

# PHOTOVOLTAIC ROOF MOUNT SYSTEM

23 MODULES-ROOF MOUNTED - 8.970 kWDC, 6.670 kWAC  
104 HORSE WHISPERER LN, LILLINGTON, NC 27546, USA



## SYSTEM SUMMARY:

- (N) 23 - CANADIAN SOLAR CS3N-390MS (390W) MODULES
- (N) 23 - ENPHASE ENERGY IQ8PLUS-72-2-US MICRO-INVERTER
- (N) ENPHASE IQ COMBINER BOX 4
- (N) JUNCTION BOX
- (E) 200A MAIN SERVICE PANEL, (MLO)
- (N) 60A NON-FUSED AC DISCONNECT

## DESIGN CRITERIA:

ROOF TYPE: - COMP SHINGLE  
NUMBER OF LAYERS: - 01  
ROOF FRAME: - 2"X4" RAFTERS @ 24" O.C.  
STORY: - TWO STORY  
SNOW LOAD : - 10 PSF  
WIND SPEED :- 117 MPH  
WIND EXPOSURE:- C  
RISK CATEGORY:- II



## GOVERNING CODES:

THIS PROJECT SHALL COMPLY WITH THE FOLLOWING CODE  
2018 NORTH CAROLINA BUILDING CODE (NCBC)  
2018 NORTH CAROLINA RESIDENTIAL CODE (NCRC)  
2018 NORTH CAROLINA FIRE CODE (NCFC)  
2018 NORTH CAROLINA PLUMBING CODE (NCPC)  
2018 NORTH CAROLINA MECHANICAL CODE (NMC)  
2018 NORTH CAROLINA FUEL GAS CODE (NCFG)  
2018 NORTH CAROLINA ENERGY CONSERVATION CODE (NCECC)  
2020 NORTH CAROLINA ELECTRICAL CODE (NCEC)

## SHEET INDEX

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PV-2	ROOF PLAN WITH MODULES
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PV-4	ELECTRICAL LINE DIAGRAM & CALCULATIONS
PV-5	PLACARDS & WARNING LABELS
PV-6+	EQUIPMENT SPEC SHEETS

**INTERCONNECTION METHOD** : SUPPLY SIDE BREAKER PER NEC705.12(A)

## GENERAL NOTES

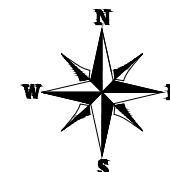
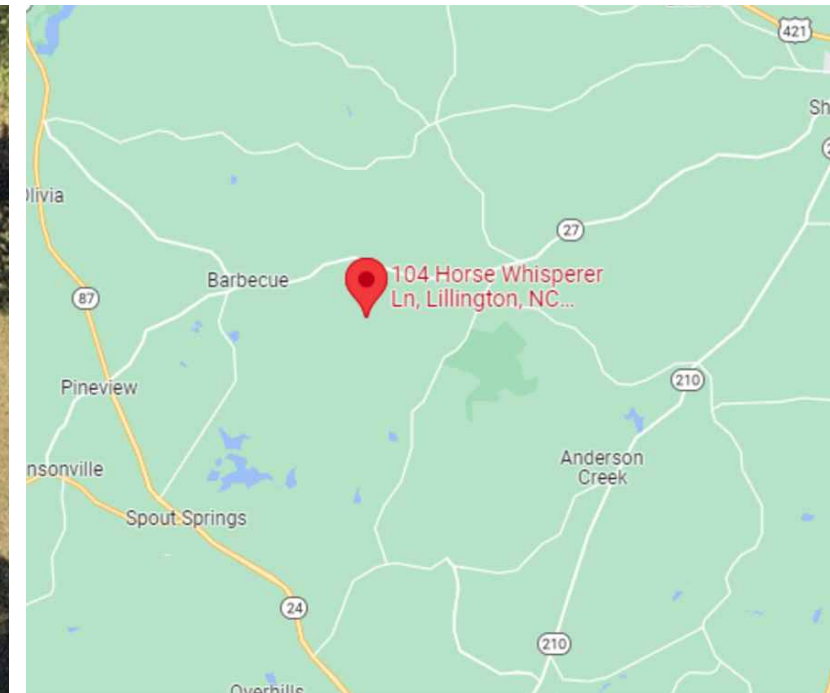
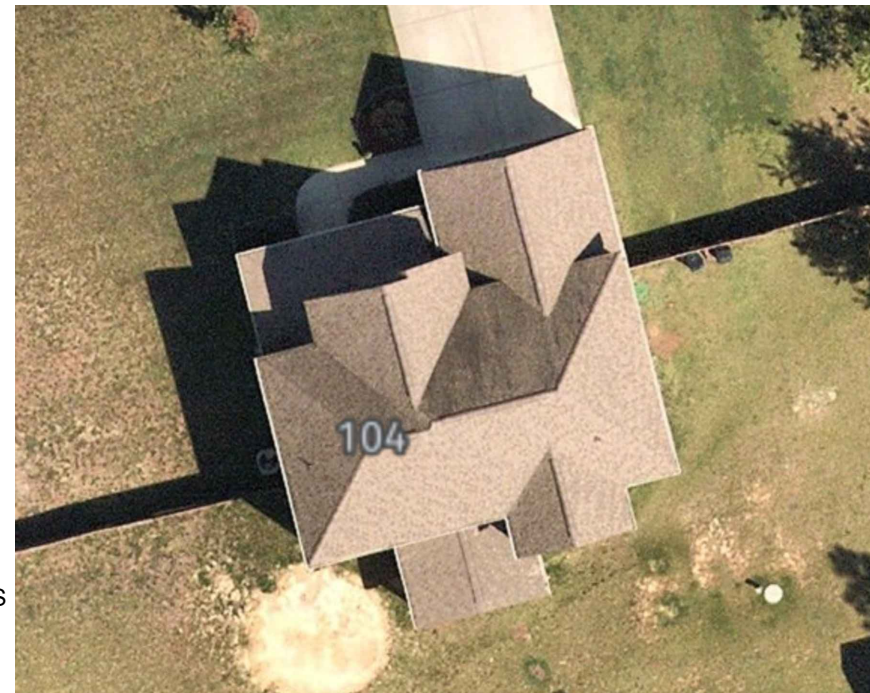
- THE CONTRACTOR/INSTALLER OF THE SOLAR PV SYSTEM OVER EXISTING ROOF SHALL CONFORM TO OSHA REQUIREMENTS DURING THE CONSTRUCTION PHASE. JOB SAFETY AND CONSTRUCTION PROCEDURES ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR/INSTALLER.
- REFER TO ELECTRICAL DRAWING PV-4 FOR PANEL DETAILED INFORMATION.
- IN CASE OF CONFLICT BETWEEN STRUCTURAL DRAWINGS AND ELECTRICAL DRAWINGS, THE MOST RIGID REQUIREMENTS SHALL GOVERN.
- THE CONTRACTOR/INSTALLER SHALL VERIFY ALL EXISTING BUILDING INFORMATION SHOWN (DIMENSIONS, ROOF TOP PROJECTIONS, ETC.) AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES PRIOR TO INSTALLATIONS OF PV SYSTEM.
- THE CONTRACTOR/INSTALLER SHALL VERIFY AND COORDINATE EXISTING OPENINGS, ROOF TOP UNITS, VENT PIPES, ETC. SHOWN ON DRAWINGS. IF THERE IS A DISCREPANCY BETWEEN DRAWINGS, IT IS THE CONTRACTORS/INSTALLER'S RESPONSIBILITY TO NOTIFY ENGINEER PRIOR TO PERFORMING THE WORK.
- ALL CONSTRUCTION IS TO BE PERFORMED IN STRICT CONFORMANCE WITH ALL APPLICABLE TOWN, COUNTY & STATE REGULATIONS AND/OR ANY OTHER GOVERNING BODIES.
- DO NOT SCALE THESE DRAWINGS, USE DIMENSIONS. CONTRACTOR MUST CONDUCT ROOF SURVEY TO VERIFY DIMENSIONS SHOWN ON PLAN PRIOR TO INSTALLATION. IF THERE IS A DISCREPANCY IT IS CONTRACTOR/INSTALLER'S RESPONSIBILITY TO NOTIFY THE ENGINEER IMMEDIATELY.

## ELECTRICAL NOTES

- ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT.
- 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.
- WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER E.G.C. VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
- THE POLARITY OF THE GROUNDED CONDUCTORS IS NEGATIVE

## NOTE :

- PRIOR TO COMMENCEMENT OF WORK, THE CONTRACTOR SHALL VERIFY THE FRAMING SIZES, SPACINGS, AND SPANS NOTED IN THE STAMPED PLANS AND ACCOMPANYING CALCULATIONS AND NOTIFY THE ENGINEER OF RECORD OF ANY DISCREPANCIES PRIOR TO STARTING CONSTRUCTION.
- THESE PLANS ARE STAMPED FOR STRUCTURAL CODE COMPLIANCE OF THE ROOF FRAMING SUPPORTING THE PROPOSED PV INSTALLATION REFERENCED ONLY. THESE PLANS ARE NOT STAMPED FOR WATER LEAKAGE. PV MODULES, RACKING, AND ATTACHMENT COMPONENTS MUST FOLLOW MANUFACTURER GUIDELINES AND REQUIREMENTS.
- PLEASE SEE THE ACCOMPANYING STRUCTURAL CALCULATIONS REPORT FOR DETAILS REGARDING CALCULATIONS AS WELL AS LIMITS OF SCOPE OF WORK AND LIABILITY.



STAMPED 09-10-2022



DEL MAR, CA 92014, USA

## VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

## PROJECT NAME

JOSEPH N HERNANDEZ  
104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

## SHEET NAME

COVER SHEET

## SHEET SIZE

ANSI B  
11" X 17"

## SHEET NUMBER

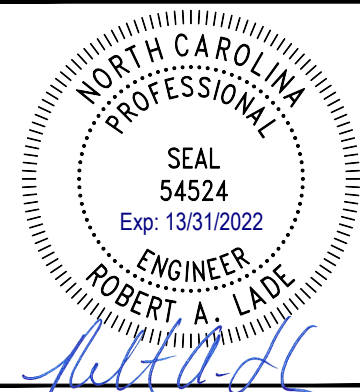
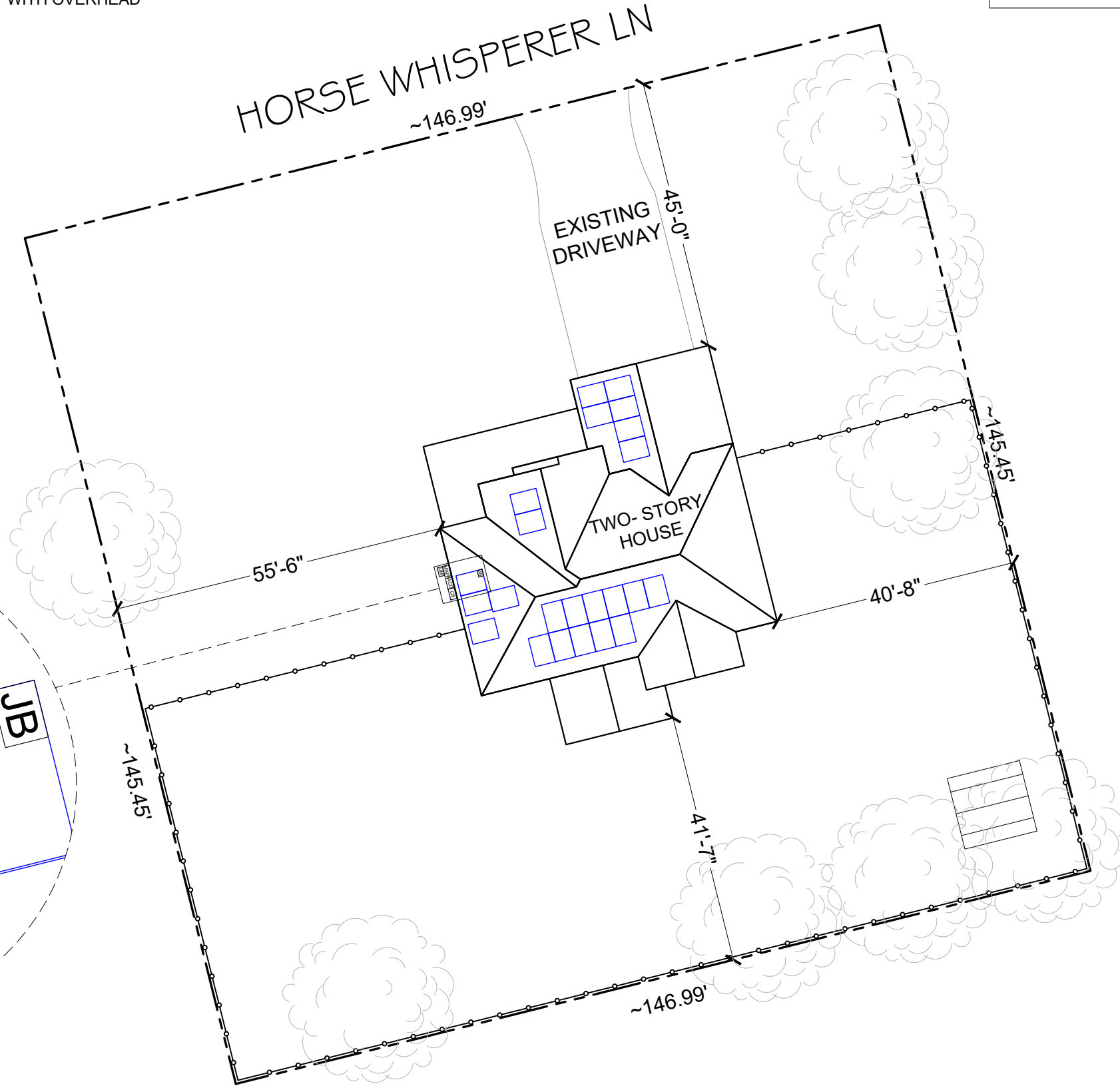
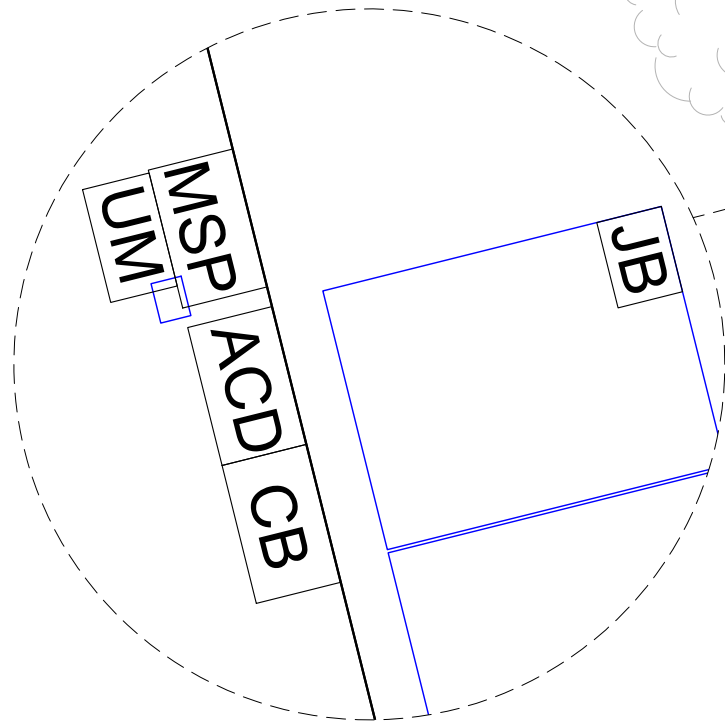
PV-0

● **ROOF ACCESS POINT** SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES OR SIGNS.

NOTE: 3/4" OR GREATER EMT CONDUIT RUN (IN ATTIC)

LEGEND	
UM	UTILITY METER
MSP	MAIN SERVICE PANEL
ACD	AC DISCONNECT
CB	ENPHASE IQ COMBINER 4
JB	JUNCTION BOX
—	PROPERTY
☁	TREES

**NOTE:**  
 • ALL ELECTRICAL EQUIPMENT, INVERTERS, DISCONNECTS, MAIN SERVICE PANELS, ETC. SHALL NOT BE INSTALLED WITHIN 3' OF THE GAS METERS' SUPPLY OR DEMAND PIPING.



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 LILLINGTON, NC 27546, USA  
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 UTILITY: DUKE ENERGY  
 AHJ: HARNETT COUNTY

SHEET NAME  
 SITE PLAN WITH  
 ROOF PLAN

SHEET SIZE  
 ANSI B  
 11" X 17"

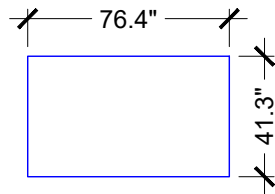
SHEET NUMBER  
 PV-1



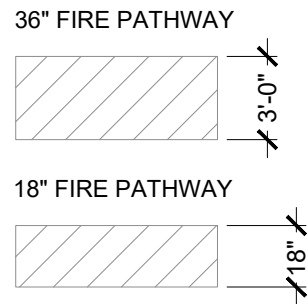
**MODULE TYPE, DIMENSIONS & WEIGHT**

NUMBER OF MODULES = 23 MODULES  
 MODULE TYPE = CANADIAN SOLAR CS3N-390MS (390W) MODULES  
 MODULE WEIGHT = 49.6 LBS / 22.5 KG.  
 MODULE DIMENSIONS = 76.4" X 41.3" = 21.91 SF  
 UNIT WEIGHT OF ARRAY = 2.26 PSF  
 DISTRIBUTED DEAD LOAD = 2.54 PSF  
 AVERAGE ROOF POINT DEAD LOAD = 22.75LBS  
 TOTAL SYSTEM WEIGHT: 1501.76 LBS

PHOTOVOLTAIC MODULES  
 CANADIAN SOLAR CS3N-390MS (390W)



"APPROVED ROOF ATTACHMENT OPTIONS INDICATED ON PV-3 & PV-3.1 ATTACHMENT DETAILS PAGE(S)



ROOF	# OF MODULES	ARRAY AREA (Sq. Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)
#1	11	241.03	485.87	49.61
#2	04	87.65	182.42	48.05
#3	02	43.82	136.19	32.18
#4	06	131.47	193.46	67.96

AREA OF NEW ARRAY (Sq. Ft.)	AREA OF ROOF (PLAN VIEW) (Sq. Ft.)	TOTAL ROOF AREA COVERED BY ARRAY %
503.97	2563.60	20%
20%	ROOF AREA (ARRAY <33% OF ROOF AREA)	

ROOF TYPE				COMP SHINGLE ROOF	
ROOF	# OF MODULES	ROOF TILT	AZIMUTH	RAFTERS SIZE	RAFTERS SPACING
#1	11	40°	166°	2"x4"	24" O.C.
#2	04	45°	256°	2"x4"	24" O.C.
#3	02	45°	256°	2"x4"	24" O.C.
#4	06	45°	256°	2"x4"	24" O.C.

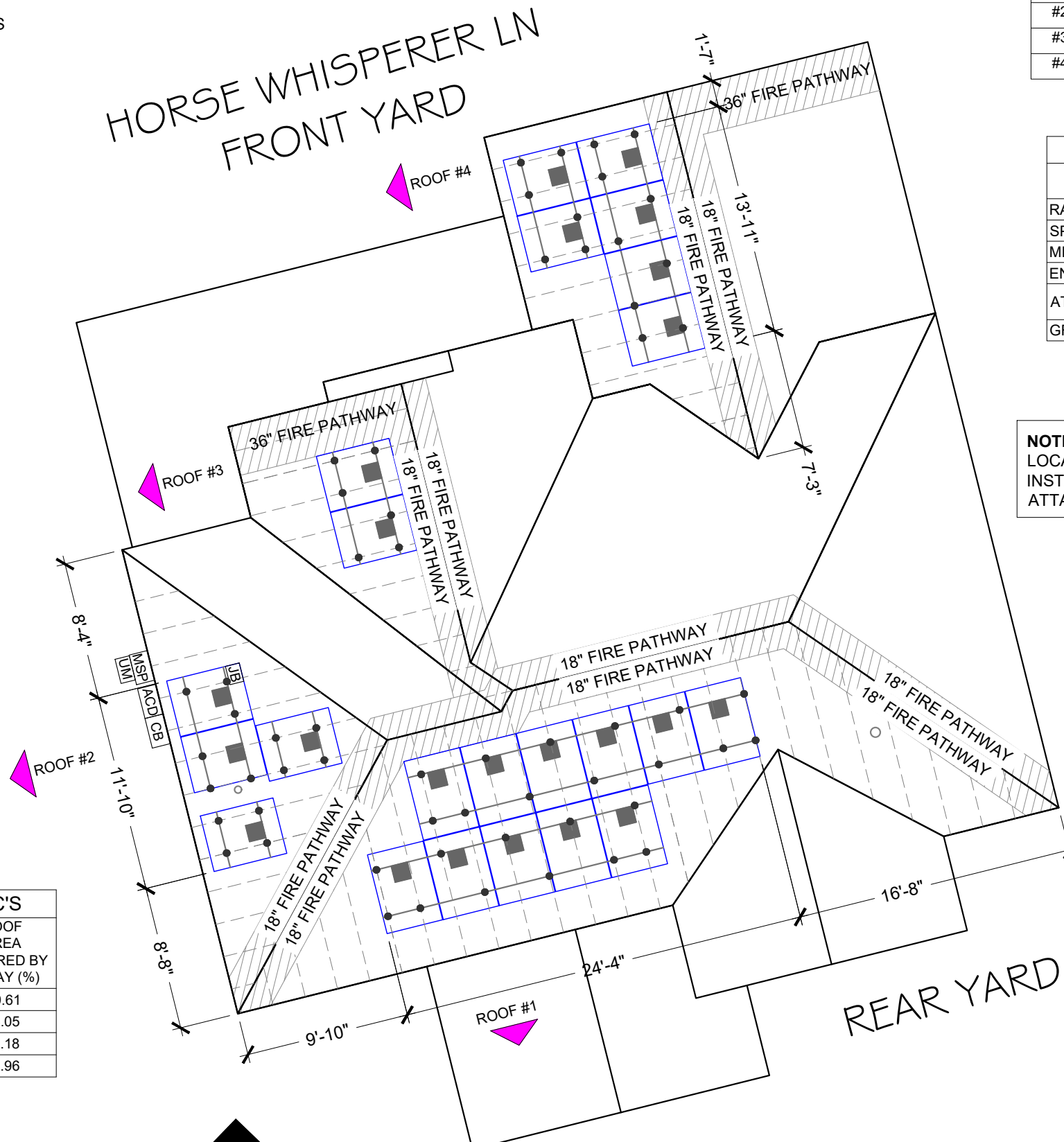
EQUIPMENT	QTY	DESCRIPTION
RAIL	12	UNIRAC SM LIGHT RAIL 168" MILL
SPLICE	04	BND SPLICE BAR PRO SERIES MILL
MID CLAMP	30	UNIVERSAL AF MID CLAMPS
END CLAMP	32	UNIVERSAL AF END CLAMPS
ATTACHMENT	59	UNIRAC FLASHLOC OR FLASHKIT PRO
GROUNDING LUG	08	GROUND LUG

NOTE: 3/4" OR GREATER EMT CONDUIT RUN (IN ATTIC)

NOTE: ACTUAL ROOF CONDITIONS AND RAFTERS (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

HORSE WHISPERER LN  
 FRONT YARD

REAR YARD

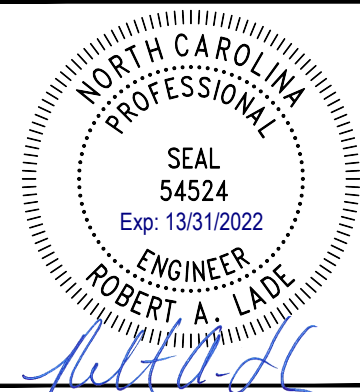


[UM]	UTILITY METER
[MSP]	MAIN SERVICE PANEL
[ACD]	AC DISCONNECT
[INV]	INVERTER
[JB]	JUNCTION BOX
—	UNIRAC SM LIGHT RAIL
- - -	RAFTERS
■	MICRO-INVERTERS
●	UNIRAC FLASHLOC OR FLASHKIT PRO ATTACHMENT @ 48"O.C.
○ □	VENT, ATTIC FAN (ROOF OBSTRUCTION)
⊗	CHIMNEY

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



• PLUMBING VENTS, SKYLIGHTS AND MECHANICAL VENTS SHALL NOT BE COVERED, MOVED, RE-ROUTED OR RE-LOCATED.



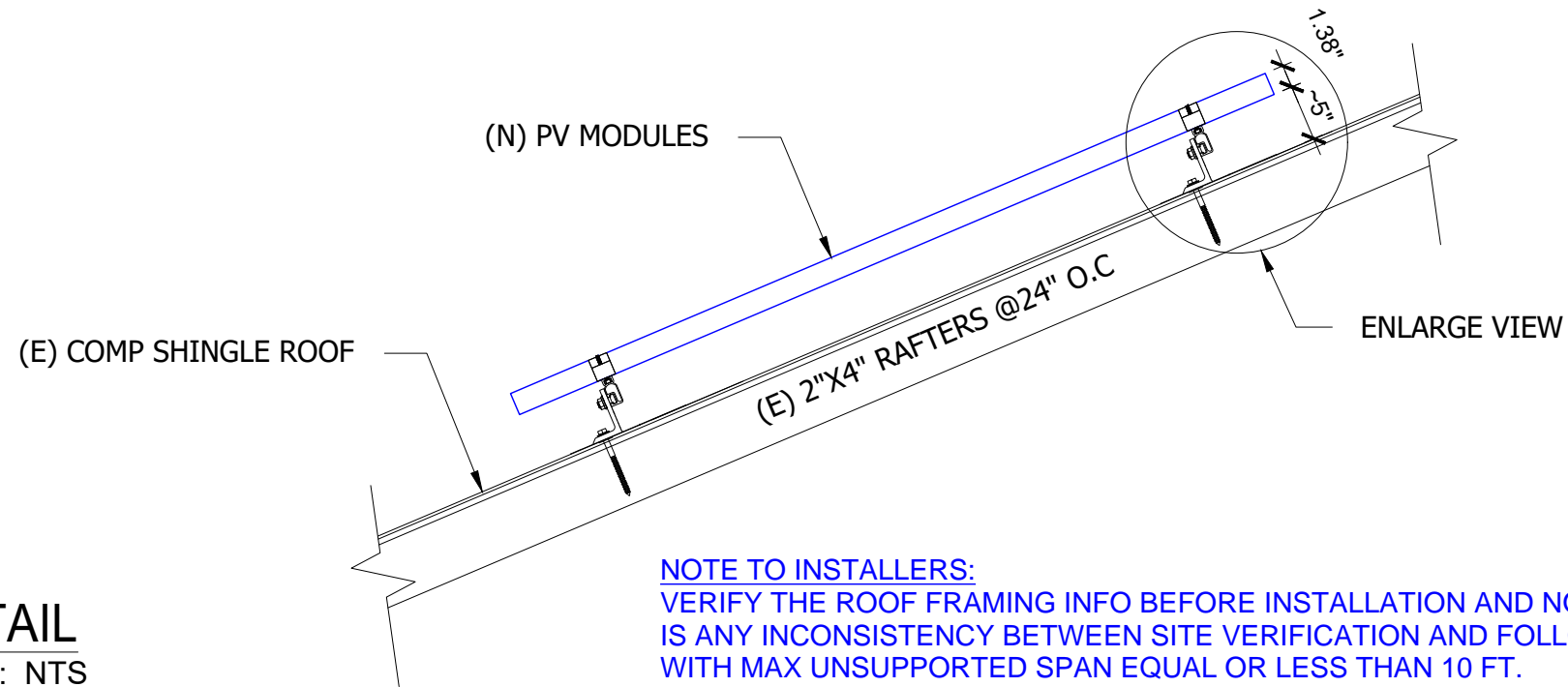
DEL MAR, CA 92014, USA

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INITIAL RELEASE	10/07/2022	UR

PROJECT NAME  
**JOSEPH N HERNANDEZ**  
**104 HORSE WHISPERER LN,**  
**LILLINGTON, NC 27546, USA**  
 APN# 030507 0200 28  
 UTILITY: DUKE ENERGY  
 AHJ: HARNETT COUNTY

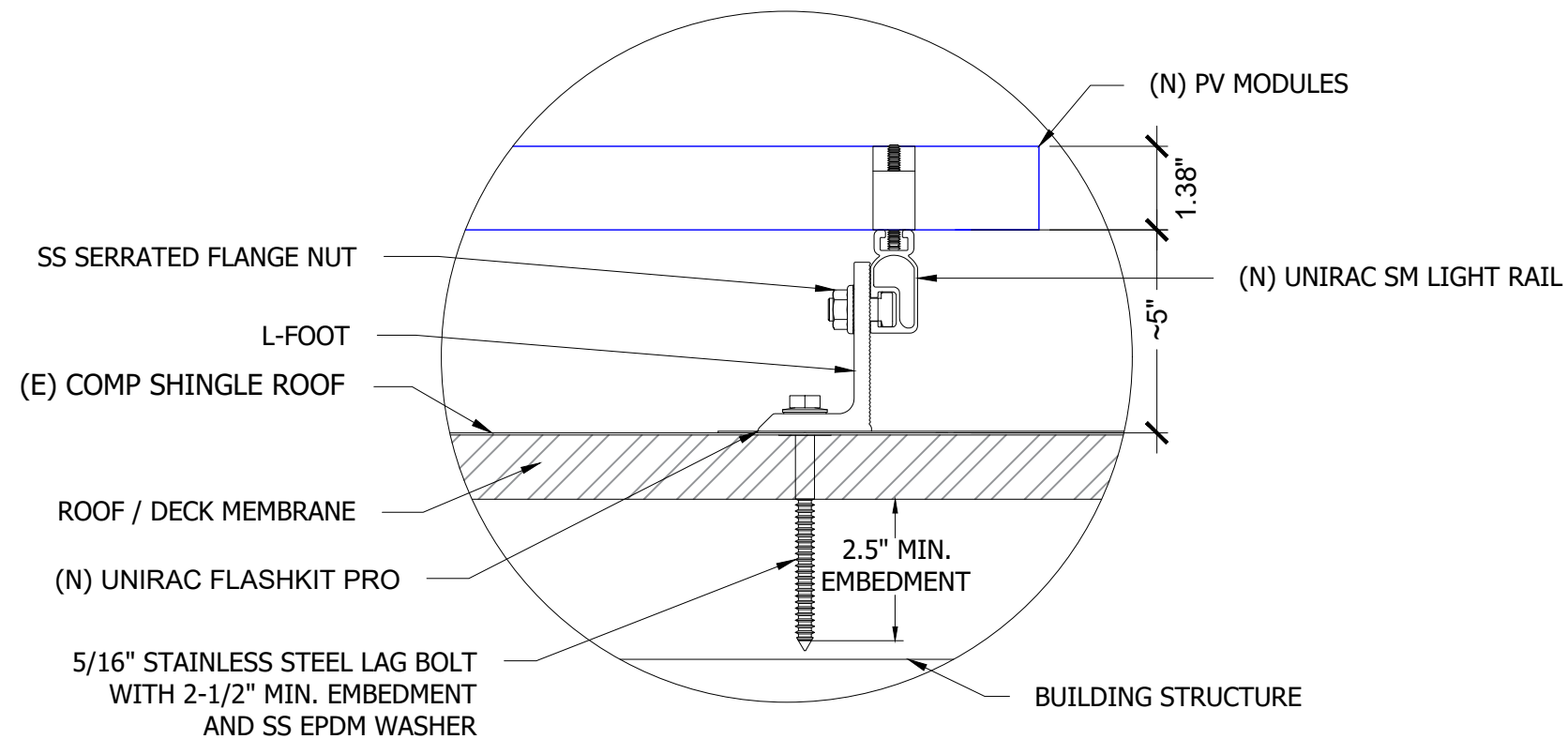
SHEET NAME  
**ROOF PLAN WITH MODULES**  
 SHEET SIZE  
**ANSI B**  
**11" X 17"**  
 SHEET NUMBER  
**PV-2**

**NOTE:** ACTUAL ROOF CONDITIONS AND RAFTERS (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

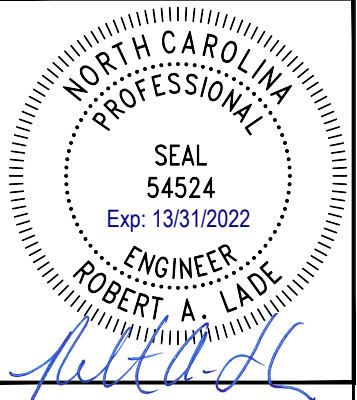


**NOTE TO INSTALLERS:**  
 VERIFY THE ROOF FRAMING INFO BEFORE INSTALLATION AND NOTIFY THE EOR AT 951.405.1733 IF THERE IS ANY INCONSISTENCY BETWEEN SITE VERIFICATION AND FOLLOWING: 2x4 RAFTERS @ 24" OC SPACING WITH MAX UNSUPPORTED SPAN EQUAL OR LESS THAN 10 FT.

**1 ATTACHMENT DETAIL**  
 SCALE: NTS



**2 ATTACHMENT DETAIL (ENLARGED VIEW)**  
 SCALE: NTS



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VERSION		
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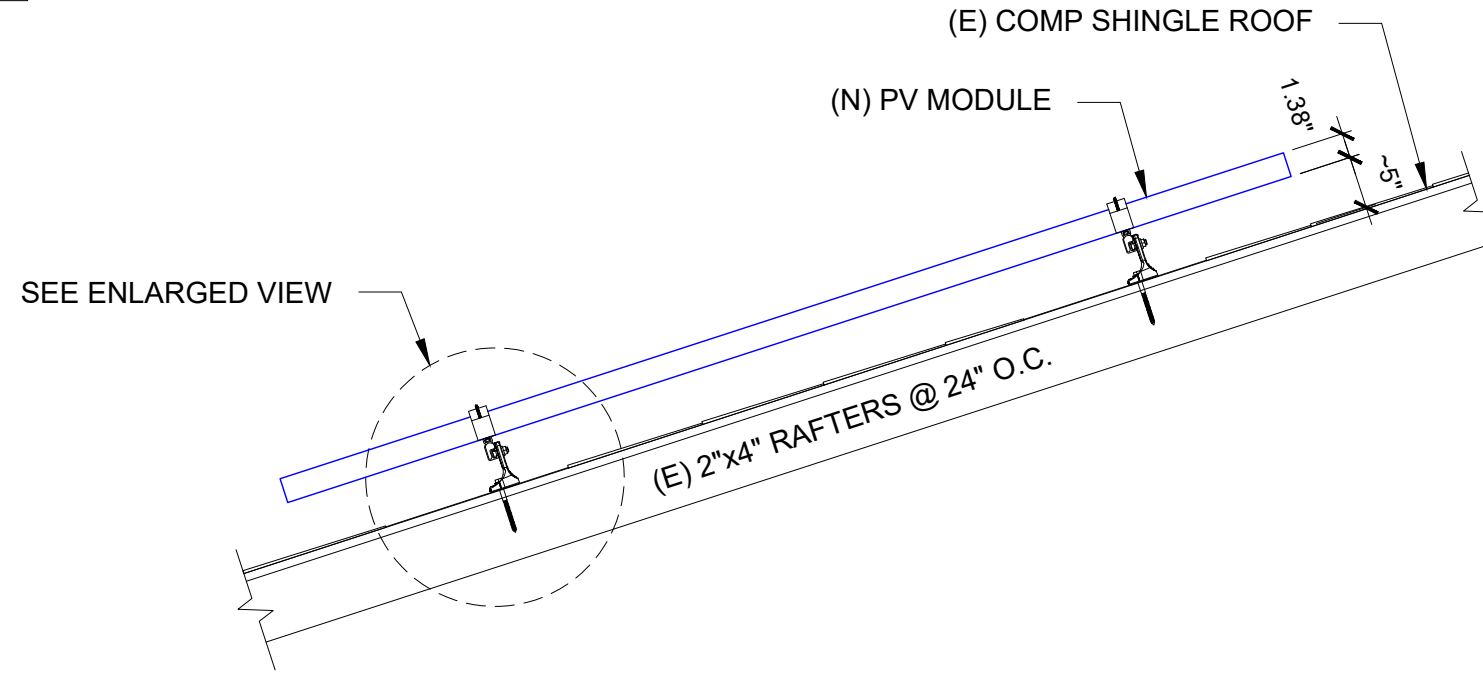
PROJECT NAME  
**JOSEPH N HERNANDEZ**  
**104 HORSE WHISPERER LN,**  
**LILLINGTON, NC 27546, USA**  
 APN# 030507 0200 28  
 UTILITY: DUKE ENERGY  
 AHJ: HARNETT COUNTY

SHEET NAME  
**ATTACHMENT DETAIL**

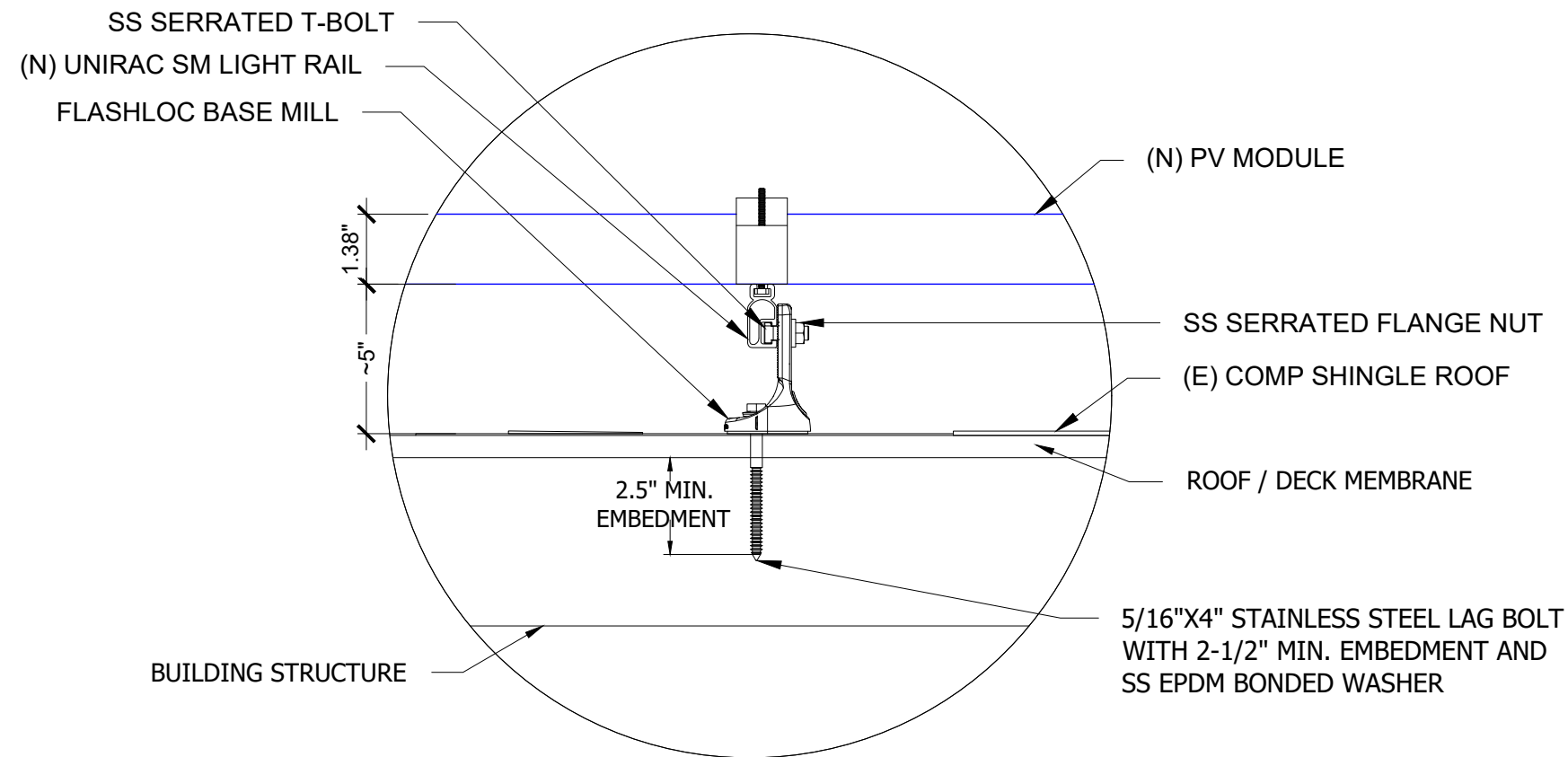
SHEET SIZE  
**ANSI B**  
**11" X 17"**

SHEET NUMBER  
**PV-3**

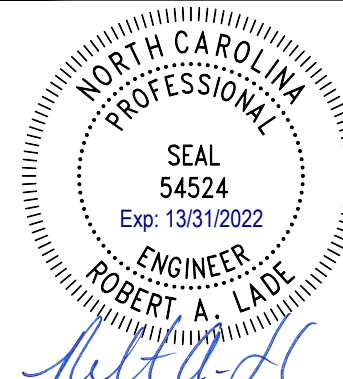
**NOTE:** ACTUAL ROOF CONDITIONS AND RAFTERS (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS



**1 ATTACHMENT DETAIL**  
SCALE: NTS



**2 ATTACHMENT DETAIL (ENLARGED VIEW)**  
SCALE: NTS



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104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

SHEET NAME  
ATTACHMENT  
DETAIL

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
PV-3.1

**SOLAR MODULE SPECIFICATIONS**

MANUFACTURER / MODEL #	VMP	IMP	VOC	ISC	TEMPERATURE COEFFICIENT OF Voc	# OF MODULES
CANADIAN SOLAR CS3N-390MS (390W)	36.8	10.60	44.1	11.38	-0.27%/°C	23
MODULE DIMENSION	76.4" L x 41.3" W x 1.38" D					

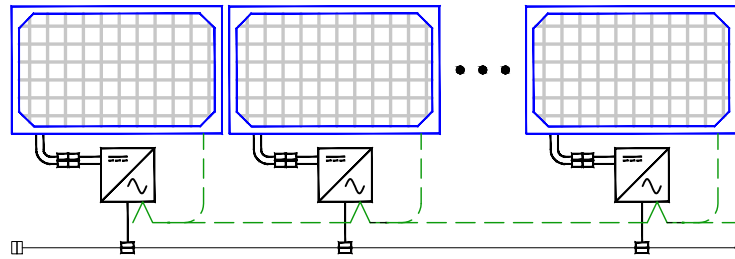
**AMBIENT TEMPERATURE SPECIFICATIONS**

RECORD LOW TEMP	AMBIENT TEMP (HIGH TEMP 2%)	CONDUIT HEIGHT	CONDUCTOR TEMPERATURE RATE (ON ROOF)	CONDUCTOR TEMPERATURE RATE (OFF ROOF)
-13°	33°	IN ATTIC	90°	75°

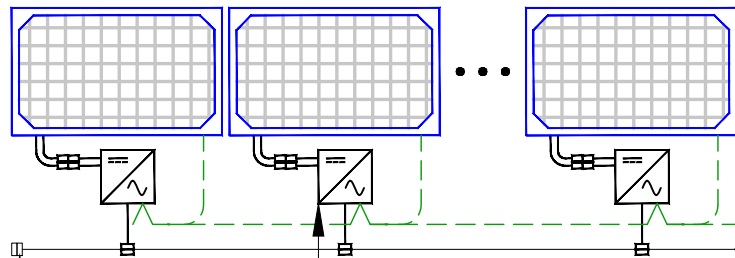
**INVERTER SPECIFICATIONS**

MANUFACTURER / MODEL #	QUANTITY	NOMINAL OUTPUT VOLTAGE	NOMINAL OUTPUT CURRENT
ENPHASE ENERGY IQ8PLUS-72-2-US	23	240 VAC	1.21A

**12 MICRO-INVERTERS IN BRANCH CIRCUIT #1**



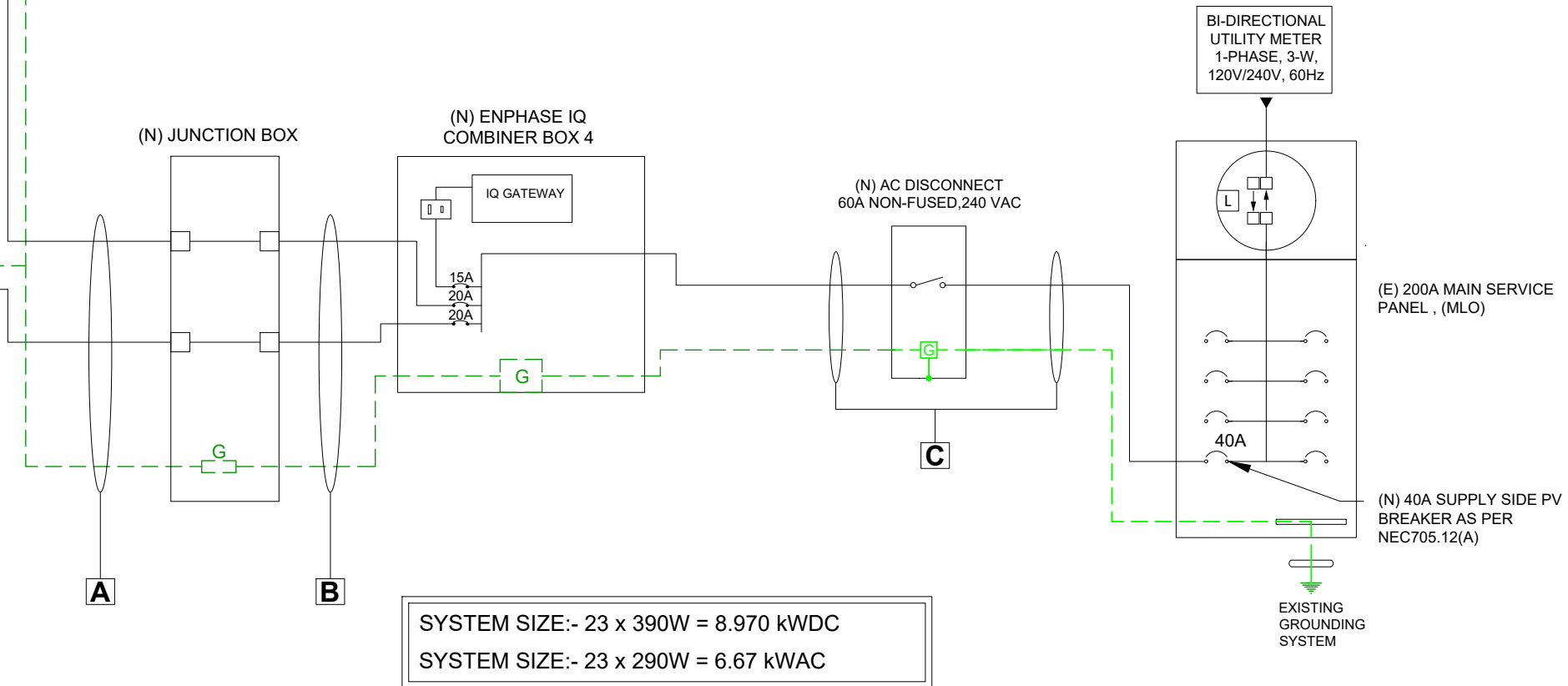
**11 MICRO-INVERTERS IN BRANCH CIRCUIT #2**



ENPHASE ENERGY IQ8PLUS-72-2-US, 240V, MICRO-INVERTERS  
 TERMINATOR CAP ON LAST CABLE CONNECTOR Q CABLE (TYP)

**SERVICE INFO.**

UTILITY PROVIDER: DUKE ENERGY  
 MAIN SERVICE VOLTAGE: 240V  
 MAIN PANEL BRAND: SQUARE D  
 MAIN SERVICE PANEL: (E) 200A  
 MAIN CIRCUIT BREAKER RATING: N/A  
 MAIN SERVICE LOCATION: NORTH WEST  
 SERVICE FEED SOURCE: EATON



SYSTEM SIZE:- 23 x 390W = 8.970 kWDC  
 SYSTEM SIZE:- 23 x 290W = 6.67 kWAC

Wire Tag	Conduit	Wire Qty	Wire Gauge	Wire Type	Temp. Rating	Wire Ampacity (A)	Temp. Derate	Conduit Fill Derate	Derated Ampacity (A)	Inverter Qty	NOC (A)	Design Current (A)	Ground Size	Ground Wire Type
A	OPEN AIR	2	12 AWG	Q Cable	90°C	30	0.96	1.0	28.80	12	1.21	14.52	06 AWG	BARE CU
B	3/4" EMT	4 OR 2	12 OR 10 AWG	THWN-2 OR #12 NM-B CABLES WHERE RUN INDOOR	90°C	40 OR 30	0.96	0.80	30.72 OR 23.04	12	1.21	14.52	10 AWG	THWN-2
C	3/4" EMT	3	8 AWG	THWN	75°C	50	0.94	1.0	47.00	23	1.21	27.83	10 AWG	THWN

**1 ELECTRICAL LINE DIAGRAM WITH CALCULATION**  
 SCALE: NTS



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 LILLINGTON, NC 27546, USA  
 APN# 030507 0200 28  
 UTILITY: DUKE ENERGY  
 AHJ: HARNETT COUNTY

**SHEET NAME**

ELECTRICAL LINE DIAGRAM

**SHEET SIZE**

ANSI B  
 11" X 17"

**SHEET NUMBER**

PV-4

**⚠ 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)

**PHOTOVOLTAIC**  
**AC DISCONNECT**

LABEL LOCATION:  
AC DISCONNECT  
NEC 690.13(B)

**⚠ WARNING DUAL POWER SOURCE**  
**SECOND SOURCE IS PHOTOVOLTAIC SYSTEM**

LABEL LOCATION:  
POINT OF INTERCONNECTION  
PRODUCTION METER  
NEC 705.12(B)(3)(3) & NEC 690.59)

**⚠ 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)

**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.

**PHOTOVOLTAIC AC DISCONNECT**  
MAXIMUM AC OPERATING CURRENT: 27.83 AMPS  
NOMINAL OPERATING AC VOLTAGE: 240 VAC

LABEL LOCATION:  
AC DISCONNECT(S), PHOTOVOLTAIC SYSTEM POINT OF INTERCONNECTION.  
PER CODE(S): NEC 2020: 690.54

**PHOTOVOLTAIC POWER SOURCE**

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

**MAIN PHOTOVOLTAIC SYSTEM DISCONNECT**

LABEL LOCATION:  
MAIN SERVICE DISCONNECT / UTILITY METER  
(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)

**RAPID SHUTDOWN FOR SOLAR PV SYSTEM**

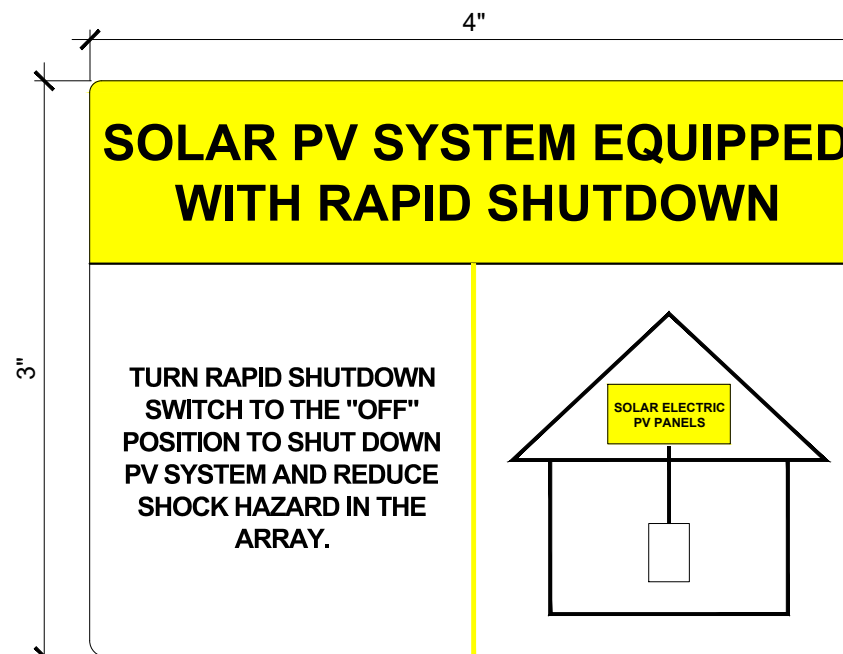
LABEL LOCATION:  
UTILITY SERVICE ENTRANCE/METER, INVERTER/DC DISCONNECT IF REQUIRED BY LOCAL AHJ, OR OTHER LOCATIONS AS REQUIRED BY LOCAL AHJ.  
PER CODE(S): NEC 2020: 690.56(C)(2)

**⚠ CAUTION**  
**PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED**

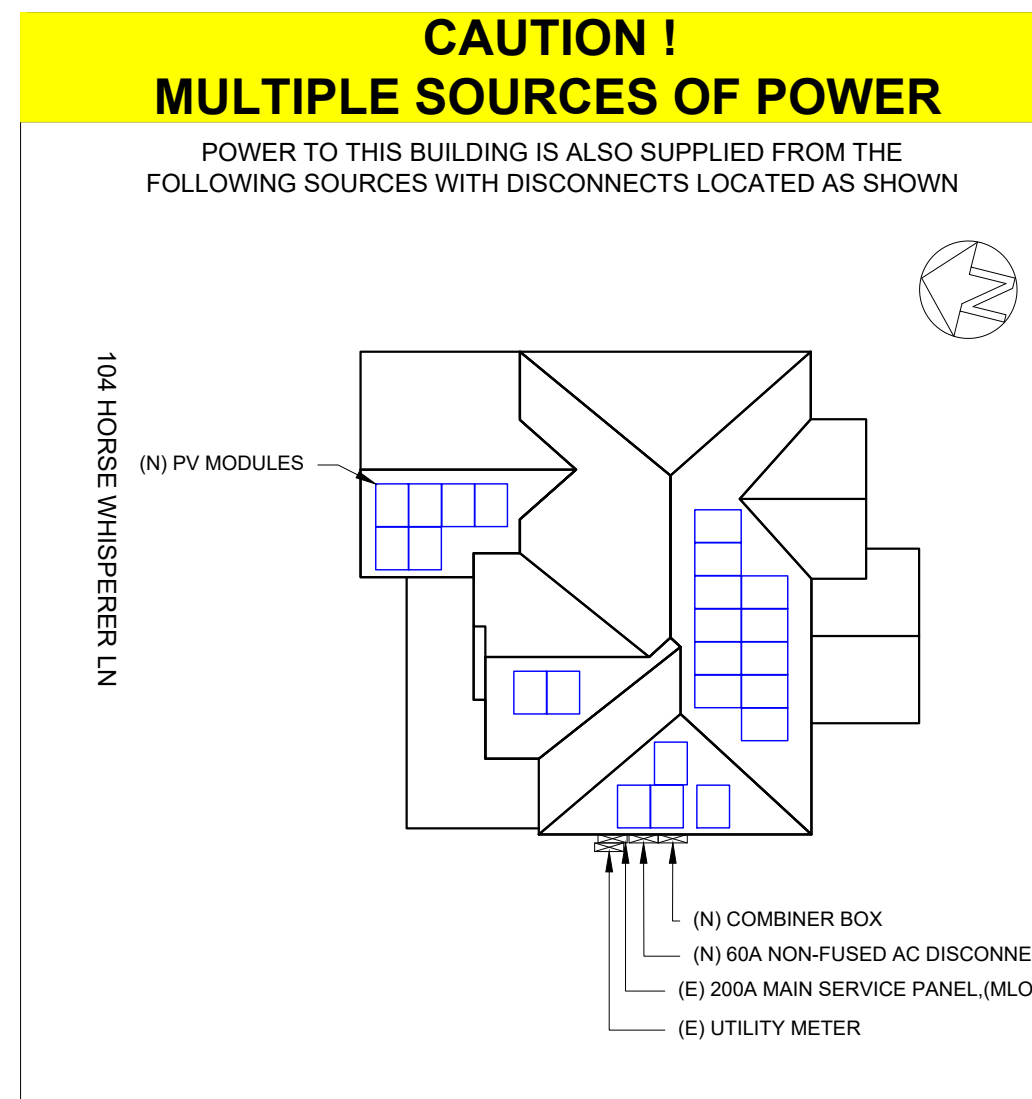
LABEL LOCATION:  
MSP (PER CODE: NEC 705.12(D) & NEC 690.59

**⚠ WARNING**  
**THE DISCONNECTION OF THE GROUNDED CONDUCTOR(S) MAY RESULT IN OVERVOLTAGE ON THE EQUIPMENT**

LABEL LOCATION:  
INVERTER  
PER CODE: NEC 690.31(E)



LABEL LOCATION:  
ON OR NO MORE THAN 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)



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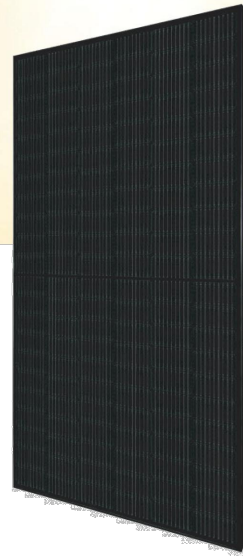
VERSION		
DESCRIPTION	DATE	REV
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PROJECT NAME  
**JOSEPH N HERNANDEZ**  
**104 HORSE WHISPERER LN,**  
**LILLINGTON, NC 27546, USA**  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

SHEET NAME  
**WARNING LABELS & PLACARD**

SHEET SIZE  
**ANSI B**  
**11" X 17"**

SHEET NUMBER  
**PV-5**



# HiKuBlack Mono PERC

## BLACK FRAME ON BLACK BACKSHEET

### F23 Frame

#### 380 W ~ 410 W

#### CS3N-380 | 385 | 390 | 395 | 400 | 405 | 410MS

#### MORE POWER

**410 W** Module power up to 410 W  
Module efficiency up to 20.2 %

**\$** Lower LCOE & BOS cost

**📈** Comprehensive LID / LeTID mitigation technology, up to 50% lower degradation

**🏠** Better shading tolerance

#### MORE RELIABLE

**🛡️** Minimizes micro-crack impacts

**\*\*\*** Heavy snow load up to 8100 Pa, enhanced wind load up to 6000 Pa\*

**25 Years** Industry Leading Product Warranty on Materials and Workmanship\*

**25 Years** Linear Power Performance Warranty\*

**1<sup>st</sup> year power degradation no more than 2%**  
**Subsequent annual power degradation no more than 0.55%**

\*Subject to the terms and conditions contained in the applicable Canadian Solar Limited Warranty Statement. Also this 25-year limited product warranty is available only for products installed and operating on residential rooftops in certain regions.

#### MANAGEMENT SYSTEM CERTIFICATES\*

ISO 9001: 2015 / Quality management system  
ISO 14001: 2015 / Standards for environmental management system  
ISO 45001: 2018 / International standards for occupational health & safety

#### PRODUCT CERTIFICATES\*

IEC 61215 / IEC 61730 / CE  
FSEC (US Florida) / UL 61730 / IEC 61701 / IEC 62716



\* The specific certificates applicable to different module types and markets will vary, and therefore not all of the certifications listed herein will simultaneously apply to the products you order or use. Please contact your local Canadian Solar sales representative to confirm the specific certificates available for your Product and applicable in the regions in which the products will be used.

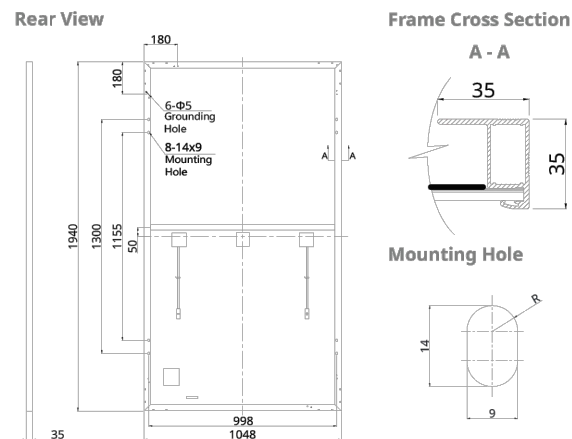
**CSI SOLAR (USA) CO., LTD.** is committed to providing high quality solar photovoltaic modules, solar energy and battery storage solutions to customers. The company was recognized as the No. 1 module supplier for quality and performance/price ratio in the IHS Module Customer Insight Survey. Over the past 20 years, it has successfully delivered over 63 GW of premium-quality solar modules across the world.

\* For detailed information, please refer to Installation Manual.

**CSI SOLAR (USA) CO., LTD.**

1350 Treat Blvd. Suite 500, Walnut Creek, CA 94598, USA | [www.csisolar.com/na](http://www.csisolar.com/na) | [service.ca@csisolar.com](mailto:service.ca@csisolar.com)

#### ENGINEERING DRAWING (mm)



#### ELECTRICAL DATA | STC\*

CS3N	380MS	385MS	390MS	395MS	400MS	405MS	410MS
Nominal Max. Power (Pmax)	380 W	385 W	390 W	395 W	400 W	405 W	410 W
Opt. Operating Voltage (Vmp)	36.4 V	36.6 V	36.8 V	37.0 V	37.2 V	37.4 V	37.6 V
Opt. Operating Current (Imp)	10.44 A	10.52 A	10.60 A	10.68 A	10.76 A	10.83 A	10.92 A
Open Circuit Voltage (Voc)	43.7 V	43.9 V	44.1 V	44.3 V	44.5 V	44.7 V	44.9 V
Short Circuit Current (Isc)	11.26 A	11.32 A	11.38 A	11.44 A	11.50 A	11.56 A	11.62 A
Module Efficiency	18.7%	18.9%	19.2%	19.4%	19.7%	19.9%	20.2%
Operating Temperature	-40°C ~ +85°C						
Max. System Voltage	1000V (UL)						
Module Fire Performance	TYPE 2 (UL 61730 1000V)						
Max. Series Fuse Rating	20 A						
Application Classification	Class A						
Power Tolerance	0 ~ + 10 W						

\* Under Standard Test Conditions (STC) of irradiance of 1000 W/m<sup>2</sup>, spectrum AM 1.5 and cell temperature of 25°C.

#### ELECTRICAL DATA | NMOT\*

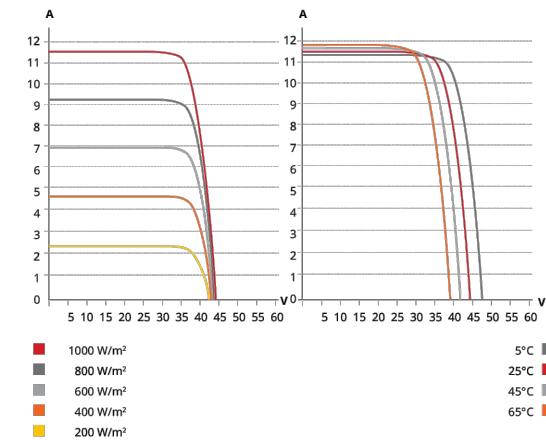
CS3N	380MS	385MS	390MS	395MS	400MS	405MS	410MS
Nominal Max. Power (Pmax)	284 W	288 W	291 W	295 W	299 W	303 W	306 W
Opt. Operating Voltage (Vmp)	34.0 V	34.2 V	34.4 V	34.6 V	34.7 V	34.9 V	35.1 V
Opt. Operating Current (Imp)	8.35 A	8.42 A	8.48 A	8.54 A	8.60 A	8.66 A	8.73 A
Open Circuit Voltage (Voc)	41.2 V	41.4 V	41.6 V	41.8 V	41.9 V	42.1 V	42.3 V
Short Circuit Current (Isc)	9.08 A	9.13 A	9.18 A	9.23 A	9.28 A	9.33 A	9.37 A

\* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m<sup>2</sup>, spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

\* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. CSI Solar Co., Ltd. reserves the right to make necessary adjustment to the information described herein at any time without further notice. Please be kindly advised that PV modules should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

**CSI SOLAR (USA) CO., LTD.**

#### CS3N-400MS / I-V CURVES



#### MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline
Cell Arrangement	132 [2 X (11 X 6)]
Dimensions	1940 X 1048 X 35 mm (76.4 X 41.3 X 1.38 in)
Weight	23.4 kg (51.6 lbs)
Front Cover	3.2 mm tempered glass
Frame	Anodized aluminium alloy
J-Box	IP68, 3 bypass diodes
Cable	12 AWG (UL)
Cable Length (Including Connector)	Portrait: 400 mm (15.7 in) (+) / 280 mm (11.0 in) (-) (supply additional cable jumper: 2 lines/pallet); landscape: 1250 mm (49.2 in)*
Connector	T4 or MC4 series
Per Pallet	30 pieces
Per Container (40' HQ)	720 pieces

\* For detailed information, please contact your local Canadian Solar sales and technical representatives.

#### TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.34 % / °C
Temperature Coefficient (Voc)	-0.26 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	42 ± 3°C

#### PARTNER SECTION



DEL MAR, CA 92014, USA

#### VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

#### PROJECT NAME

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104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

#### SHEET NAME

SPEC SHEETS

#### SHEET SIZE

ANSI B  
11" X 17"

#### SHEET NUMBER

PV-6





## IQ8 Series 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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IQ8SE-DS-0001-01-EN-US-2022-03-17

### 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

\* Only when installed with IQ System Controller 2, meets UL 1741. IQ8H-208V operates only in grid-tied mode.  
\*\* IQ8 Series Microinverters supports split phase, 240V. IQ8H-208 supports split phase, 208V only.

## IQ8 Series Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US	IQ8M-72-2-US	IQ8A-72-2-US	IQ8H-240-72-2-US	IQ8H-208-72-2-US <sup>1</sup>
Commonly used module pairings <sup>2</sup>	W	235 – 350	235 – 440	260 – 460	295 – 500	320 – 540+	295 – 500+
Module compatibility		60-cell/120 half-cell, 66-cell/132 half-cell and 72-cell/144 half-cell					
MPPT voltage range	V	27 – 37	29 – 45	33 – 45	36 – 45	38 – 45	38 – 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 <sup>3</sup> [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	IQ8M-72-2-US	IQ8A-72-2-US	IQ8H-240-72-2-US	IQ8H-208-72-2-US
Peak output power	VA	245	300	330	366	384	366
Max continuous output power	VA	240	290	325	349	380	360
Nominal (L-L) voltage/range <sup>4</sup>	V	240 / 211 – 264					208 / 183 – 250
Max continuous output current	A	1.0	1.21	1.35	1.45	1.58	1.73
Nominal frequency	Hz	60					
Extended frequency range	Hz	50 – 68					
AC short circuit fault current over 3 cycles	Arms			2		4.4	
Max units per 20 A (L-L) branch circuit <sup>5</sup>		16	13	11	11	10	9
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	97.6	97.6	97.6	97.4
CEC weighted efficiency	%	97	97	97	97.5	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					
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					

(1) The IQ8H-208 variant will be operating in grid-tied mode only at 208V AC. (2) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (3) Maximum continuous input DC current is 10.6A (4) Nominal voltage range can be extended beyond nominal if required by the utility. (5) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8SE-DS-0001-01-EN-US-2022-03-17



DEL MAR, CA 92014, USA

### VERSION

DESCRIPTION	DATE	REV
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### PROJECT NAME

JOSEPH N HERNANDEZ  
104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

### SHEET NAME

SPEC SHEETS

### SHEET SIZE

ANSI B  
11" X 17"

### SHEET NUMBER

PV-7

# 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](https://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](https://enphase.com)

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DEL MAR, CA 92014, USA

### VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

### PROJECT NAME

JOSEPH N HERNANDEZ  
104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

### SHEET NAME

SPEC SHEETS

### SHEET SIZE

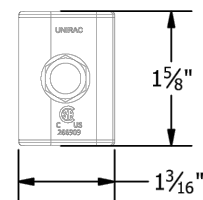
ANSI B  
11" X 17"

### SHEET NUMBER

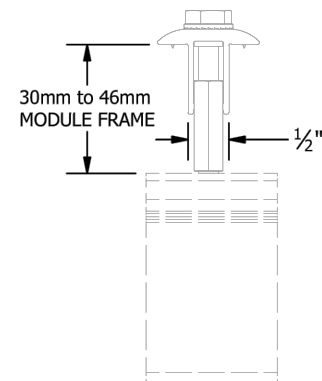
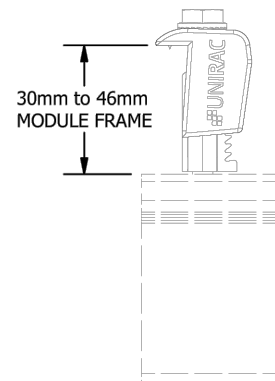
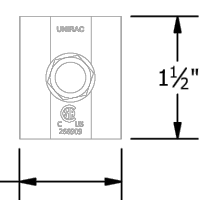
PV-8

PART # TABLE	
P/N	DESCRIPTION
302045M	UNIVERSAL AF MID CLAMP - MILL
302045D	UNIVERSAL AF MID CLAMP - DRK
302050M	UNIVERSAL AF END CLAMP - MILL
302050D	UNIVERSAL AF END CLAMP - DRK

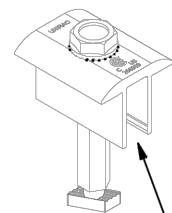
UNIVERSAL AF  
END CLAMP



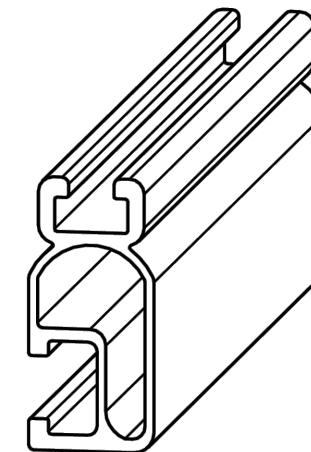
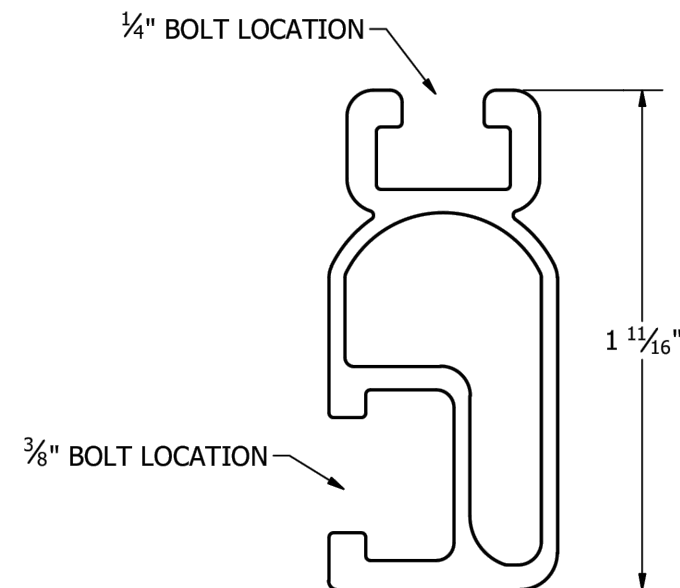
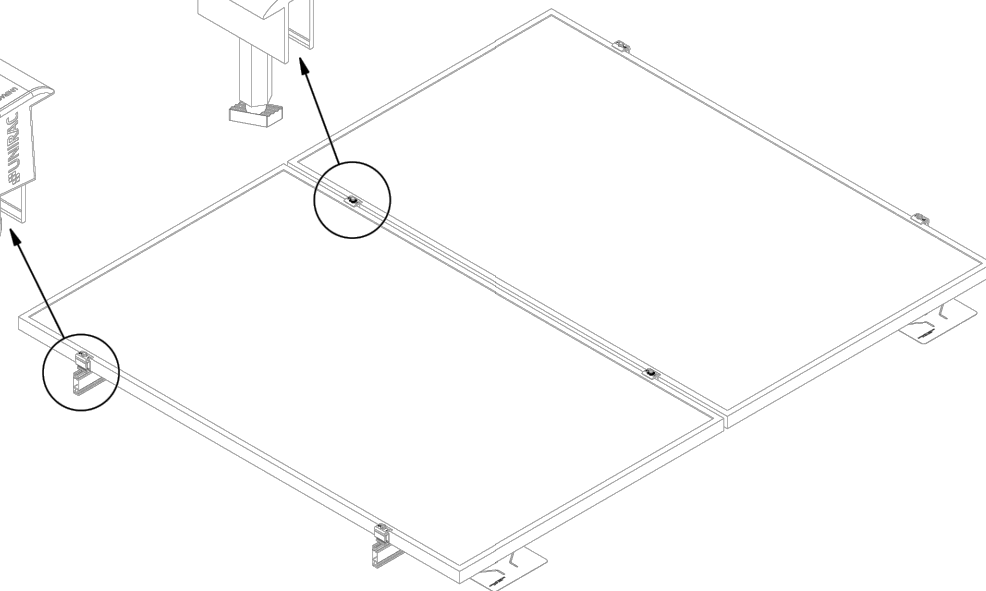
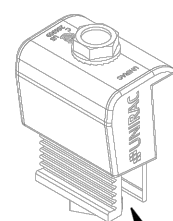
UNIVERSAL AF  
MID CLAMP



UNIVERSAL  
MID CLAMP



UNIVERSAL  
END CLAMP



PART # TABLE		
P/N	DESCRIPTION	LENGTH
315168M	SM LIGHT RAIL 168" MILL	168"
315168D	SM LIGHT RAIL 168" DRK	168"
315240M	SM LIGHT RAIL 240" MILL	240"
315240D	SM LIGHT RAIL 240" DRK	240"



1411 BROADWAY BLVD. NE  
ALBUQUERQUE, NM 87102 USA  
PHONE: 505.242.6411  
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	UNIVERSAL AF CLAMPS
REVISION DATE:	9/28/2020

DRAWING NOT TO SCALE  
ALL DIMENSIONS ARE  
NOMINAL

PRODUCT PROTECTED BY  
ONE OR MORE US PATENTS  
LEGAL NOTICE

SM-A01B

SHEET



1411 BROADWAY BLVD. NE  
ALBUQUERQUE, NM 87102 USA  
PHONE: 505.242.6411  
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	LIGHT RAIL
REVISION DATE:	9/11/2017

DRAWING NOT TO SCALE  
ALL DIMENSIONS ARE  
NOMINAL

PRODUCT PROTECTED BY  
ONE OR MORE US PATENTS  
LEGAL NOTICE

SM-P02

SHEET



DEL MAR, CA 92014, USA

VERSION		
DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

PROJECT NAME

JOSEPH N HERNANDEZ  
104 HORSE WHISPERER LN,  
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APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

SHEET NAME

SPEC SHEETS

SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

PV-9

# FLASHKIT PRO



FLASHKIT PRO is the complete attachment solution for composition shingle roofs. Featuring Unirac's patented SHED & SEAL technology, a weather proof system which provides the ultimate protection against roof leaks. Kitted in 10 packs for maximum convenience, flashings and hardware are available in Mill or Dark finishes. With FLASHKIT pro, you have everything you need for a quick, professional installation.



**TRUSTED WATER SEAL FLASHINGS**  
FEATURING SHED & SEAL TECHNOLOGY



**YOUR COMPLETE SOLUTION**  
Flashings, lags, continuous slot L-Feet and hardware



**CONVENIENT 10 PACKS**  
Packaged for speed and ease of handling

# FLASHKIT PRO



## INSTALLATION GUIDE

FLASHKIT PRO IS THE COMPLETE FLASHING AND ATTACHMENT SOLUTION FOR COMPOSITION ROOFS.



INSTALL FLASHKIT PRO FLASHING



INSTALL L-FOOT



ATTACH L-FOOT TO RAIL

### PRE-INSTALL

- Locate roof rafters and snap chalk lines to mark the installation point for each roof attachment.
- Drill a 7/32" pilot hole at each roof attachment. Fill each pilot hole with sealant.

### STEP 1 INSTALL FLASHKIT PRO FLASHING

- Add a U-shaped bead of roof sealant to the underside of the flashing with the open side of the U pointing down the roof slope. Slide the aluminum flashing underneath the row of shingles directly up slope from the pilot hole as shown. Align the indicator marks on the lower end of the flashing with the chalk lines on the roof to center the raised hole in the flashing over the pilot hole in the roof. When installed correctly, the flashing will extend under the two courses of shingles above the pilot hole.

### STEP 2 INSTALL L-FOOT

- Fasten L-foot and Flashing into place by passing the included lag bolt and pre-installed stainless steel-backed EPDM washer through the L-foot EPDM grommet, and the raised hole in the flashing, into the pilot hole in the roof rafter.

- Drive the lag bolt down until the L-foot is held firmly in place. It is normal for the EPDM on the underside of the stainless steel backed EPDM washer to compress and expand beyond the outside edge of the steel washer when the proper torque is applied.

#### TIP:

- Use caution to avoid over-torquing the lag bolt if using an impact driver.
- Repeat Steps 1 and 2 at each roof attachment point.

### STEP 3 ATTACH L-FOOT TO RAIL

- Insert the included 3/8"-16 T-bolts into the lower slot on the Rail (sold separately), spacing the bolts to match the spacing between the roof attachments.
- Position the Rail against the L-Foot and insert the threaded end of the T-Bolt through the continuous slot in the L-Foot. Apply anti-seize to bolt threads to prevent galling of the T-bolt and included 3/8" serrated flange nut. Place the 3/8" flange nut on the T-bolt and finger tighten. Repeat STEP 3 until all L-Feet are secured to the Rail with a T-bolt. Adjust the level and height of the Rail and torque each bolt to 30ft-lbs.

## THE COMPLETE ROOF ATTACHMENT SOLUTION

FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR CALL (505) 248-2702

## FASTER INSTALLATION. 25-YEAR WARRANTY.

FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR CALL (505) 248-2702



DEL MAR, CA 92014, USA

#### VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

#### PROJECT NAME

JOSEPH N HERNANDEZ  
104 HORSE WHISPERER LN,  
LILLINGTON, NC 27546, USA  
APN# 030507 0200 28  
UTILITY: DUKE ENERGY  
AHJ: HARNETT COUNTY

#### SHEET NAME

SPEC SHEETS

#### SHEET SIZE

ANSI B  
11" X 17"

#### SHEET NUMBER

PV-10

# FLASH LOC



**FLASHLOC** is the ultimate attachment for composition shingle and rolled comp roofs. The all-in-one mount installs fast — no kneeling on hot roofs to install flashing, no prying or cutting shingles, no pulling nails. Simply drive the lag bolt and inject sealant into the base. **FLASHLOC's** patented TRIPLE SEAL technology preserves the roof and protects the penetration with a permanent pressure seal. Kitted with lag bolts, sealant, and hardware for maximum convenience. Don't just divert water, **LOC it out!**



### PROTECT THE ROOF

Install a high-strength waterproof attachment without lifting, prying or damaging shingles.



### LOC OUT WATER

With an outer shield **1** contour-conforming gasket **2** and pressurized sealant chamber **3** the Triple Seal technology delivers a 100% waterproof connection.



### HIGH-SPEED INSTALL

Simply drive lag bolt and inject sealant into the port **4** to create a permanent pressure seal.

# FLASH LOC

## INSTALLATION GUIDE



### PRE-INSTALL

Snap chalk lines for attachment rows. On shingle roofs, snap lines 1-3/4" below upslope edge of shingle course. Locate rafters and mark attachment locations.

At each location, drill a 7/32" pilot hole. Clean roof surface of dirt, debris, snow, and ice. Next, BACKFILL ALL PILOT HOLES WITH SEALANT.

**NOTE:** Space mounts per racking system install specifications.



### STEP 1: SECURE

Place **FLASHLOC** over pilot hole with lag on down-slope side. Align indicator marks on sides of mount with chalk line. Pass included lag bolt and sealing washer through **FLASHLOC** into pilot hole. Drive lag bolt until mount is held firmly in place.

**NOTE:** The EPDM in the sealing washer will expand beyond the edge of the metal washer when proper torque is applied.



### STEP 2: SEAL

Insert tip of UNIRAC provided sealant into port. Inject until sealant exits both vents.

Continue array installation, attaching rails to mounts with provided T-bolts.



**NOTE:** When **FLASHLOC** is installed over gap between shingle tabs or vertical joints, fill gap/joint with sealant between mount and upslope edge of shingle course.

**USE ONLY UNIRAC APPROVED SEALANTS:** Chemlink Duralink 50 (included in kit) or Chemlink M-1

**FASTER INSTALLATION. 25-YEAR WARRANTY.**

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ANSI B  
11" X 17"

#### SHEET NUMBER

PV-11

### SYSTEM LEVEL FIRE CLASSIFICATION

The system fire class rating requires installation in the manner specified in the SOLARMOUNT Installation Guide. SOLARMOUNT has been classified to the system level fire portion of UL 1703. This UL 1703 classification has been incorporated into our UL 2703 product certification. SOLARMOUNT has achieved system level performance for steep sloped roofs. System level fire performance is inherent in the SOLARMOUNT design, and no additional mitigation measures are required. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes  $\geq 2$  inches per foot, or 9.5 degrees). The system is to be mounted over fire resistant roof covering rated for the application. There is no required minimum or maximum height limitation above the roof deck to maintain the system fire rating for SOLARMOUNT. Module Types & System Level Fire Ratings are listed below:

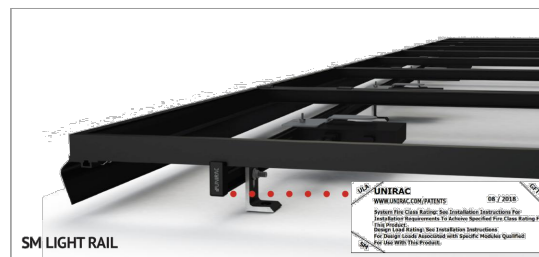
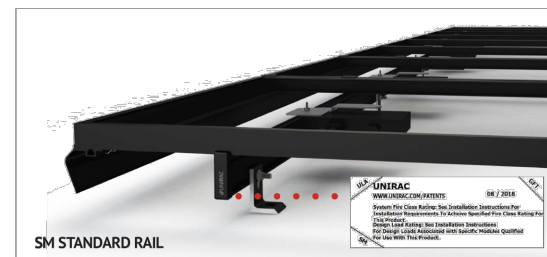
Rail Type	Module Type	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required
Standard Rail	Type 1, Type 2, Type 3 & Type 10	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Light Rail	Type 1 & Type 2	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required

This racking system may be used to ground and/or mount a PV module complying with UL1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

### UL2703 CERTIFICATION MARKING LABEL

Unirac SOLARMOUNT is listed to UL 2703. Certification marking is embossed on all mid clamps as shown. Labels with additional information will be provided. After the racking system is fully assembled, a single label should be applied to the SOLARMOUNT rail at the edge of the array. Before applying the label, the corners of the label that do not pertain to the system being installed must be removed so that only the installed system type is showing.

Note: The sticker label should be placed such that it is visible, but not outward facing.



**BONDING MIDCLAMP ASSEMBLY**

- Stainless steel Midclamp points, 2 per module, pierce module frame anodization to bond module to module through clamp.
- Serrated flange nut bonds stainless steel clamp to stainless steel T-bolt.
- Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to grounded SM rail.

**ENDCLAMP ASSEMBLY**

- Serrated flange nut bonds aluminum Endclamp to stainless steel T-bolt.
- Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and Endclamp to grounded SM rail.

Note: End clamp does not bond to module frame.

**BONDING RAIL SPLICE BAR**

- Bonding Hardware creates bond between splice bar and each rail section.
- Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

Note: Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.

**RAIL TO L-FOOT w/BONDING T-BOLT**

- Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt.
- Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail.

**BONDING MICROINVERTER MOUNT**

- Hex nut w/ captive lock washer bonds metal microinverter flange to stainless steel T-bolt.
- Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail. System ground including racking and modules may be achieved through the trunk cable of approved microinverter systems. See page 1 for details.

**RACK SYSTEM GROUND**

- WEEB washer dimples pierce anodized rail to create bond between rail and lug.
- Solid copper wire connected to lug is routed to provide final system ground connection.

Note: Ilcoo lug can also be used when secured to the side of the rail. See page 2 for details.

- Position clamp to align T-bolt with rail slot. Lower clamp and insert T-bolt into rail slot.
- Rotate clamp clockwise 2/3 of a turn to engage T-bolt inside rail slot.
- Place module at least 3/4" from end of rail and position clamp against module frame.
- While applying pressure to hold the clamp against the module, push down on the module side of the clamp cap.
- When the cap contacts the module frame, release and it will re-engage to the clamp base.
- Tighten bolt and torque to 15 ft-lbs.
- Confirm clamp is engaged in correct module height position and that the top of the cap is sitting level with the module frame.

NOTE: When installing 46mm modules, loosen bolt by 1 turn before positioning clamp against module frame. Do not force clamp onto module frame as this may damage the bonding pin.

- Position clamp to align T-bolt with rail slot. Lower clamp and insert T-bolt into rail slot.
- Rotate clamp clockwise 2/3 of a turn to engage T-bolt inside rail slot.
- Slide clamp into position against module.
- Place second module.
- Tighten bolt and torque to 15 ft-lbs.

NOTE: If excessive force is applied in step 2, the cap may over-rotate causing it to be mis-aligned with the module frame. If this occurs, keep rotating the cap clockwise until it returns to the original position.



DEL MAR, CA 92014, USA

VERSION		
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JOSEPH N HERNANDEZ  
 104 HORSE WHISPERER LN,  
 LILLINGTON, NC 27546, USA  
 APN# 030507 0200 28  
 UTILITY: DUKE ENERGY  
 AHJ: HARNETT COUNTY

SHEET NAME  
 SPEC SHEETS

SHEET SIZE  
 ANSI B  
 11" X 17"

SHEET NUMBER  
 PV-12



# Descriptive Report and Test Results

**MASTER CONTRACT:** 266909  
**REPORT:** 70131735  
**PROJECT:** 80128750

**Edition 1:** September 20, 2017; Project 70131735– Albuquerque  
Issued by Michael Hoffnagle

**Edition 17:** April 22, 2022; Project 80116723 - Irvine  
Prepared By: Michael Hoffnagle  
Authorized By: Michael Hoffnagle

**Edition 18:** June 8, 2022; Project 80128750 - Irvine  
Prepared By: Michael Hoffnagle  
Authorized By: Michael Hoffnagle

Report pages reissued

**Contents:** Certificate of Compliance - Pages 1 to 6  
Supplement to Certificate of Compliance - Pages 1 to 3  
Description and Tests - Pages 1 to 27  
Att1 Installation Manual SM– Pages 1 to 36  
Att2 Schematics SM/ULA– Pages 1 to 72  
Att3 Installation Manual ULA– Pages 1 to 22  
Att4 RM5\_Installation Guide - 1 to 19  
Att5 RMDT\_Installation Guide - 1 to 20  
Att6 RM series schematics – 1 to 32  
Att7 Installation Manual, GFT Shared Rail – Pages 1 to 40  
Att8 Installation Manual, GFT 4-Rail – Pages 1 to 39  
Att9 GFT Schematics – Pages 1 to 42  
Att10 NXT Horizon Installation Manual – Pages 1 to 22  
Att11 Schematics NXT Horizon – Pages 1 to 13

### PRODUCTS

CLASS - C531302 - POWER SUPPLIES - PHOTOVOLTAICS-PV Racking and clamping systems  
CLASS - C531382 - POWER SUPPLIES - PHOTOVOLTAICS-PV Racking and clamping systems -  
Certified to US Standards

The reader is responsible for any liability arising from actions taken in interpreting or applying the results presented in this report. This report shall not be reproduced except in full, without written approval from CSA Group Testing & Certification Inc. The results of this report only relate to those items tested.

34 Bunsen, Irvine, CA, U.S.A. 92618  
Telephone: 949.733.4300 1.800.463.6727 Fax: 949.733.4320 www.csagroup.org



DEL MAR, CA 92014, USA

#### VERSION

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104 HORSE WHISPERER LN,  
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APN# 030507 0200 28  
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AHJ: HARNETT COUNTY

#### SHEET NAME

SPEC SHEETS

#### SHEET SIZE

ANSI B  
11" X 17"

#### SHEET NUMBER

PV-13



### Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the SOLARMOUNT system.

Manufacture	Module Model / Series	Manufacture	Module Model / Series	Manufacture	Module Model / Series
Aionrise	AION60G1, AION72G1			Hyundai	KG, MG, RW, TG, RI, RG, TI, KI, HI Series
Aleo	P-Series & S-Series	Canadian Solar (cont.)	CS5A-M CS6K-(M/MS/MS AllBlack/P/P HE) CS6P-(M/P) CS6U-(M/P/P HE) CS6X-P, CSX-P ELPS CS6(A/P)-MM	ITEK	iT-SE Series
Aptos Solar	DNA-120-MF10 DNA-120-(MF/BF)23 DNA-144-(MF/BF)23 DNA-120-(MF/BF)26 DNA-144-(MF/BF)26	Centrosolar America	C-Series & E-Series	Japan Solar	JPS-60 & JPS-72 Series
Astronergy	CHSM6612 M, M/HV CHSM6612P Series CHSM6612P/HV Series CHSM72M-HC CHSM72M(DG)/F-BH	CertainTeed	CT2xxMxx-01, CT2xxPxx-01, CTxxMxx-01 CTxxPxx-01, CTxxMxx-02, CTxxMxx-03 CTxxMxx-04, CTxxHC11-04	JA Solar	JAM72D30MB, JAM78D10MB JAP6 60-xxx JAM6(k)-60/xxx, JAP6(k)-72-xxx/4BB JAP72S##-xxx/** JAP6(k)-60-xxx/4BB, JAP60S##-xxx/** JAM6(k)-72-xxx/**, JAM72S##-xxx/** JAM6(k)-60-xxx/**, JAM60S##-xxx/** i. #: 01, 02, 03, 09, 10 ii. **: SC, PR, BP, HiT, IB, MW, MR ** = Backsheet, ## Cell technology
Auxin	AXN6M610T AXN6P610T AXN6M612T AXN6P612T	Eco Solargy	Orion 1000 & Apollo 1000	Jinko	JKM & JKMS Series JKMxxxM-72HL-V JKMxxxM-72HL4-(T)V JKMxxxM-7RL3-V
Axitec	AC-xxx(M/P)/60S, AC-xxx(M/P)/72S AC-xxxP/156-60S AC-xxxMH/120(S/V/SB/VB) AC-xxxMH/144(S/V/SB/VB)	ET Solar	ET AC Module, ET Module	Kyocera	KD-F & KU Series
Boviet	BVM6610, BVM6612	First Solar	FS-6XXX(A) FS-6XXX(A)-P, FS-6XXX(A)-P-I	LA Solar	LSxxxHC(166)
BYD	P6K & MHK-36 Series	Flextronics	FXS-xxxBB	LG Electronics	LGxxx(E1C/E1K/N1C/N1K/N2T/N2W/S1C/ S2W/Q1C/Q1K)-A5 LGxxx(A1C/M1C/M1K/N1C/N1K/Q1C/Q1K/ QAC/QAK)-A6 LGxxxN2W-B3 LGxxxN2T-B5 LGxxxN1K-B6 LGxxx(N1C/N1K/N2T/N2W)-E6 LGxxx(N1C/N1K/N2W/S1C/S2W)-G4
Canadian Solar	CS1(H/K/U/Y)-MS CS3K-(MB/MB-AG/MS/P/P HE/PB-AG) CS3L-(MS/P) <b>CS3N-MS</b> CS3U-(MB/MB-AG/MS/P/P HE/PB/PB-AG) CS3W-(MS/P/P-PB-AG)	GCL	GCL-P6 & GCL-M6 Series		
		Hanwha SolarOne	HSL 60		
		Hansol	TD-AN3, TD-AN4 UB-AN1, UD-AN1		
		Heliene	36M, 36P 60M, 60P, 72M & 72P Series 144HC M6		
		HT Solar	HT72-156(M/P) HT72-156P-C, HT72-156P(V)-C HT72-156M(PDV)-BF, HT72-156M(PD)-BF HT60-156M-C HT60-156M(V)-C		

- Unless otherwise noted, all modules listed above include all wattages and specific models within that series. Variable wattages are represented as "xxx"
- Items in parenthesis are those that may or may not be present in a compatible module's model ID
- Slashes "/" between one or more items indicates that either of those items may be the one that is present in a module's model ID
- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- **Listed models can be used to achieve a Class A fire system rating for steep slope applications. See Appendix A, page A**



DEL MAR, CA 92014, USA

VERSION		
DESCRIPTION	DATE	REV
INITIAL RELEASE	10/07/2022	UR

PROJECT NAME  
**JOSEPH N HERNANDEZ**  
**104 HORSE WHISPERER LN,**  
**LILLINGTON, NC 27546, USA**  
**APN# 030507 0200 28**  
**UTILITY: DUKE ENERGY**  
**AHJ: HARNETT COUNTY**

SHEET NAME	<b>SPEC SHEETS</b>
SHEET SIZE	<b>ANSI B 11" X 17"</b>
SHEET NUMBER	<b>PV-14</b>





# Certificate of Compliance

**Certificate:** 70131735                      **Master Contract:** 266909  
**Project:** 80128750                      **Date Issued:** 2022-06-08  
**Issued To:** Unirac  
1411 Broadway NE  
Albuquerque, New Mexico, 87102  
United States  
**Attention:** Rob D'Anastasio

*The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.*



**Issued by:** Michael Hoffnagle  
Michael Hoffnagle

### PRODUCTS

CLASS - C531302 - POWER SUPPLIES - PHOTOVOLTAICS-PV Racking and clamping systems  
CLASS - C531382 - POWER SUPPLIES - PHOTOVOLTAICS-PV Racking and clamping systems -  
Certified to US Standards



**Certificate:** 70131735  
**Project:** 80128750

**Master Contract:** 266909  
**Date Issued:** 2022-06-08

Models:	SM	-	SOLARMOUNT Flush-to-Roof is an extruded aluminum rail PV racking system that is installed parallel to the roof in landscape or portrait orientations.
	ULA	-	Unirac Large Array is a ground mount system using the SolarMount (SM) platform for the bonding and grounding of PV modules.

### Solarmount

The system listed is designed to provide bonding/grounding, and mechanical stability for photovoltaic modules. The system is secured to the roof with the L-Foot components through the roofing material to building structure. Modules are secured to the racking system with stainless steel or aluminum mid clamps and Aluminum end clamps. The modules are bonded to the racking system with the stainless-steel bonding mid clamps with piercing points. The system is grounded with 10 AWG copper wire to bonding/grounding lugs. Fire ratings of Class A with Type 1, 2, 3 (with metallic frame), 4 (with trim), 5 (with trim), 10(with metallic frame), 19, 22, 25, 29, or 30 for steep slope. Tested at 5" interstitial gap which allows installation at any stand-off height.

The grounding of the system is intended to comply with the latest edition of the National Electrical Code, to include NEC 250 & 690. Local codes compliance is required, in addition to national codes. All grounding/bonding connections are to be torqued in accordance with the Installation Manual and the settings used during the certification testing for the current edition of the project report.

The system may employ optimizers/micro-inverters and used for grounding when installed per installation instructions.

UL 2703 Mechanical Load ratings:

Downward Design Load (lb/ft <sup>2</sup> )	113.5
Upward Design Load (lb/ft <sup>2</sup> )	50.7
Down-Slope Load (lb/ft <sup>2</sup> )	16.13

Test Loads:

Downward Load (lb/ft <sup>2</sup> )	170.20
Upward Load (lb/ft <sup>2</sup> )	76.07
Down-Slope Load (lb/ft <sup>2</sup> )	24.2



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AHJ: HARNETT COUNTY

### SHEET NAME

SPEC SHEETS

### SHEET SIZE

ANSI B  
11" X 17"

### SHEET NUMBER

PV-15