IQ Combiner 4 with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery system and IQ System Controller 2 and to deflect heat. |
| IQ Combiner 4C (X-IQ-AM1-240-4C) | IQ Combiner 4C with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat. |
| ACCESSORIES AND REPLACEMENT PARTS (not included, order separately) | |
| Ensemble Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05 | - Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan |
| Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B | Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support |
| EPLC-01 | Power line carrier (communication bridge pair), quantity - one pair |
| XA-SOLARSHIELD-ES | Replacement solar shield for IQ Combiner 4/4C |
| XA-PLUG-120-3 | Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01) |
| XA-ENV-PCBA-3 | Replacement IQ Gateway printed circuit board (PCB) for Combiner 4/4C |
| X-IQ-NA-HD-125A | Hold down kit for Eaton circuit breaker with screws. |
| ELECTRICAL SPECIFICATIONS | |
| Rating | Continuous duty |
| System voltage | 120/240 VAC, 60 Hz |
| Eaton BR series busbar rating | 125 A |
| Max. continuous current rating | 65 A |
| Max. continuous current rating (input from PV/storage) | 64 A |
| Max. fuse/circuit rating (output) | 90 A |
| Branch circuits (solar and/or storage) | Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included) |
| Max. total branch circuit breaker rating (input) | 80A of distributed generation / 95A with IQ Gateway breaker included |
| IQ Gateway breaker | 10A or 15A rating GE/Siemens/Eaton included |
| Production metering CT | 200 A solid core pre-installed and wired to IQ Gateway |
| Consumption monitoring CT (CT-200-SPLIT) | A pair of 200 A split core current transformers |
| MECHANICAL DATA | |
| Dimensions (WxHxD) | 37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"). Height is 21.06" (53.5 cm) with mounting brackets. |
| Weight | 7.5 kg (16.5 lbs) |
| Ambient temperature range | -40° C to +46° C (-40° to 115° F) |
| Cooling | Natural convection, plus heat shield |
| Enclosure environmental rating | Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction |
| Wire sizes | <ul style="list-style-type: none"> • 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing. |
| Altitude | Up to 3000 meters (9,842 feet) |
| INTERNET CONNECTION OPTIONS | |
| Integrated Wi-Fi | 802.11b/g/n |
| Cellular | CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations. |
| Ethernet | Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included) |
| COMPLIANCE | |
| Compliance, IQ Combiner | UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5 |
| Compliance, IQ Gateway | UL 60601-1/CANCSA 22.2 No. 61010-1 |

To learn more about Enphase offerings, visit enphase.com

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To learn more about Enphase offerings, visit enphase.com



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SPECIFICATION

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PV-9

Datasheet




Flush Mount System




Built for solar's toughest roofs.


IronRidge builds the strongest mounting system for pitched roofs in solar. Every component has been tested to the limit and proven in extreme environments.


Our rigorous approach has led to unique structural features, such as curved rails and reinforced flashings, and is also why our products are fully certified, code compliant and backed by a 20-year warranty.


Strength Tested
 All components evaluated for superior structural performance.

PE Certified
 Pre-stamped engineering letters available in most states.

Class A Fire Rating
 Certified to maintain the fire resistance rating of the existing roof.

Design Assistant
 Online software makes it simple to create, share, and price projects.

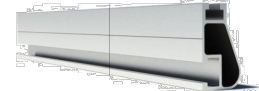
UL 2703 Listed System
 Entire system and components meet newest effective UL 2703 standard.

20-Year Warranty
 Twice the protection offered by competitors.

Datasheet

XR Rails

XR10 Rail



A low-profile mounting rail for regions with light snow.

- 6' spanning capability
- Moderate load capability
- Clear and black finish

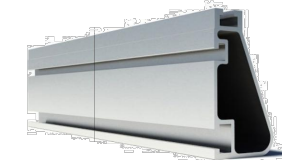
XR100 Rail



The ultimate residential solar mounting rail.

- 8' spanning capability
- Heavy load capability
- Clear and black finish

XR1000 Rail



A heavyweight mounting rail for commercial projects.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish

Bonded Splices

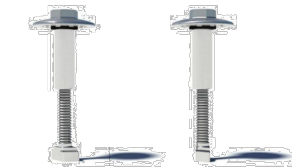


All rails use internal splices for seamless connections.

- Self-drilling screws
- Varying versions for rails
- Forms secure bonding

Clamps & Grounding

UFOs



Universal Fastening Objects bond modules to rails.

- Fully assembled & lubed
- Single, universal size
- Clear and black finish

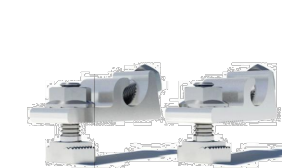
Stopper Sleeves



Snap onto the UFO to turn into a bonded end clamp.

- Bonds modules to rails
- Sized to match modules
- Clear and black finish

Grounding Lugs



Connect arrays to equipment ground.

- Low profile
- Single tool installation
- Mounts in any direction

Microinverter Kits



Mount MIs or POs to XR Rails.

- Bonds devices to rails
- Kit comes assembled
- Listed to UL 2703

Attachments

FlashFoot2



Flash and mount XR Rails with superior waterproofing.

- Twist-on Cap eases instal
- Wind-driven rain tested
- Mill and black finish

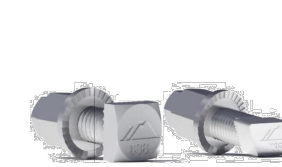
Slotted L-Feet



Drop-in design for rapid rail attachment.

- Secure rail connections
- Slot for vertical adjusting
- Clear and black finish

Bonding Hardware



Bond and attach XR Rails to roof attachments.

- T & Square Bolt options
- Nut uses 7/16" socket
- Assembled and lubricated

Flush Standoffs



Raise Flush Mount System to various heights.

- Works with vent flashing
- 4" and 7" lengths
- Ships assembled

Resources



Design Assistant
 Go from rough layout to fully engineered system. For free.
[Go to IronRidge.com/design](http://IronRidge.com/design)



NABCEP Certified Training
 Earn free continuing education credits, while learning more about our systems.
[Go to IronRidge.com/training](http://IronRidge.com/training)



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