

PHOTOVOLTAIC ROOF MOUNT SYSTEM

34 MODULES - SYSTEM SIZE STC (13.09 KW DC / 9.86 KW AC)
 203 EAST K STREET, ERWIN, NC 28339, USA (35.3314063°, -78.6739339°)

SYSTEM SUMMARY STC DC/AC (13.09 KW DC / 9.86 KW AC)

- 1X STRING OF 12 CONNECTED IN PARALLEL
- 2X STRINGS OF 11 CONNECTED IN PARALLEL
- (34) MISSION SOLAR ENERGY MSE385SX5R 385W MODULES
- (34) ENPHASE IQ8PLUS-72-2-US [240V] MICROINVERTERS
- STC DC: (34) 385 = 13.09 KW
- STC AC: (34) 290 = 9.86 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:

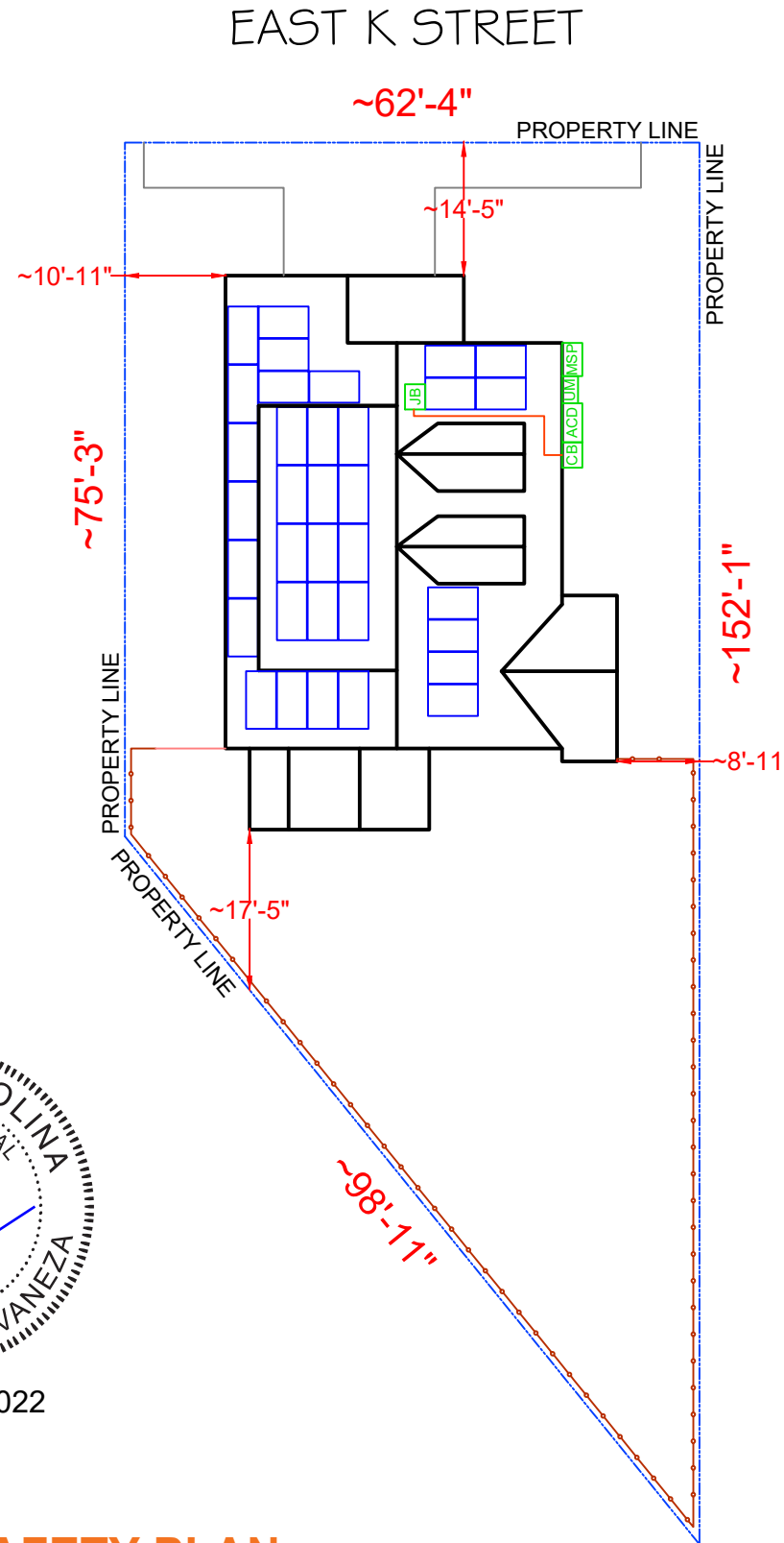
LEGEND	
	PV MODULE
	DIMENSIONS
	CONDUIT
	PROPERTY LINE
	DRIVEWAY
	FENCE
	GATE

	MAIN SERVICE PANEL (EXISTING, 200A)		AC DISCONNECT UNFUSED (NEW)
	UTILITY METER (EXISTING)		AC DISCONNECT FUSED (N/A)
	PRODUCTION METER (N/A)		JUNCTION BOX (NEW)
	BATTERY (N/A)		AUTO TRANSFORMER (N/A)
	(0) INVERTER (N/A)		SUBPANEL (N/A)
	COMBINER BOX (NEW)		DC DISCONNECT (N/A)
	SOLAREGE METER (N/A)		DC COMBINER (N/A)
	BACKUP LOAD PANEL (N/A)		EXISTING EQUIPMENT



Signed 11/9/2022

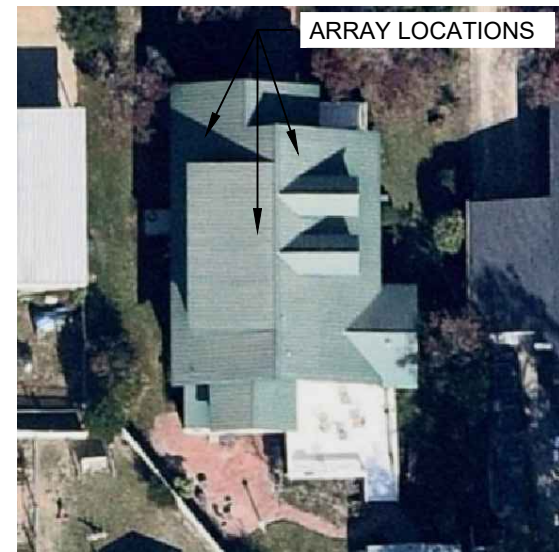
SITE PLAN & SAFETY PLAN
 SCALE: 1"=20'-0"



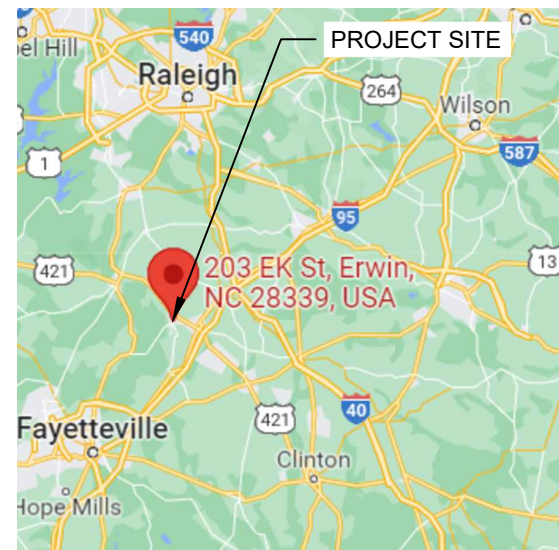
SHEET INDEX

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

AHJ: CITY OF ERWIN
 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
 CONTRACTOR LICENSE #: SC - CLG. 123883
 ELECTRICAL LICENSE #: NC - 87345
 EMAIL: bdunford@top tiersolarsolutions.com

REVISIONS

DESCRIPTION	DATE	REV

SIGNATURE & SEAL

HOMEOWNER INFO

MEAGHAN NITCHALS
 203 E K ST, ERWIN, NC 28339,
 USA

APN: 0597-75-2667.000
 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):
 - (34X) MISSION SOLAR ENERGY MSE385SX5R 385W (75.1" X 41.1", 49 LBS)
 MICRO-INVERTER TYPES (COUNT, WEIGHT):
 - (34X) ENPHASE IQ8PLUS-72-2-US [240V] (2.38 LBS)
 ATTACHMENT COUNT: 113
 MOUNTING SYSTEM WEIGHT/MODULE: 1.5 LBS
 TOTAL ROOF AREA: 2075 SF
 TOTAL ARRAY AREA: (34) 75.1" X 41.1" = 728.78 SF
 TOTAL ARRAY WEIGHT: (34) 49.0 + (34) 2.4 + (34) 1.5 = 1798 LBS
 WEIGHT AT EACH CONNECTION: 1798 LBS / 113 = 15.92 LBS
 DISTRIBUTED LOAD: 1798 LBS / 728.78 SF = 2.47 PSF
 ROOF AREA COVERED BY ARRAY: 729 SF / 2075 SF = 35.13%

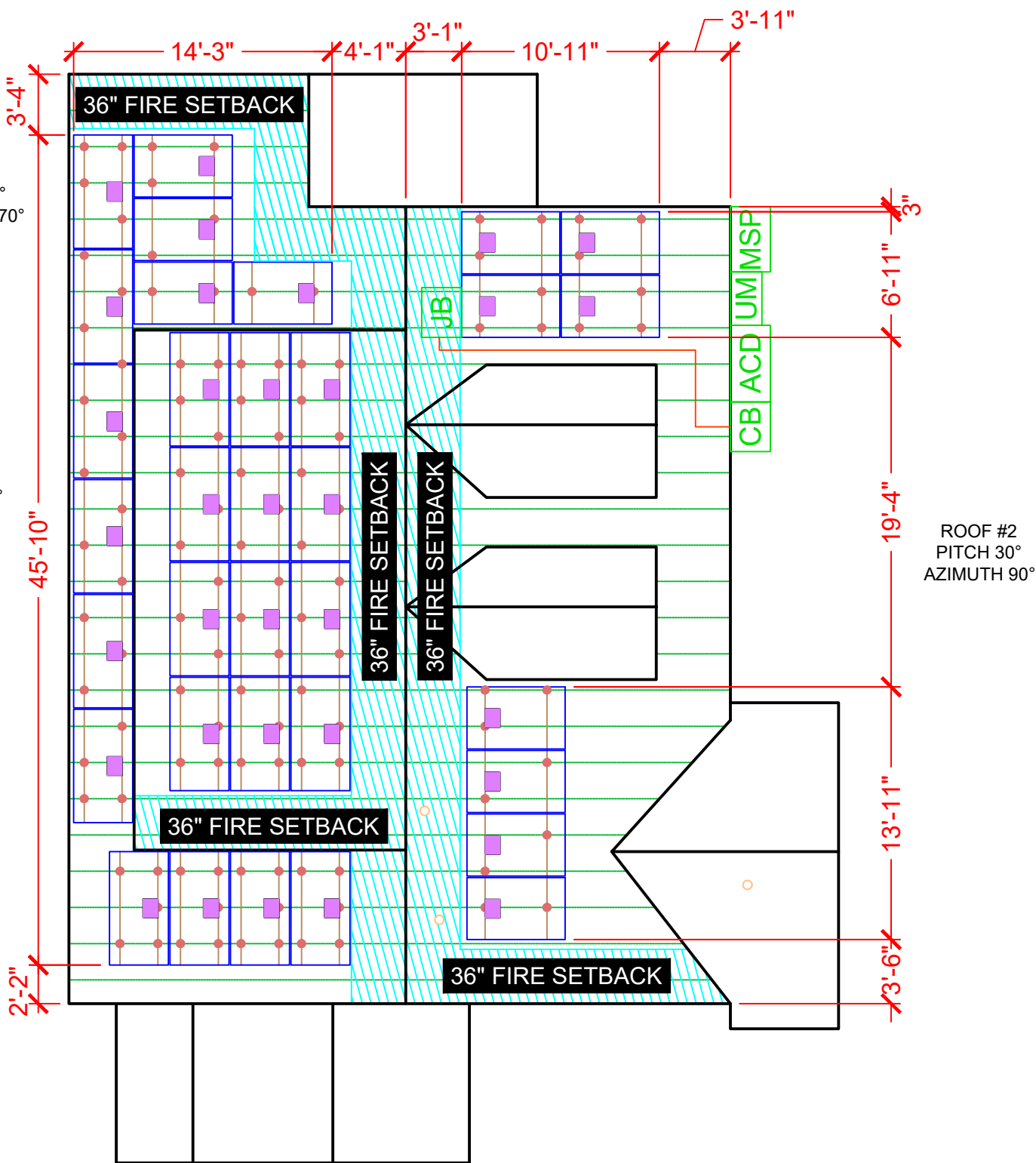
DESIGN CRITERIA

EXPOSURE CATEGORY = C
 WIND SPEED = 119 MPH
 SNOW LOAD = 10 PSF

BILL OF MATERIALS		
SOLAR PV MODULES	34	MISSION SOLAR ENERGY MSE385SX5R 385W
MICRO INVERTERS	34	ENPHASE IQ8PLUS-72-2-US [240V]
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	113	S-5I PROTEA BRACKET
RAIL	25	IRONRIDGE RESOURCES - XR10
RAIL SPLICES	10	RAIL SPLICES
MID CLAMPS	42	MID CLAMP
END CLAMPS	52	END CLAMP
GROUNDING LUG	13	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°	270°
#2	2" x 4"	24" O.C.	48" O.C	8	30°	90°
#3	2" x 4"	24" O.C.	48" O.C	12	18°	270°

EAST K STREET
(E) FRONT YARD



ROOF #1
PITCH 30°
AZIMUTH 270°

ROOF #3
PITCH 18°
AZIMUTH 270°

ROOF #2
PITCH 30°
AZIMUTH 90°



Signed 11/9/2022

LEGEND	
	PV MODULE
	FIRE SETBACK
	MICRO-INVERTER
	ROOF ATTACHMENT
	DIMENSIONS
	TRUSS
	CONDUIT
	RAIL
	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

ROOF PLAN WITH MODULES

SCALE: 1/8" = 1'-0"

(E) BACKYARD



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SHEET NAME

ROOF PLAN WITH
MODULES

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-2





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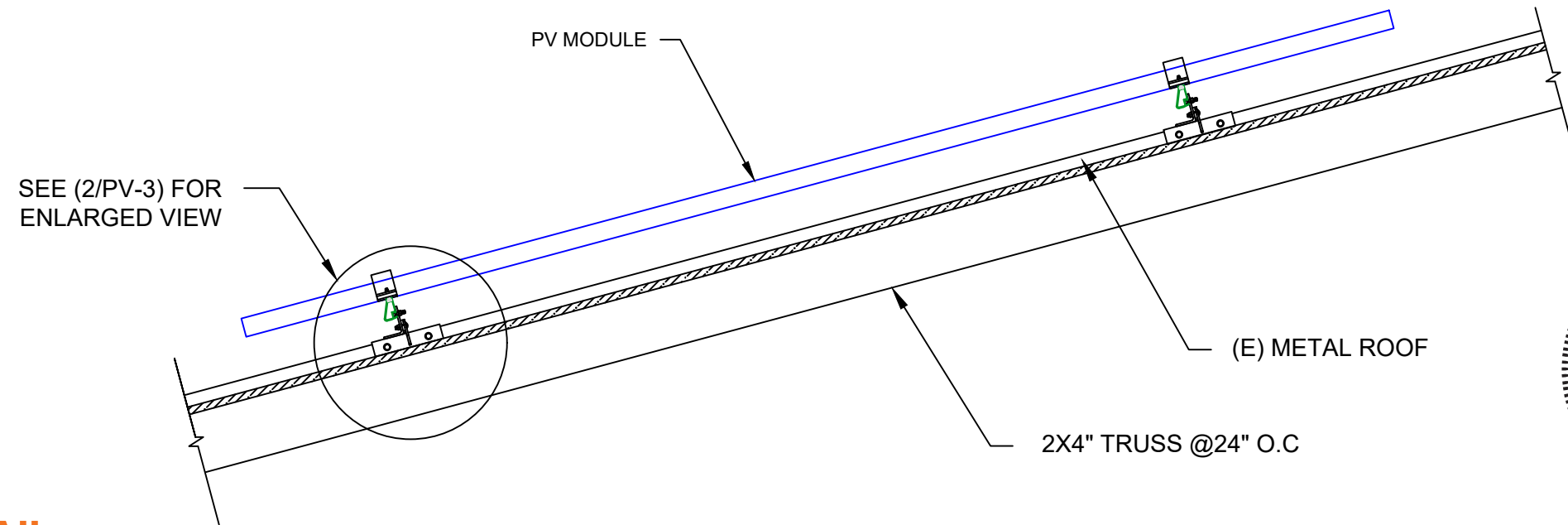
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ATTACHMENT DETAIL

SCALE: NTS

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SHEET NAME

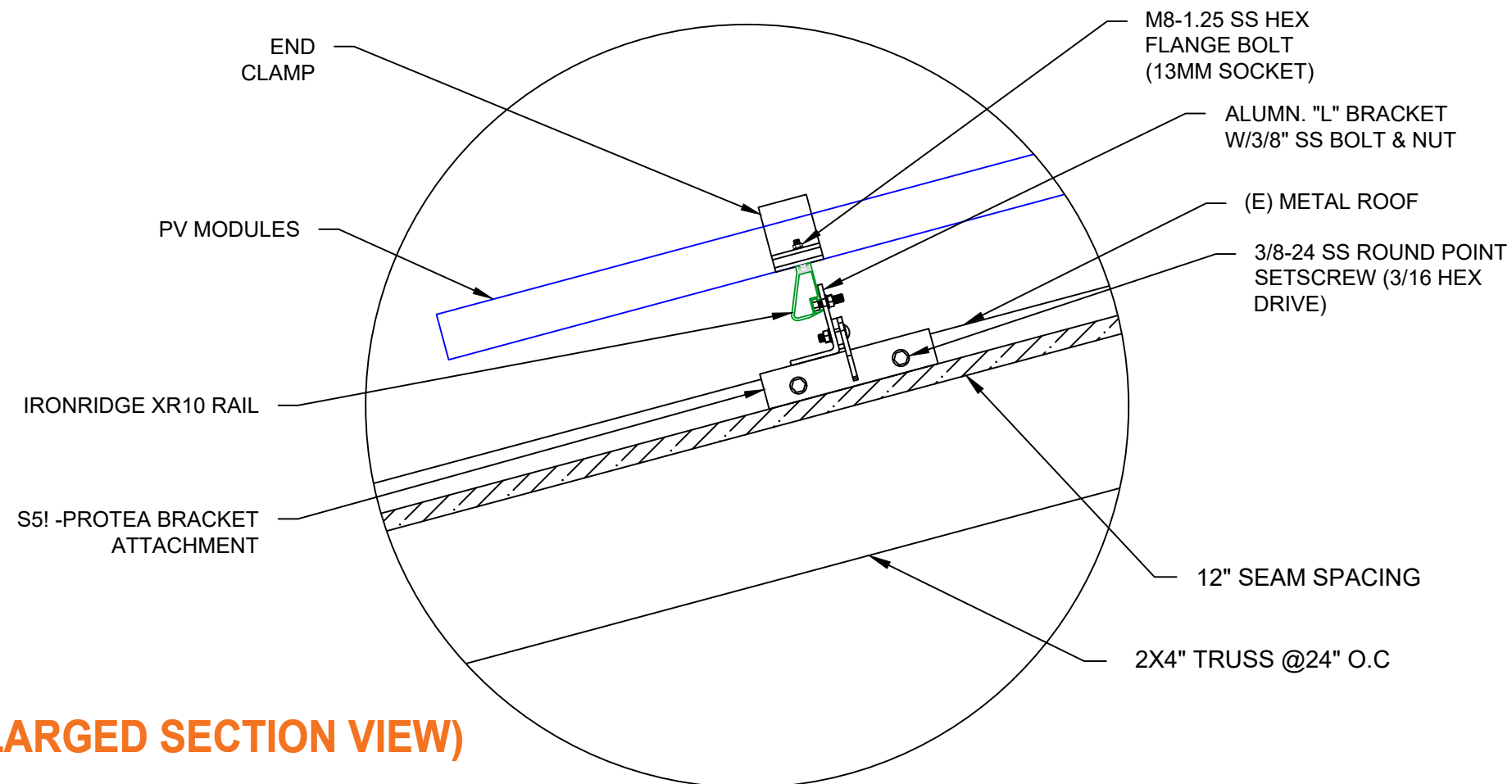
ATTACHMENT
 DETAIL

SHEET SIZE

ANSI B
 11" X 17"

SHEET NUMBER

PV-3



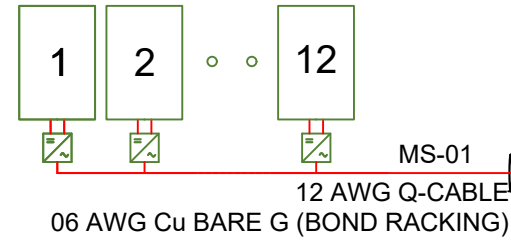
ATTACHMENT DETAIL (ENLARGED SECTION VIEW)

SCALE: NTS

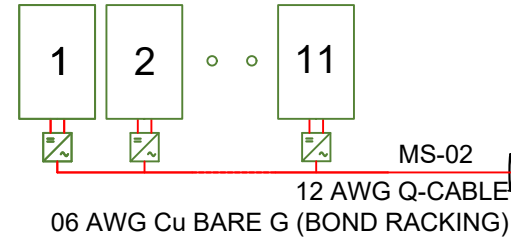
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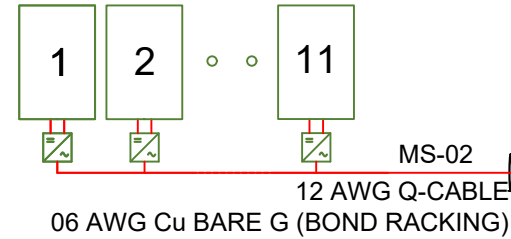
MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 STRING X 12 MICRO-INV)



MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 STRING X 11 MICRO-INV)

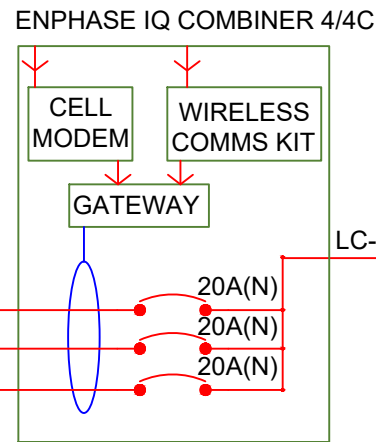


MOD: MISSION SOLAR ENERGY
 MSE385SX5R 385W
 INV: ENPHASE IQ8PLUS-72-2-US (240V)
 (1 STRING X 11 MICRO-INV)



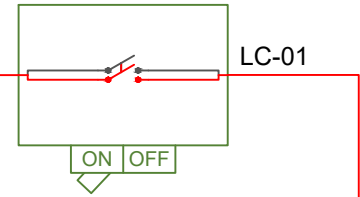
JUNCTION BOX
 600V, NEMA 3R
 UL LISTED

MCB-01
 MCB-02
 MCB-02



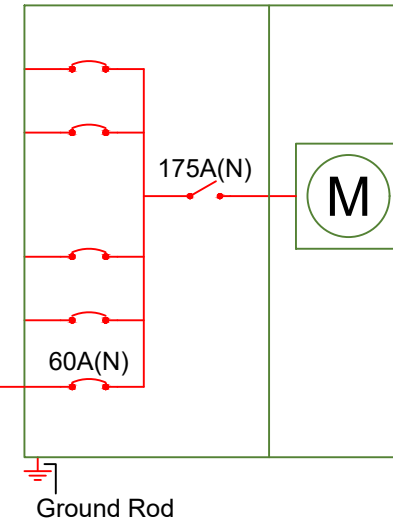
LC-01

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



DERATE MAIN BREAKER FROM 200A TO 175A

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 1PH
 TO UTILITY
 GRID

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)	-	-	-
MS-02	16.64A	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
MCB-02	16.64A	(2) 10 AWG THWN-2	10 AWG THWN-2	10 AWG THWN-2	0.50 in	0.50 in	0.50 in
LC-01	51.43A	(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 + 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)**

$I_{sc}(25^{\circ}C) = 10.97A$, $T_{isc} = 0.039\%/^{\circ}C$
 $I_{sc}(T) = I_{sc}(25^{\circ}C) \times [1 + T_{isc} \times (T - 25^{\circ}C)]$
 $I_{sc}(-10^{\circ}C) = 10.82A$, $I_{sc}(35^{\circ}C) = 11.01A$
 $V_{oc}(25^{\circ}C) = 45.03V$, $T_{voc} = -0.262\%/^{\circ}C$
 $V_{oc}(T) = V_{oc}(25^{\circ}C) \times [1 + T_{voc} \times (T - 25^{\circ}C)]$
 $V_{oc}(-10^{\circ}C) = 49.16V$, $V_{oc}(35^{\circ}C) = 43.85V$

- 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.



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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

(13.09 KW DC / 9.86 KW AC)

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EMAIL: -
PHONE: -

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	12	240 V	18.15 A	20 A	3.5 kW	1	2	35	25 x 0.94 x 1.00 = 23.50 A	12 AWG (Q-Cable)	06 AWG BARE (NOT IN CONDUIT)	Cu	50 ft	1.05 %	-	-	-
MS-02	11	240 V	16.64 A	20 A	3.2 kW	1	2	35	25 x 0.94 x 1.00 = 23.50 A	12 AWG (Q-Cable)	06 AWG BARE (NOT IN CONDUIT)	Cu	50 ft	0.97 %	-	-	-
MCB-01	12	240 V	18.15 A	20 A	3.5 kW	1	2	35	35 x 0.94 x 1.00 = 32.90 A	10 AWG THWN-2	10 AWG THWN-2	Cu	50 ft	0.63 %	0.50 in	0.50 in	0.50 in
MCB-02	11	240 V	16.64 A	20 A	3.2 kW	1	2	35	35 x 0.94 x 1.00 = 32.90 A	10 AWG THWN-2	10 AWG THWN-2	Cu	50 ft	0.58 %	0.50 in	0.50 in	0.50 in
LC-01	34	240 V	51.43 A	60 A	9.9 kW	1	2	35	65 x 0.94 x 1.00 = 61.10 A	06 AWG THWN-2	10 AWG THWN-2	Cu	10 ft	0.15 %	0.75 in	0.75 in	0.75 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(35°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(-10°C) = 49.16V, Voc(35°C) = 43.85V

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.

⚠ 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

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

⚠ 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: 41.14 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))

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

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)



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

MEAGHAN NITCHALS
203 E K ST, ERWIN, NC 28339,
USA

APN: 0597-75-2667.000
EMAIL: -
PHONE: -

SHEET NAME
PLACARDS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-6

MSE PERC 66

MISSION SOLAR ENERGY



385W

Positive Power Tolerance

Class leading power output -0 to +3%

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



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

UL 61730 / IEC 61215 / IEC 61730 / IEC 61701

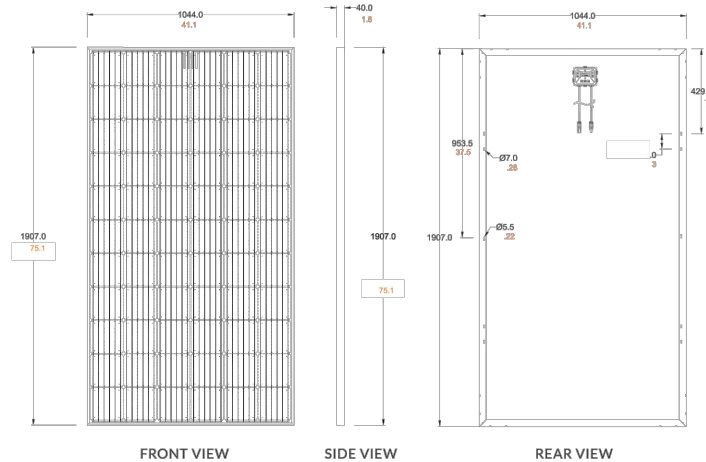


Class Leading
375-385W

MSE PERC 66

BASIC DIMENSIONS

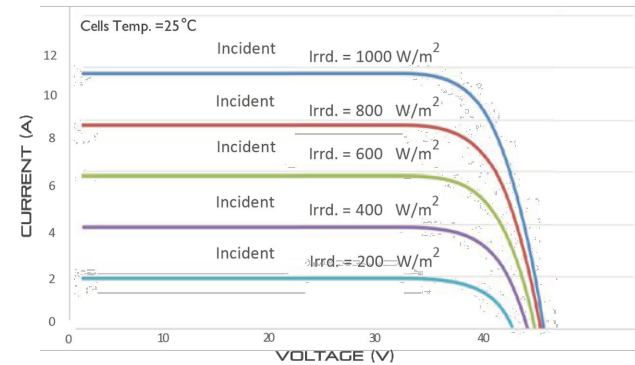
[UNITS: MM/IN]



CURRENT-VOLTAGE CURVE

MSE385X5R: 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	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 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	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)



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EQUIPMENT SPECIFICATION

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-7

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.



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

CONTRACTOR

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EQUIPMENT SPECIFICATION

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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SHEET NAME

**EQUIPMENT
SPECIFICATION**

SHEET SIZE

**ANSI B
11" X 17"**

SHEET NUMBER

PV-9

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.
- Class A Fire Rating**
 Certified to maintain the fire resistance rating of the existing roof.
- UL 2703 Listed System**
 Entire system and components meet newest effective UL 2703 standard.

- PE Certified**
 Pre-stamped engineering letters available in most states.
- Design Assistant**
 Online software makes it simple to create, share, and price projects.
- 20-Year Warranty**
 Twice the protection offered by competitors.

XR Rails ☺

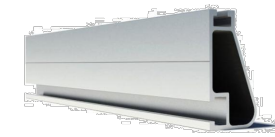
XR10 Rail



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

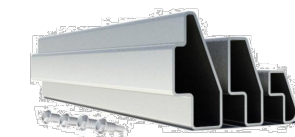
XR1000 Rail



A heavyweight mounting rail for commercial projects.

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

Bonded Splices

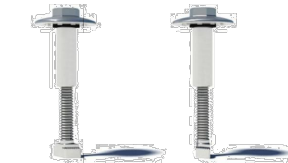


All rails use internal splices for seamless connections.

- 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

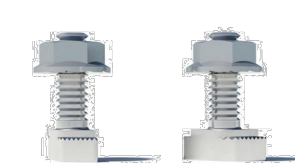
Grounding Lugs



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

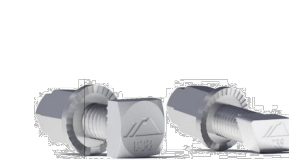
Slotted L-Feet



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](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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PV-10

S-5![®]

The Right Way

The right way to attach almost anything to metal roofs!

ProteaBracket™

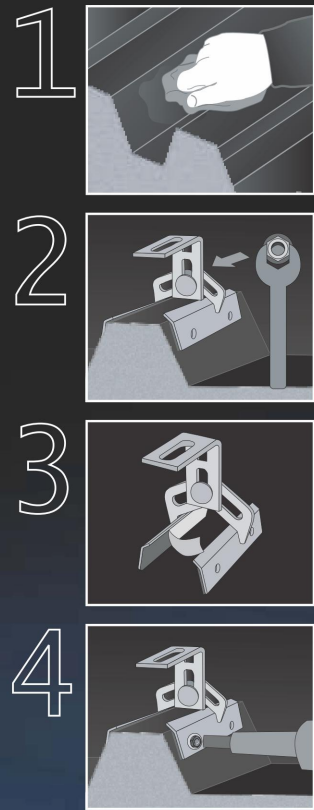
ProteaBracket™ is the most versatile attachment solution on the market, fitting most metal trapezoidal sheet profiles with and without intermediate insulation. It features an adjustable attachment base and multiple solar module attachment options (illustrated on back) to accommodate varying widths and heights. There are no messy sealants to apply and no chance for leaks; the ProteaBracket comes with factory-applied, adhesive rubber sealant to ensure quick installation and a weather-proof fit.

The ProteaBracket is mounted directly onto the crown of the panel, straddling the profile. No surface preparation is necessary; simply wipe away excess oil and debris, align, and apply. Secure ProteaBracket through all 6 pre-punched holes.

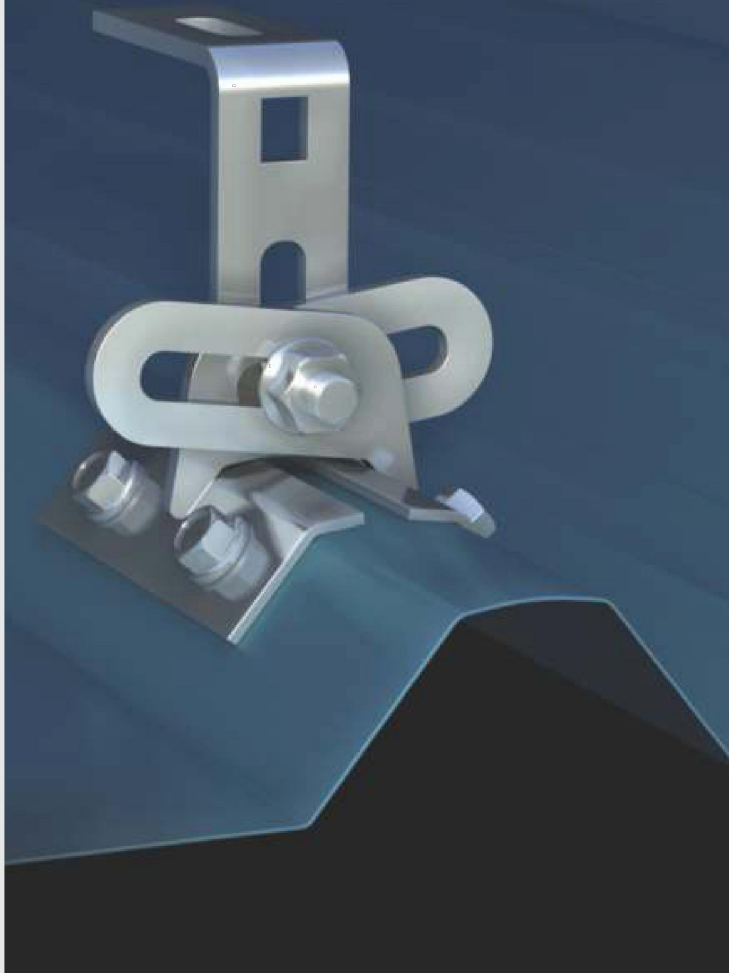
ProteaBracket is the perfect match for the S-5-PV Kit, for a solar attachment solution that is both economical and easy to use.

S-5![®] ProteaBracket™ is a versatile bracket that adjusts easily to most trapezoidal roof profiles.

S-5! PV kits have an M8 bolt and are suitable for use with all S-5! clamps.



ProteaBracket™



S-5![®]

The Right Way

ProteaBracket™ is the perfect solar attachment solution for most trapezoidal exposed-fastened metal roof profiles. No messy sealants to apply: the factory-applied adhesive rubber sealant weather-proofs and makes installation easy.

S-5![®] holding strength is unmatched in the industry.

Each ProteaBracket™ comes with a factory-applied, adhesive rubber sealant on the base. A structural A2 stainless steel bimetal attachment bracket, ProteaBracket is compatible with most common metal roofing materials.

All four pre-punched holes must be used to achieve tested strength. For design assistance, contact Safintra South Africa (and see our website www.safintra.co.za), or visit www.S-5.com for the independent lab test data that can be used for load-critical designs and applications. Also, please visit S-5! website for more information including metallurgical compatibilities and specifications.

Multiple Attachment Options:

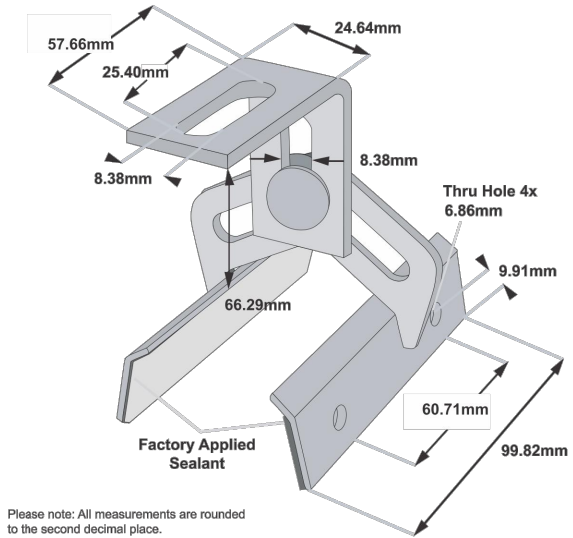
ProteaBracket™ with Top Rail option for PV attachment



ProteaBracket™ with S-5-PV Kit option (if not using a rail)



ProteaBracket™



S-5![®] Warning! Please use this product responsibly!

S-5! Brackets and clamps are not tested for performance as part of a Fall Arrest or Personal Safety system. These applications need to be tested as a dynamic system and warranties or test results must be issued by the system provider. Safintra, Safal Group and its subsidiaries provide no warranties or any assurances in this application, and will accept no claims of any nature whatsoever arising out of any such applications.

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TOP TIER
SOLAR SOLUTIONS

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

MEAGHAN NITCHALS
203 E K ST, ERWIN, NC 28339,
USA

APN: 0597-75-2667.000
EMAIL: -
PHONE: -

SHEET NAME

EQUIPMENT
SPECIFICATION

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-11