

PHOTOVOLTAIC ROOF MOUNT SYSTEM

36 MODULES - SYSTEM SIZE STC (13.86 KW DC / 10.44 KW AC)

300 BRUCE JOHNSON ROAD, LILLINGTON, NC 27546, USA (35.42909°, -78.801489°)

SYSTEM SUMMARY STC DC/AC (13.86 KW DC / 10.44 KW AC)

- 3X STRINGS OF 12 CONNECTED IN PARALLEL
- (36) MISSION SOLAR ENERGY MSE385SX5R 385W MODULES
- (36) ENPHASE IQ8PLUS-72-2-US MICROINVERTERS
- STC DC: (36) 385 = 13.86 KW
- STC AC: (36) 290 = 10.44 KW

GOVERNING CODES

- ALL WORK SHALL CONFIRM TO THE FOLLOWING CODES
- 2015 INTERNATIONAL BUILDING CODE
 - 2018 NORTH CAROLINA STATE BUILDING CODE
 - 2018 INTERNATIONAL RESIDENTIAL CODE
 - 2018 INTERNATIONAL FIRE CODE
 - 2020 NORTH CAROLINA ELECTRICAL CODE

GENERAL NOTES

- ALL PANELS, SWITCHES, ETC. SHALL HAVE SUFFICIENT GUTTER SPACE AND LUGS IN COMPLIANCE WITH UL REQUIREMENTS TO ACCOMMODATE CONDUCTORS SHOWN.
- THIS SYSTEM WILL NOT BE INTERCONNECTED UNTIL APPROVAL FROM THE LOCAL JURISDICTION AND UTILITY IS OBTAINED.
- 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.
- 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. AN OSHA APPROVED LADDER PROVIDING ACCESS TO ALL PORTIONS OF THE ARRAY SHALL BE SECURED IN PRIOR TO REQUESTING INSPECTION.
- 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

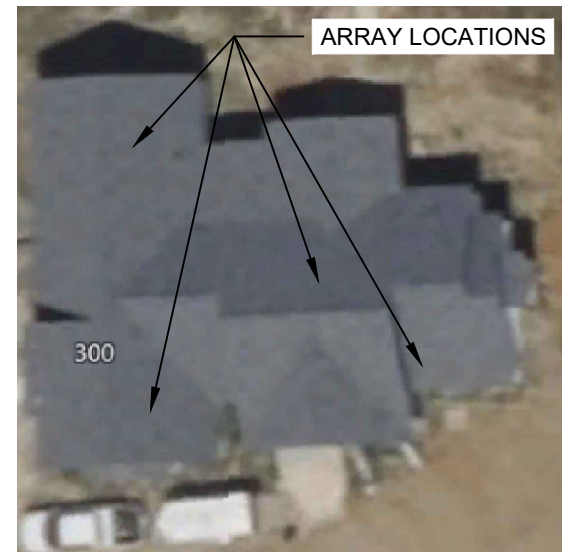
- (FOR INSTALLER USE ONLY)
- NAME:
 - ADDRESS:
 - PHONE NUMBER:



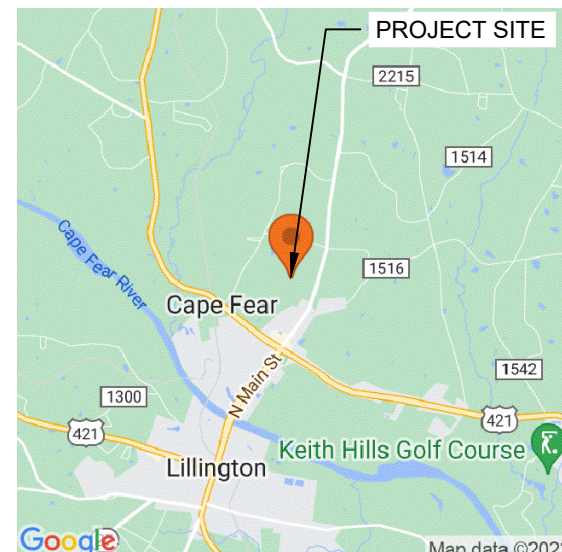
SHEET INDEX

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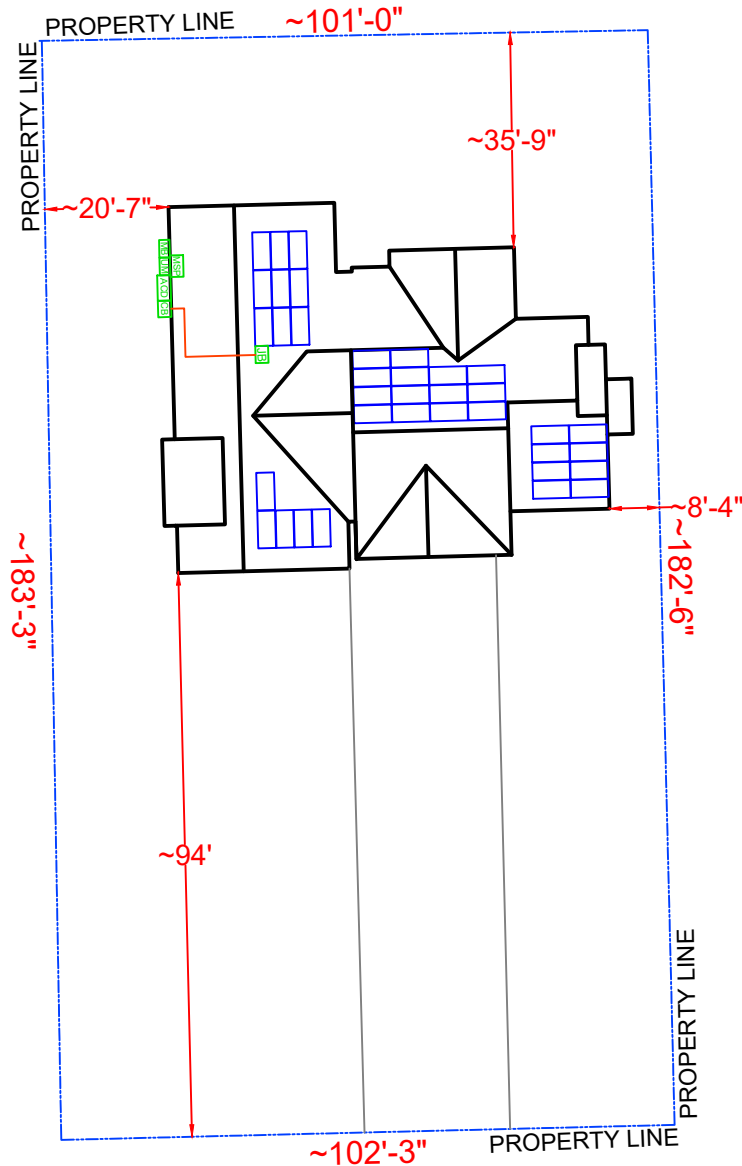
AHJ: CITY OF LILLINGTON
UTILITY: DUKE ENERGY
(PROGRESS ENERGY CAROLINAS INC.)



HOUSE PHOTO
SCALE: NTS



VICINITY MAP
SCALE: NTS



BRUCE JOHNSON ROAD

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

| LEGEND | |
|--------|---|
| | PV MODULE |
| | DIMENSIONS |
| | CONDUIT |
| | PROPERTY LINE |
| | GATE |
| | FENCE |
| | MSP MAIN SERVICE PANEL (EXISTING, 200A) |
| | UM UTILITY METER (EXISTING) |
| | PM PRODUCTION METER (N/A) |
| | BAT BATTERY (N/A) |
| | INV (I) INVERTER (N/A) |
| | CB COMBINER BOX (NEW) |
| | SM SOLAREGE METER (N/A) |
| | BLP BACKUP LOAD PANEL (N/A) |
| | 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 |



CONTRACTOR

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

REVISIONS

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

SIGNATURE & SEAL

HOMEOWNER INFO

THOMAS HUNTER
300 BRUCE JOHNSON ROAD,
LILLINGTON, NC 27546, USA

APN: 1106410203
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):
 - (36X) MISSION SOLAR ENERGY MSE385SX5R 385W (75.1" X 41.1", 49 LBS)
 MICRO-INVERTER TYPES (COUNT, WEIGHT):
 - (36X) ENPHASE IQ8PLUS-72-2-US (2.38 LBS)
 ATTACHMENT COUNT: 148
 MOUNTING SYSTEM WEIGHT/MODULE: 1.5 LBS
 TOTAL ROOF AREA: 3622 SF
 TOTAL ARRAY AREA: (36) 75.1" X 41.1" = 771.65 SF
 TOTAL ARRAY WEIGHT: (36) 49.0 + (36) 2.4 + (36) 1.5 = 1904 LBS
 WEIGHT AT EACH CONNECTION: 1904 LBS / 148 = 12.86 LBS
 DISTRIBUTED LOAD: 1904 LBS / 771.65 SF = 2.47 PSF
 ROOF AREA COVERED BY ARRAY: 772 SF / 3622 SF = 21.3%

DESIGN CRITERIA

EXPOSURE CATEGORY = B
 WIND SPEED = 118 MPH
 SNOW LOAD = 15 PSF

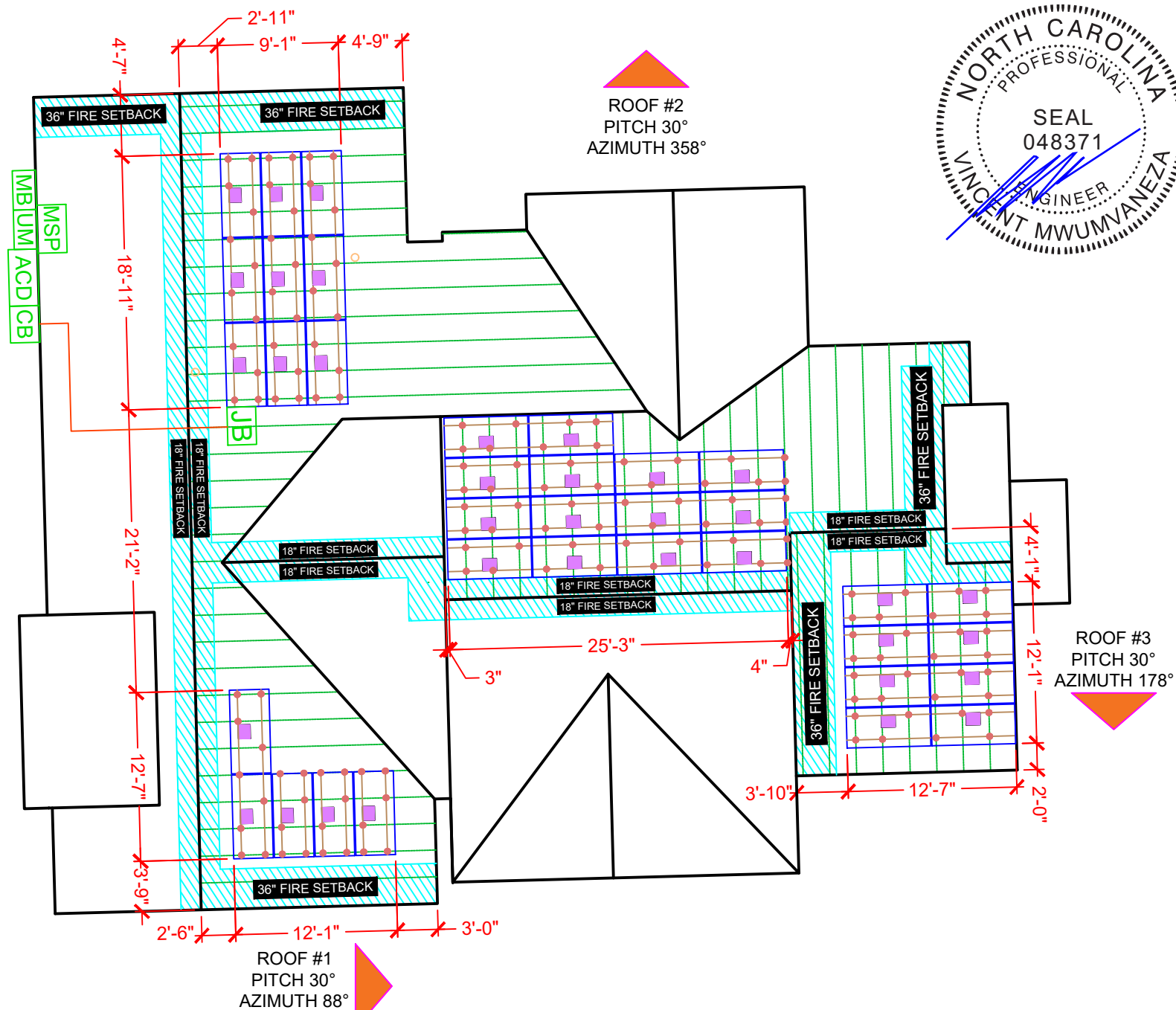
| BILL OF MATERIALS | | |
|-------------------|-----|---|
| SOLAR PV MODULES | 36 | MISSION SOLAR ENERGY MSE385SX5R 385W |
| MICRO INVERTERS | 36 | ENPHASE IQ8PLUS-72-2-US |
| JUNCTION BOX | 01 | 600V, NEMA 3R RATED JBOX |
| LOAD CENTER | 01 | ENPHASE IQ COMBINER BOX 4/4C |
| AC DISCONNECT | 01 | PV VISIBLE LOCKABLE LABELED DISCONNECT (60A UNFUSED 1PH 240VAC) |
| ATTACHMENTS | 148 | IRONRIDGE - SLOTTED L-FEET |
| RAIL | 33 | IRONRIDGE RESOURCES - XR10 |
| RAIL SPLICES | 12 | RAIL SPLICES |
| MID CLAMPS | 42 | MID CLAMP |
| END CLAMPS | 60 | END CLAMP |
| GROUNDING LUG | 15 | GROUNDING LUG |

| ROOF DESCRIPTION TABLE | | | | | | |
|------------------------|------------|---------------|--------------------|--------------|------------|---------|
| ROOF PLANE | TRUSS SIZE | TRUSS SPACING | ATTACHMENT SPACING | MODULE COUNT | ARRAY TILT | AZIMUTH |
| #1 | 2" x 4" | 24" O.C. | 48" O.C. | 14 | 30° | 88° |
| #2 | 2" x 4" | 24" O.C. | 48" O.C. | 14 | 30° | 358° |
| #3 | 2" x 4" | 24" O.C. | 48" O.C. | 8 | 30° | 178° |

LEGEND

- PV MODULE
- FIRE SETBACK
- MICRO-INVERTER
- ROOF ATTACHMENT
- DIMENSIONS
- CONDUIT
- TRUSS
- RAIL
- 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 SOLAREEDGE METER (N/A)
- BLP BACKUP LOAD PANEL (N/A)
- 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

(E) BACK YARD



(E) FRONT YARD

BRUCE JOHNSON ROAD



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SHEET NAME
 ROOF PLAN WITH
 MODULES

SHEET SIZE
 ANSI B
 11" X 17"

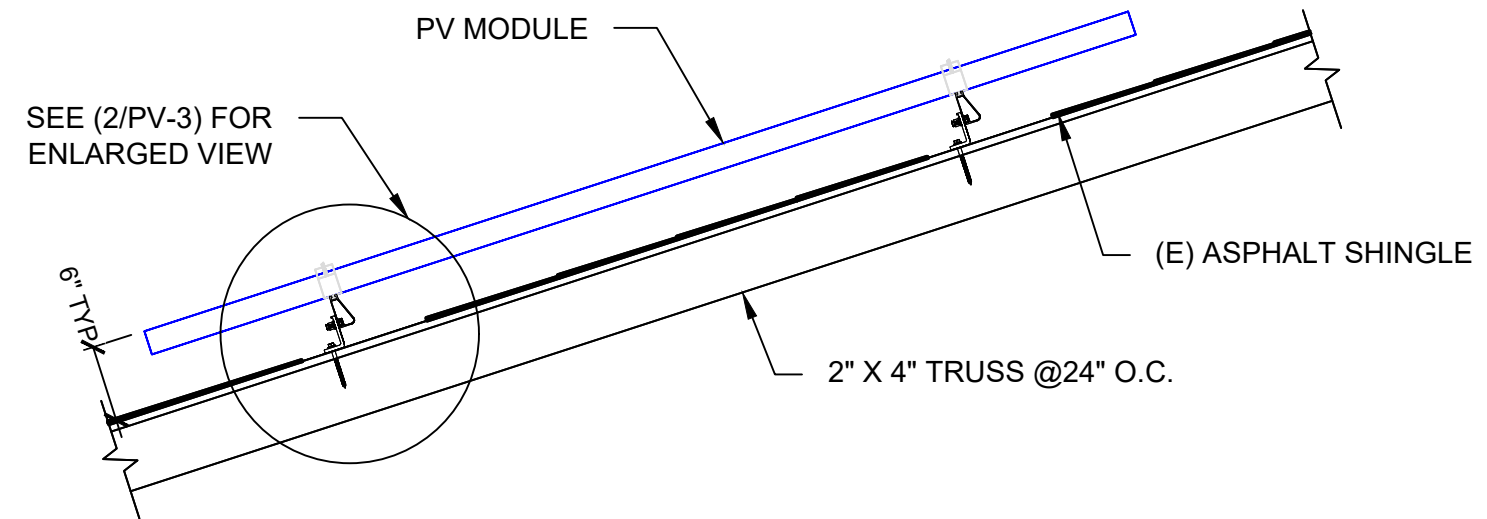
SHEET NUMBER
 PV-2

ROOF PLAN WITH MODULES
 SCALE: 3/32" = 1'-0"





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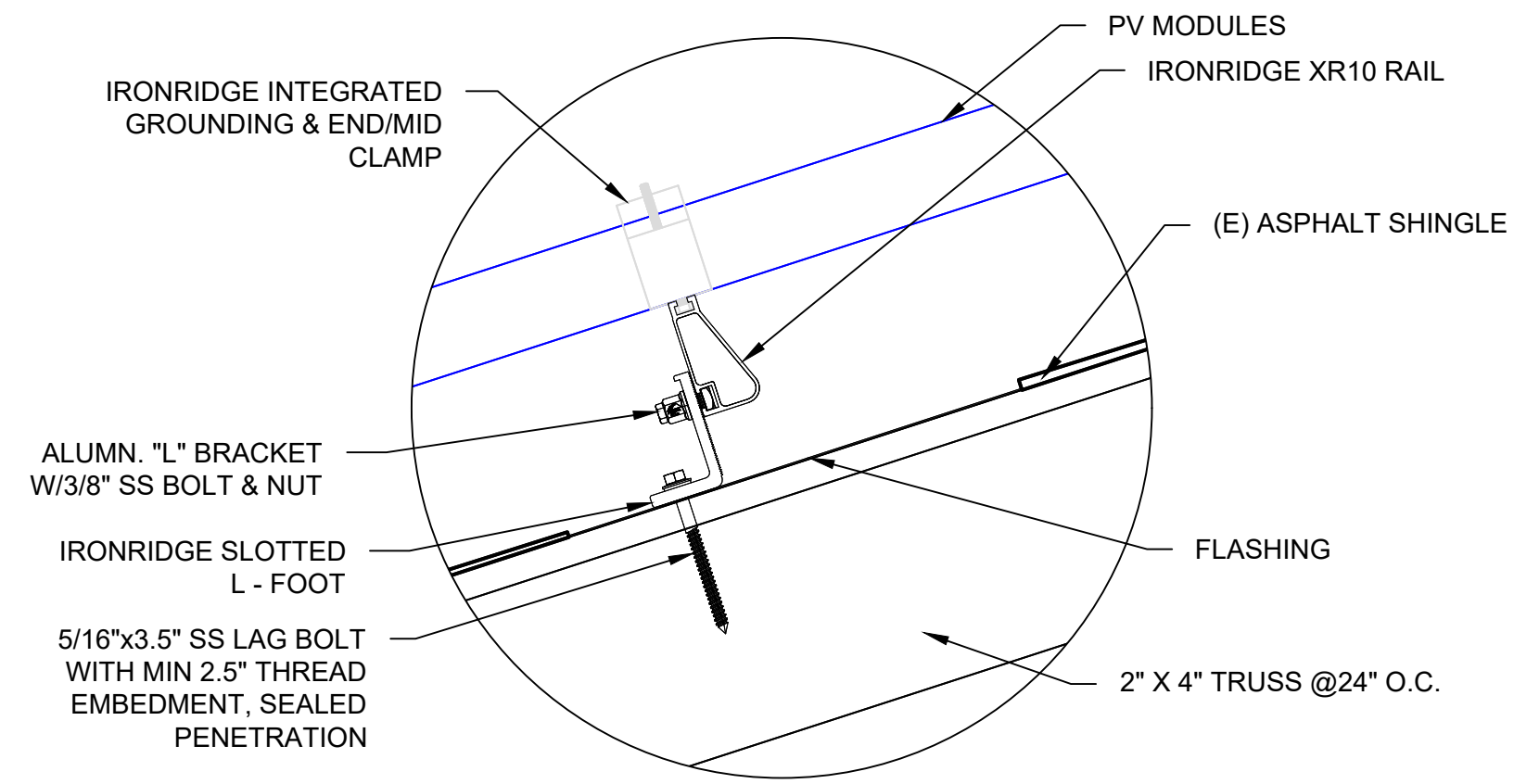
APN: 1106410203
 EMAIL: -
 PHONE: -

SHEET NAME
 ATTACHMENT
 DETAIL

SHEET SIZE
 ANSI B
 11" X 17"

SHEET NUMBER
 PV-3

ATTACHMENT DETAIL
 SCALE: NTS

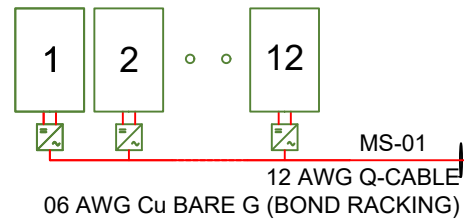


ATTACHMENT DETAIL (ENLARGED SECTION VIEW)
 SCALE: NTS

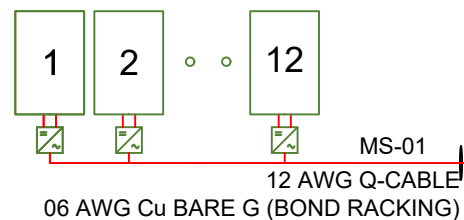
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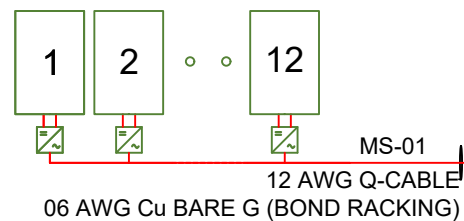
MOD: MISSION SOLAR ENERGY
MSE385SX5R 385W
INV: ENPHASE IQ8PLUS-72-2-US (240V)
(1 STRING X 12 MICRO-INV)



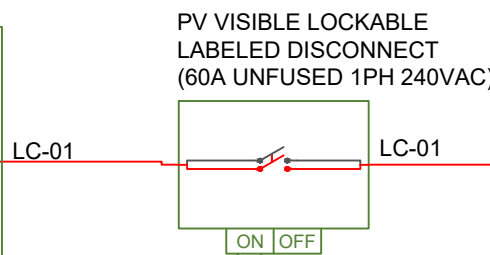
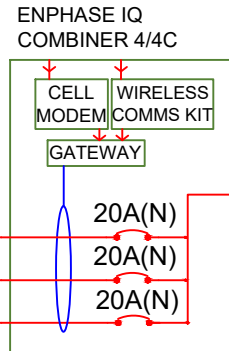
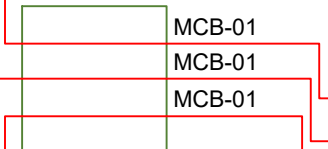
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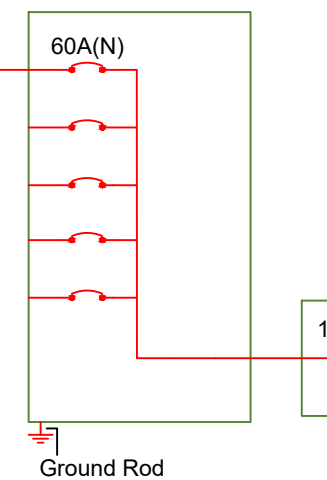


JUNCTION BOX
600V, NEMA 3R
UL LISTED

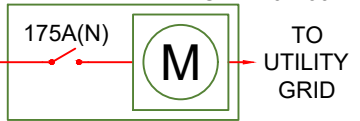


DERATE 200A MAIN BREAKER TO
175A FOR PV BACKFEED

MAIN SERVICE PANEL
(EXISTING, BOTTOM-FED)
BUS RATING: 200A



UTILITY METER
UTILITY: DUKE ENERGY
(PROGRESS ENERGY
CAROLINAS INC.)
SERVICE: 240V 60HZ 1PH



- 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.

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

| AC wire details | | | | | | | |
|-----------------|--------------|-------------------|---------------|------------------------------|---------|---------|---------|
| Wire | Min Ampacity | Live | Neutral | Ground | Min EMT | Min PVC | Min RMC |
| MS-01 | 18.15A | 12 AWG (Q-Cable) | - | 06 AWG BARE (NOT IN CONDUIT) | - | - | - |
| MCB-01 | 18.15A | (2) 10 AWG THWN-2 | 10 AWG THWN-2 | 10 AWG THWN-2 | 0.50 in | 0.50 in | 0.50 in |
| LC-01 | 54.45A | (2) 04 AWG THWN-2 | 04 AWG THWN-2 | 10 AWG THWN-2 | 1.00 in | 1.00 in | 1.00 in |

INTERCONNECTION 120% RULE (MAIN PANEL)

UTILITY FEED + TOTAL BACKFEED
175A + 60A = 235A

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)

$I_{sc}(25^{\circ}C) = 10.97A$, $T_{isc} = 0.039\%/^{\circ}C$
 $I_{sc}(T) = I_{sc}(25^{\circ}C) \times [1 + T_{isc} \times (T - 25^{\circ}C)]$
 $I_{sc}(-10^{\circ}C) = 10.82A$, $I_{sc}(36^{\circ}C) = 11.02A$

$V_{oc}(25^{\circ}C) = 45.03V$, $T_{voc} = -0.262\%/^{\circ}C$
 $V_{oc}(T) = V_{oc}(25^{\circ}C) \times [1 + T_{voc} \times (T - 25^{\circ}C)]$
 $V_{oc}(-10^{\circ}C) = 49.16V$, $V_{oc}(36^{\circ}C) = 43.73V$



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SHEET NAME

SINGLE LINE
DIAGRAM

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-4

ELECTRICAL SINGLE LINE DIAGRAM

SCALE: NTS

SYSTEM SUMMARY STC DC/AC

(13.86 KW DC / 10.44 KW AC)

- 3X STRINGS OF 12 CONNECTED IN PARALLEL
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| DESCRIPTION | DATE | REV |
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| | | |
| | | |

SIGNATURE & SEAL

| 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 | 12 | 240 V | 18.15 A | 20 A | 3.5 kW | 1 | 2 | 36 | 25 x 0.88 x - = 22.00 A | 12 AWG (Q-Cable) | 06 AWG BARE (NOT IN CONDUIT) | Cu | 50 ft | 1.06 % | - | - | - |
| MCB-01 | 12 | 240 V | 18.15 A | 20 A | 3.5 kW | 1 | 2 | 36 | 35 x 0.88 x 1.00 = 30.80 A | 10 AWG THWN-2 | 10 AWG THWN-2 | Cu | 50 ft | 0.63 % | 0.50 in | 0.50 in | 0.50 in |
| LC-01 | 36 | 240 V | 54.45 A | 60 A | 10.5 kW | 1 | 2 | 36 | 85 x 0.88 x 1.00 = 74.80 A | 04 AWG THWN-2 | 10 AWG THWN-2 | Cu | 10 ft | 0.10 % | 1.00 in | 1.00 in | 1.00 in |

INTERCONNECTION 120% RULE (MAIN PANEL)

UTILITY FEED + TOTAL BACKFEED
175A + 60A = 235A

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(-10°C) = 10.82A, Isc(36°C) = 11.02A

Voc(25°C) = 45.03V, Tvoc = -0.262%/°C
Voc(T) = Voc(25°C) x [1 + Tvoc x (T-25°C)]
Voc(-10°C) = 49.16V, Voc(36°C) = 43.73V

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.

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SHEET NAME

WIRING
CALCULATION

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-5

⚠ 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 2020: NEC 706.15 (C)(4) & NEC 690.13(B)

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 2020: 690.56(C)(2)

⚠ WARNING

POWER SOURCE OUTPUT CONNECTION

DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:
 ADJACENT TO PV BREAKER AND ESS OCPD (IF APPLICABLE).
 PER CODE(S): NEC 2020: NEC 705.12 (B)(3)(2)

⚠ WARNING DUAL POWER SOURCE

SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:
 POINT OF INTERCONNECTION
 PRODUCTION METER
 NEC 705.12(B)(3)(3)

PHOTOVOLTAIC AC DISCONNECT

LABEL LOCATION:
 AC DISCONNECT/BREAKER/
 POINT OF CONNECTION
 (PER CODE: NEC 690.13(B))

NOTES AND SPECIFICATIONS:

- SIGNS AND LABELS SHALL MEET THE REQUIREMENTS OF THE 2020 ARTICLE 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.

⚠ WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

LABEL LOCATION:
 DC DISCONNECT, POINT OF INTERCONNECTION
 (PER CODE: NEC 690.13(B))

⚠ WARNING

THIS EQUIPMENT FED BY MULTIPLE SOURCES: TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN POWER SUPPLY SHALL NOT EXCEED AMPACITY OF BUSBAR

LABEL LOCATION:
 POINTS OF CONNECTION/BREAKER
 CODE: NEC 705.12(B)(3)(3)

⚠ WARNING

POWER SOURCE OUTPUT CONNECTION

DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:
 SERVICE PANEL IF SUM OF BREAKERS EXCEEDS PANEL RATING
 NEC 705.12 (B)(3)(2)

PHOTOVOLTAIC AC DISCONNECT

RATED AC OPERATING CURRENT: 43.56 AMPS

NOMINAL OPERATING AC VOLTAGE: 240 VAC

LABEL LOCATION: MAIN PANEL AC DISCONNECT(S)
 CODE REF: NEC 690.54

⚠ CAUTION

PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LABEL LOCATION:
 MSP (PER CODE: NEC 705.12(D) & NEC 690.59

MAIN PHOTOVOLTAIC SYSTEM DISCONNECT

LABEL LOCATION:
 MAIN SERVICE DISCONNECT / UTILITY METER
 (PER CODE: NEC 690.13(B))

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL LOCATION:
 EMT / CONDUIT RACEWAYS
 (PER CODE: NEC690.31(D)(2))

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 1 M (3 FT) FROM THE SERVICE DISCONNECTING MEANS TO WHICH THE PV SYSTEMS ARE CONNECTED.
 PER CODE(S): NEC 2020: IFC 690.56(C)

CAUTION:

MULTIPLE SOURCES OF POWER

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

AT: MAIN SERVICE PANEL & UTILITY METER
 AC DISCONNECT, COMBINER BOX, MAIN BREAKER

PV ARRAYS

BRUCE JOHNSON ROAD

(N) COMBINER BOX
 (N) AC DISCONNECT
 (E) UTILITY METER
 (E) MAIN SERVICE PANEL
 (N) MAIN BREAKER



CONTRACTOR

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

REVISIONS

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

SIGNATURE & SEAL

HOMEOWNER INFO

THOMAS HUNTER
 300 BRUCE JOHNSON ROAD,
 LILLINGTON, NC 27546, USA

APN: 1106410203
 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

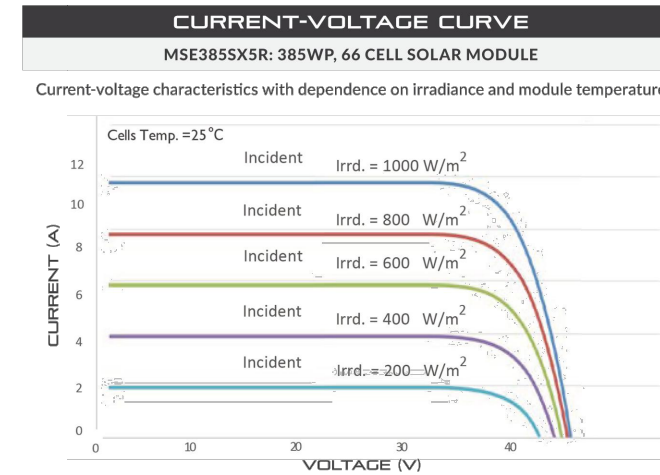
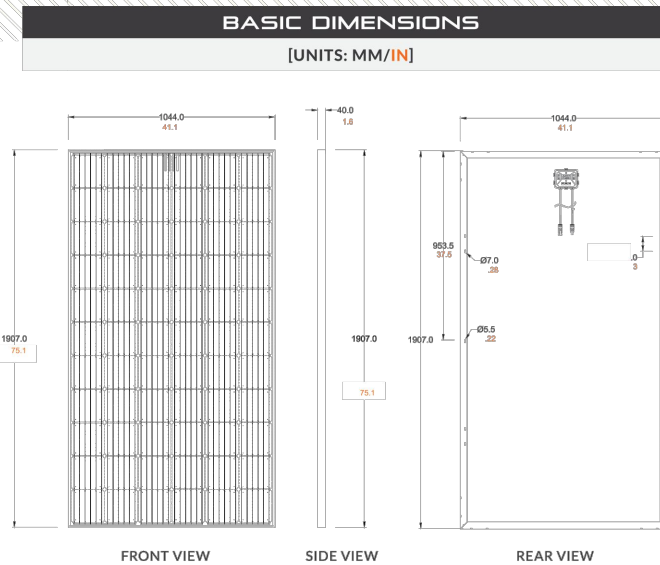
If you have questions or concerns about certification of our products in your area, please contact Mission Solar Energy.



CEC



Class Leading
375-385W



| CERTIFICATIONS AND TESTS | | |
|--------------------------|---------------------|--|
| IEC | 61215, 61730, 61701 | |
| UL | 61730 | |

MSE PERC 66

| ELECTRICAL SPECIFICATION | | | | | |
|--------------------------|--------------------------------------|----------------|-------|-------|-------|
| PRODUCT TYPE | MSExxxSX5R (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) | |

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

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SHEET NAME

EQUIPMENT SPECIFICATION

SHEET SIZE

ANSI B
11" X 17"

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.

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IQ8SP-DS-0002-01-EN-US-2021-10-19

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 |
| Overtoltage 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 | 1.0 | 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% | |
| Overtoltage 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 1 m | | <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/IEE1547, 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.

IQ8SP-DS-0002-01-EN-US-2021-10-19

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SHEET NAME

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SHEET SIZE

**ANSI B
 11" X 17"**

SHEET NUMBER

PV-8

Enphase IQ Combiner 4/4C

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



X-IQ-AM1-240-4C

X-IQ-AM1-240-4



To learn more about Enphase offerings, visit enphase.com

The **Enphase IQ Combiner 4/4C** with Enphase 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 |
| 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 | • 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 | To 2000 meters (6,560 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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11" X 17"

SHEET NUMBER

PV-9



Flush Mount System


Datasheet




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.

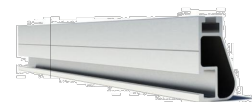
Design Assistant
 Online software makes it simple to create, share, and price projects.

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

20-Year Warranty
 Twice the protection offered by competitors.

XR Rails

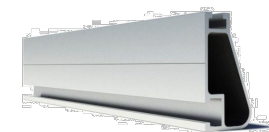
XR10 Rail



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

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

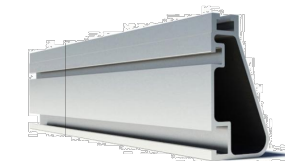
XR100 Rail



The ultimate residential solar mounting rail.

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

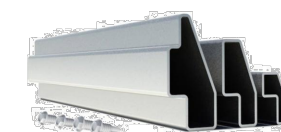
XR1000 Rail



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

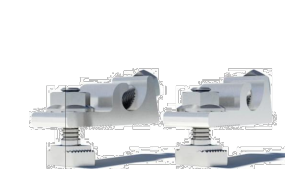
Stopper Sleeves



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

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

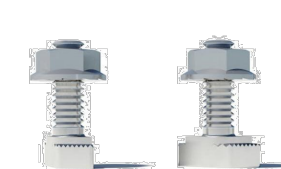
Grounding Lugs



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 install
- Wind-driven rain tested
- Mill and black finish

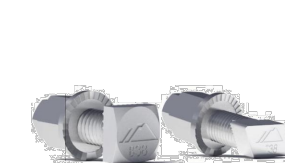
Slotted L-Feet



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



NABCEP Certified Training
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CONTRACTOR
 NAME: TOP TIER SOLAR SOLUTIONS
 ADDRESS: 1530 CENTER PARK DR,
 CHARLOTTE, NC 28217, USA
 PHONE: 855-997-1213
 CONTRACTOR LICENSE # SC - CLG.123883
 ELECTRICAL LICENSE# NC - 87345
 EMAIL: bdunford@top tiersolarsolutions.com

REVISIONS

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

SIGNATURE & SEAL

HOMEOWNER INFO

THOMAS HUNTER
 300 BRUCE JOHNSON ROAD,
 LILLINGTON, NC 27546, USA

APN: 1106410203
 EMAIL: -
 PHONE: -

SHEET NAME

EQUIPMENT SPECIFICATION

SHEET SIZE

ANSI B
 11" X 17"

SHEET NUMBER

PV-10

L-Foot

| ITEM NO | DESCRIPTION | QTY IN KIT |
|---------|----------------------------|------------|
| 1 | FOOT, EXTRUDED L - SLOTTED | 4 |

| PART NUMBER | DESCRIPTION |
|--------------|----------------------------------|
| FM-LFT-003 | Kit, 4Pcs, Slotted L-Foot, Mill |
| FM-LFT-003-B | Kit, 4Pcs, Slotted L-Foot, Black |

1) Foot, Extruded L - Slotted

v1.11

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