PRINCIPAL Engineering

1011 N Causeway Blvd, Suite 19 ◆Mandeville, Louisiana 70471◆ Phone: 985.624.5001◆ Fax: 985.624.5303

Thursday, August 3, 2023

Property Owner: Kevin Flessert

Property Address: 855 Cypress Church Road, Cameron, NC 28326

RE: Photovoltaic System Roof Installations

I have reviewed the existing structure referenced above to determine the adequacy of the existing structure to support the proposed installation of an array of solar panels on the roof.

Based on my review, the existing structure meets or exceeds applicable codes listed below to support the proposed solar panel installation. This assessment is based on recent on-site inspection by solar inspectors and photographs of the existing structure. The photovoltaic system is designed to withstand uplift and downward forces. The structural considerations used in our review and assessment include the following:

Evaluation Criteria:

Applied Codes: ASCE 7-10 NCBC 2018 NCRC 2018 NEC 2017
Risk Category: II
Design Wind Speed (3-second gust): 117 mph
Wind Exposure Category: C
Ground Snow Load: 10 PSF
Seismic Design Category: D

Existing Structure:

Roof Material: Shingle
Roof Structure: 2x4 Rafters
Roof Slope: 2/12

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NORTH CAROLINA FIRM NO. C4113

Effect of the Solar Array on Structure Loading:

Gravity Load:

Per IBC Section 1607, the areas of the roof where solar panels are located are considered inaccessible, and therefore not subject to roof live loading. Live load in these areas is replaced by the dead load of the solar array, 3 psf. The total gravity load on the structure is therefore reduced and the structure may remain unaltered. Connections of the mounts to the underlying structure are to be installed in a staggered pattern, except at the array ends, to distribute the loading evenly to the roof structure. The stresses within the rafters or truss top chord due to the introduction of discrete mount loads are within acceptable limits, as shown on the attached calculations.

Wind Load:

The solar panel array will be flush mounted (no more than 6" above the surrounding roof surface, and parallel to the roof surface. Any additional wind loading on the structure due to the presence of the array is negligible. The array structure is designed by the manufacturer to withstand uplift and downward forces resulting from wind and snow loads. The attached calculations verify the capacity of the connection of the solar array to the roof to resist uplift due to wind loads, the governing load case.

Snow Load:

The reduced friction of the glass surface of the solar panels allows for the lower slope factor (Cs) per Section 7.4 of ASCE 7.10 resulting in a reduced design snow load for the structure. This analysis conservatively considered the snow load to be unchanged.

Seismic Load:

Analysis shows that additional seismic loads due to the array installation will be small. Even conservatively neglecting the wall materials, the solar panel installation represents an increase in the total weight of the roof and corresponding seismic load of less than 10%. This magnitude of additional forces meets the requirements of the exception in Section 11B.4 of ASCE 7-10. The existing lateral force resisting system of the structure is therefore allowed to remain unaltered.

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Conclusion:

To the best of my professional knowledge and belief, the subject construction and photovoltaic system installation will be in compliance with all state and local building codes and guidelines in effect at the time of our review.

Limitations:

Engineer's assessment of the existing structure is based on recent field reports and current photographs of the elements of the structure that were readily accessible at the time of inspection. The design of the solar panel racking (mounts, rails, connectors, etc.), connections between the racking and panels, and electrical construction related to the installation are the responsibility of others. The photovoltaic system installation must be by competent personnel in accordance with manufacturer recommendations and specifications and should meet or exceed industry standards for quality. The contractor is responsible for ensuring that the solar array is installed according to the approved plans and must notify the engineer of any undocumented damage or deterioration of the structure, or of discrepancies between the conditions depicted in the approved plans and those discovered on site so that the project may be reevaluated and altered as required. Engineer does not assume any responsibility for improper installation of the proposed photovoltaic system.

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Uplift and Wind Downforce Calculation Summary (ASCE 7-10)
Mount, Rack, & Panel Proportioning

Property Owner:	Kevin Flessert	Individual Panel Dimensions		
Project Address:	855 Cypress Church Road	Length (in)	Width (in)	Area (sf)
City, State:	Cameron, NC 28326	74	41.1	21.12

Wind Load Calculation Summary (ASCE 7-10 C&C Provisions)			
Building Characteristics, Design Input, and Adjustment Factors			
Roof Dimensions:	Length (b):	50 ft.	
	Width (w):	29 ft.	Least Dimension: 29 ft.
Roof Height (h):		15 ft.	Must be less than 60 ✓
Pitch: 2 on 12 =		9.5°	Must be less than 45° ✓
Roof Configuration		Gable	
Roof Structure:		2x4 Rafters	
Roof material:		Plywood	
Ultimate Wind Speed (mph):		117	From ASCE 7-10, Fig. 26.5
Exposure Category:		C	Para 26.7.3
Directionality Factor, K_d		0.85	Table 26.6-1
Risk Category:		2	Table 1.5-2
Exposure Coefficient, K_z		0.9	Table 30.3-1
Topographic Adj., K_{zt}		1	Fig. 26.8-1
Effective Wind Area (sf):		22	(Area per individual panel)
Velocity Pressure (psf), q_h:		26.81	psf, Eq. 30.3-1
Internal Pressure Coeff, GC_{pi}		0.18	Table 26.11-1

Roof Zone Strip (a), in ft, Fig. 30.5-1, Note 5	
1 - Least Roof Horizontal Dimension (L or W) x 0.10	2.9
2 - Roof Height x 0.4	6
3 - Least Roof Horizontal Dimension (L or W) x 0.04	1.16
4 - Lesser of (1) and (2)	2.9
5 - Greater of (3) and (4)	2.9
6 - Greater of (5) and 3 feet	**a= 3 ft.**

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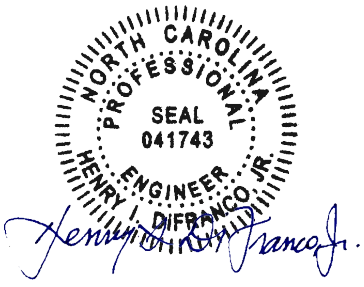
Net Design Wind Pressures					
(ASCE 7, Eq. 30.4.1; Load Factor for ASD = 0.6, per ASCE 7, 2.4.1)					
	Uplift (-psf)		Down (psf)		Description of Zone
	GC_p	**Pressure**	GC_p	**Pressure**	
Zone 1	-0.88	**-17.0**	0.39	**16.0**	Interior Roof Area, >(a) ft from edge
Zone 2	-1.52	**-27.4**	0.38	**16.0**	Strip of (a) ft wide at roof edge
Zone 3	-2.39	**-41.3**	0.35	**16.0**	Corner intersection of Zone 2 strips

Snow Load		
Ground Snow Load, p_g	10.0	From ASCE 7 or AHJ
Reducible (Y/N)?		
Terrain Category:	C	Para 6.5.6.3
Exposure	Fully	
Exposure FactorCe	0.9	Table 7-2
Thermal Factor, Ct	1.0	Table 7-3
Importance Factor, I_s	1.0	Table 1.5.2
Roof Configuration	Gable	
Roof Slope	09.5°	
Distance from Eave to Ridge	14.5	
p_m, Minimum required Snow Load	10.00 psf	Para. 7.3.4
pf, Calculated Snow Load	6.30	Eq. 7.3-1
pf, Design Snow Load	10.00 psf	



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Mount Selection and Spacing		
Manufacturer:	Unirac	Perpendicular Panel Orientation
Mount:	Flashkit Pro	Allowable Arrangement by Uplift Pressure
Substrate:	Wood Rafters/Truss Top Chord	< 39 psf : 2 rails, mounts @ 4'-0" o.c.
Connector:	3/8" - #16 Lag Bolt/Screws	39 to 78 psf : 2 rails, mounts @ 2'-0" o.c.
		78 to 117 psf : 3 rails, mounts @ 2'-0" o.c.
Allowable Uplift:	480 max.	117 to 156 psf : 4 rails, mounts @ 2'-0" o.c.
Required Mount Layout		> 156 psf : Mount capacity exceeded
Zone 1	2 rails, mounts @ 4'-0" o.c.	
Zone 2	2 rails, mounts @ 4'-0" o.c.	
Zone 3	2 rails, mounts @ 2'-0" o.c.	
(Allowable loads are based on individual mount failure before rail failure)		

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PHOTOVOLTAIC ROOF MOUNT SYSTEM

21 MODULES-ROOF MOUNTED - 8.400 kWDC, 5.040 kWAC

855 CYPRESS CHURCH RD, CAMERON, NC 28326 USA

SYSTEM SUMMARY:
(N) 21 - Q.CELL Q.PEAK DUO BLK ML-G10+ (400W) MODULES
(N) 21 - ENPHASE ENERGY IQ8-60-2-US (240V) MICRO-INVERTERS
(N) JUNCTION BOX
(E) 200A MAIN SERVICE PANEL WITH (E) 200A MAIN BREAKER
(N) 30A NON-FUSED AC DISCONNECT
(N) ENPHASE IQ COMBINER 4
X2-IQ-AM1-240-4 (IEEE 1547:2018)

INTERCONNECTION METHOD : BACKFEED BREAKER

DESIGN CRITERIA:

ROOF TYPE: - COMP SINGLE
NUMBER OF LAYERS: - 01
ROOF FRAME: - 2"X4" RAFTERS @24" O.C.
STORY: - ONE STORY
SNOW LOAD : - 10 PSF
WIND SPEED :- 117 MPH
WIND EXPOSURE:- C
RISK CATEGORY:- II
COORDINATE:- 35.239747, -79.163648

NOTE: INSTALLER TO DETERMINE OPTIMAL CONDUIT RUN ON SITE. ATTIC RUN IS OPTIONAL UNLESS REQUIRED BELOW.
ATTIC RUN: OPTIONAL

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 (NCMC)
2018 NORTH CAROLINA FUEL GAS CODE (NCFGC)
2018 NORTH CAROLINA ENERGY CONSERVATION CODE (NCECC)
2017 NORTH CAROLINA ELECTRICAL CODE (NCEC)

SHEET INDEX

CONSTRUCTION NOTE:

A LADDER SHALL BE IN PLACE FOR INSPECTION

THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY GRID INTERACTIVE SYSTEM
A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH NEC 690-47 AND 250-50 THROUGH 60 250-166 SHALL BE PROVIDED PER NEC, GROUNDING ELECTRODE SYSTEM OF EXISTING BUILDING MAY BE USED AND BONDED TO AT THE SERVICE ENTRANCE. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, OR IS ONLY METALLIC WATER PIPING, A SUPPLEMENTAL GROUNDING ELECTRODE WILL BE USED AT THE INVERTER LOCATION CONSISTING OF A UL LISTED 8 FT GROUND ROD WITH ACORN CLAMP.
GROUNDING ELECTRODE CONDUCTORS SHALL BE NO LESS THAN #8 AWG AND NO GREATER THAN #8 AWG COPPER AND BONDED TO THE EXISTING GROUNDING ELECTRODE TO PROVIDE OR A COMPLETE GROUND.
EACH MODULE WILL BE GROUNDED USING THE SUPPLIED GROUNDING POINTS IDENTIFIED BY THE MANUFACTURER.
EXPOSED NON-CURRENT CARRYING METAL PARTS OF MODULE FRAMES, EQUIPMENT, AND CONDUCTOR ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH 250.134 OR 250.136(A) REGARDLESS OF VOLTAGE.
PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED
ALL SIGNAGE WILL BE INSTALLED AS REQUIRED BY AND 2017 NEC.
HEIGHT OF INTEGRATED AC/DC DISCONNECT SHALL NOT EXCEED 6' 7" PER NEC 240.24
THE GROUNDING ELECTRODE CONDUCTOR SHALL BE PROTECTED FROM PHYSICAL DAMAGE BETWEEN THE GROUNDING ELECTRODE AND THE PANEL (OR INVERTER) IF SMALLER THAN #6 AWG COPPER WIRE PER NEC 250-64B. THE GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AT BUSBARS WITHIN LISTED EQUIPMENT PER NEC 250.64C.
ALL EXTERIOR CONDUIT SHALL BE PAINTED TO MATCH ADJACENT SURFACES.
THE PV CONNECTION IN THE PANEL BOARD SHALL BE POSITIONED AT THE OPPOSITE (LOAD) END FROM THE INPUT FEEDER LOCATION OR MAIN CIRCUIT LOCATION. NEC 690.64(B)(7)
SITE CONDITIONS SHALL PREVAIL IF NO SCALE IS GIVEN. DRAWINGS ARE NOT NECESSARILY TO SCALE. ALL DIMENSIONS SHALL BE VERIFIED BY SUBCONTRACTOR UPON COMMENCEMENT OF CONSTRUCTION.

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 & 75 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

1 AERIAL PHOTO
PV-0 SCALE: NTS

2 VICINITY MAP
PV-0 SCALE: NTS

LIGHTING ELECTRIC
230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION		
DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

NORTH CAROLINA PROFESSIONAL SEAL 041743 ENGINEER HENRY I. DIFRANCO, JR.

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NORTH CAROLINA FIRM NO. C4113

SHEET NAME
COVER SHEET

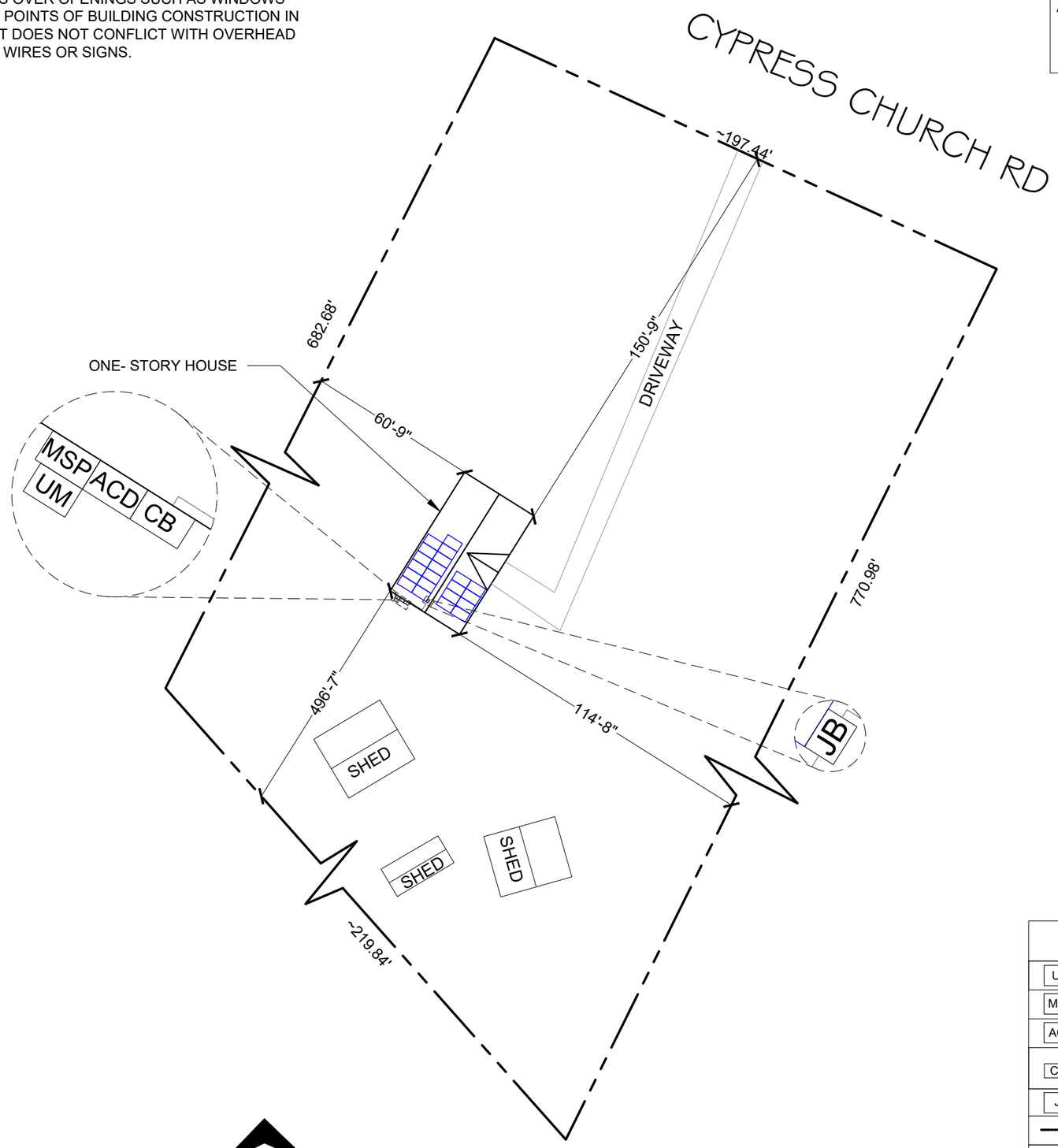
SHEET SIZE
ANSI B
11" X 17"

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 (7/8" ABOVE ROOF)

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



LEGEND	
UM	UTILITY METER
MSP	MAIN SERVICE PANEL
ACD	AC DISCONNECT
CB	ENPHASE IQ COMBINER 4 X2-IQ-AM1-240-4 (IEEE 1547:2018)
JB	JUNCTION BOX
———	PROPERTY LINE
—xx—	GATE
- - - - - -	FENCE

1 SITE PLAN WITH ROOF PLAN
SCALE: 3/128" = 1'-0"

N

LIGHTING ELECTRIC

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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 = 21 MODULES
MODULE TYPE = Q.CELL Q.PEAK DUO BLK ML-G10+ (400W) MODULES
MODULE WEIGHT = 48.5 LBS / 22.0 KG.
MODULE DIMENSIONS = 74.0X 41.1 = 21.12 SF
UNIT WEIGHT OF ARRAY = 2.30 PSF

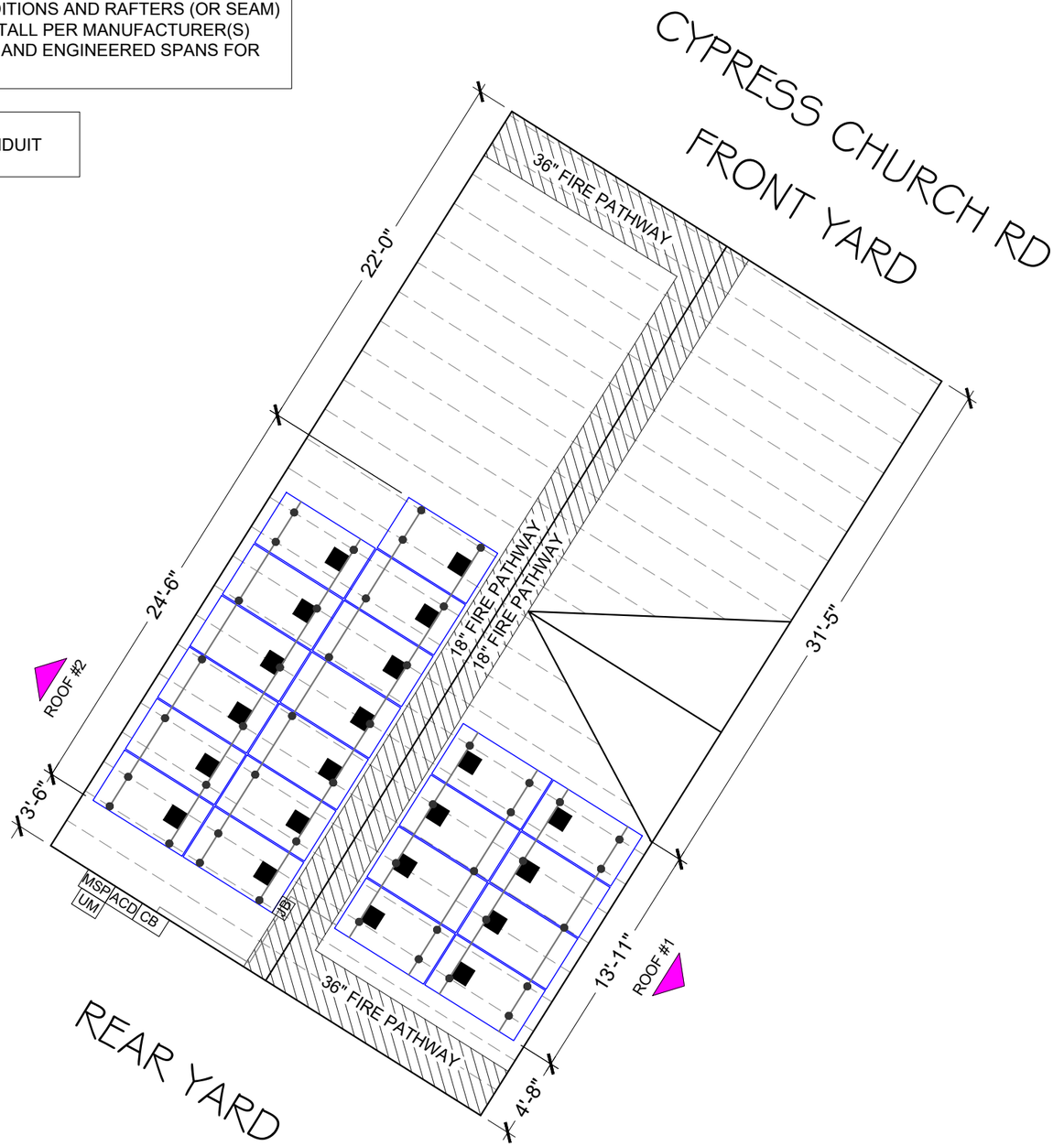
NOTE: ACTUAL ROOF CONDITIONS AND RAFTERS (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

NOTE:
3/4" OR GREATER EMT CONDUIT RUN (7/8" ABOVE ROOF)

ARRAY AREA & ROOF AREA CALC'S		
AREA OF NEW ARRAY (Sq. Ft.)	AREA OF ROOF(PLAN VIEW) (Sq. Ft.)	TOTAL ROOF AREA COVERED BY ARRAY %
443.54	1464	30.30%

ARRAY AREA & ROOF AREA CALC'S				
ROOF	# OF MODULES	ARRAY AREA (Sq. Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)
#1	08	168.97	633	26.69
#2	13	274.57	732	37.51

ROOF DESCRIPTION				
ROOF TYPE			COMP SINGLE ROOF	
ROOF	ROOF TILT	AZIMUTH	RAFTERS SIZE	RAFTERS SPACING
#1	11°	122°	2"X4"	24" O.C.
#2	11°	302°	2"X4"	24" O.C.



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

BILL OF MATERIALS		
EQUIPMENT	QTY	DESCRIPTION
RAIL	11	UNIRAC SM LIGHT RAIL 168" MILL
SPLICE	04	BND SPLICE BAR PRO SERIES MILL
MID CLAMP	34	UNIVERSAL AF SERIES MID CLAMP
END CLAMP	16	UNIVERSAL AF SERIES END CLAMP
ATTACHMENT	47	UNIRAC FLASH KIT PRO
GROUNDING LUG	04	GROUND LUG

LEGEND

UM	UTILITY METER
MSP	MAIN SERVICE PANEL
ACD	AC DISCONNECT
CB	ENPHASE IQ COMBINER 4 X2-IQ-AM1-240-4 (IEEE 1547:2018)
JB	JUNCTION BOX
■	ENPHASE ENERGY IQ8-60-2-US (240V) MICRO-INVERTER
———	UNIRAC SM LIGHT RAIL
●	ROOF ATTACHMENT UNIRAC FLASH KIT PRO @ 48" O.C.
○ □	VENT, ATTIC FAN (ROOFOBSTRUCTION)
⊠	CHIMNEY
------	RAFTERS
▨	FIRE SETBACK

N

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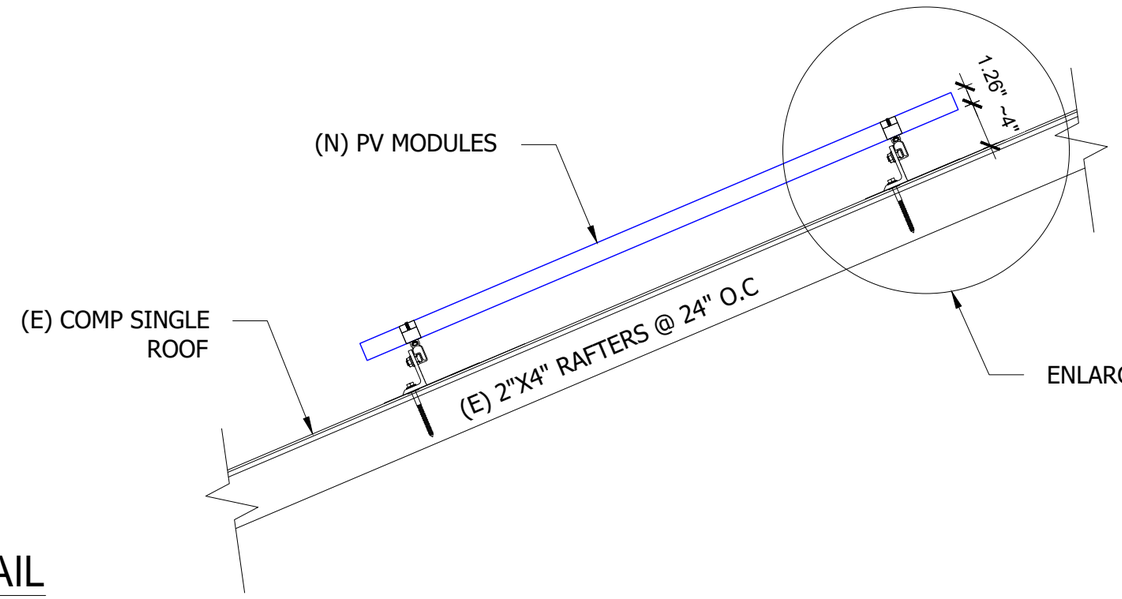
SHEET NAME
ROOF PLAN WITH MODULES

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-2



Note 1: Windspeed value is in accordance with ASCE 7-10, Risk Cat II

Note 2: a)Lag bolt shall be mounted into rafters
b)Notify Engineer immediately if conditions differ or prevent installation per plan.

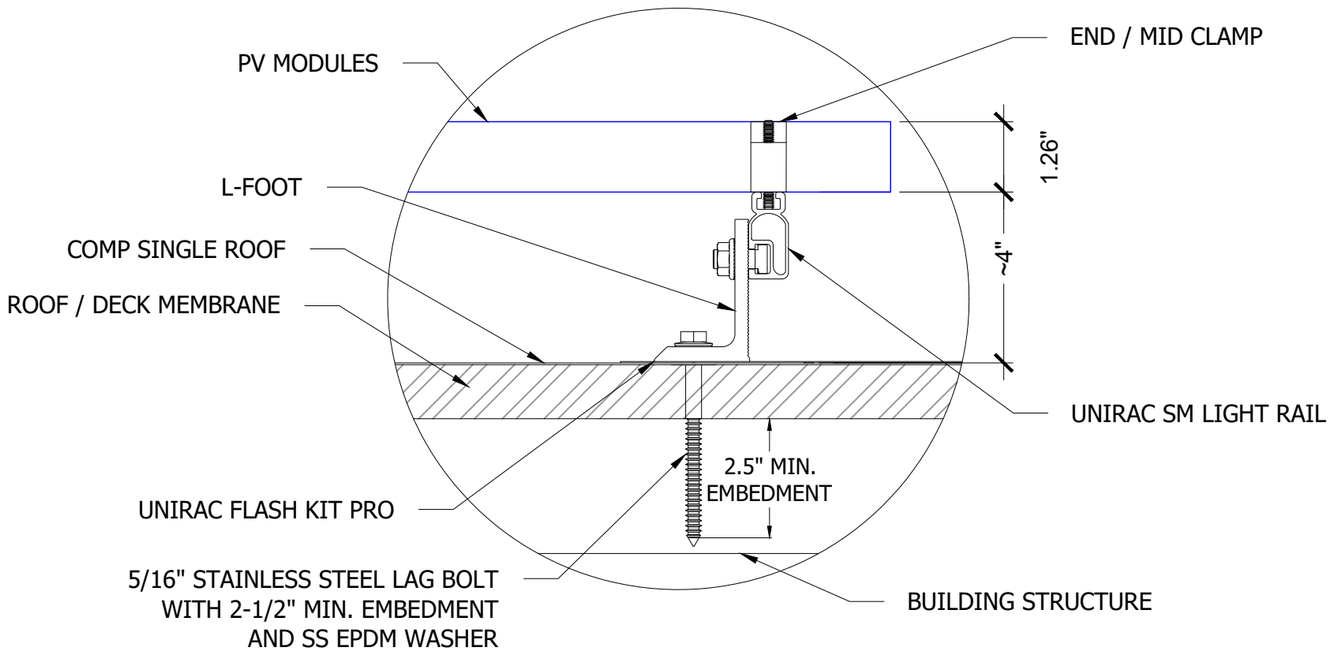
Note 3: Maximum rail cantilever distance beyond outermost mount is One-third the zone-specific mount spacing.

Note 4: Installer shall adjust mount spacing by zone to match prescribed values on engineer's calculation letter

1 ATTACHMENT DETAIL

SCALE: NTS

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



2 ATTACHMENT DETAIL (ENLARGED VIEW)

SCALE: NTS

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SHEET NAME
ATTACHMENT DETAIL

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-3

SOLAR MODULE SPECIFICATIONS

MANUFACTURER / MODEL #	VMP	IMP	VOC	ISC	TEMPERATURE COEFFICIENT OF Voc	# OF MODULES
Q.CELL Q.PEAK DUO BLK ML-G10+ (400W)	37.13	10.77	45.30	11.14	-0.27%/°C	21
MODULE DIMENSION	74.0" L x 41.1" W x 1.26"D					

SYSTEM SIZE:- 21 x 400W = 8.400 kWDC
21 x 240W = 5.040 kWAC

NOTE:
3/4" OR GREATER EMT CONDUIT RUN (7/8" ABOVE ROOF)

AMBIENT TEMPERTURE SPECIFICATIONS

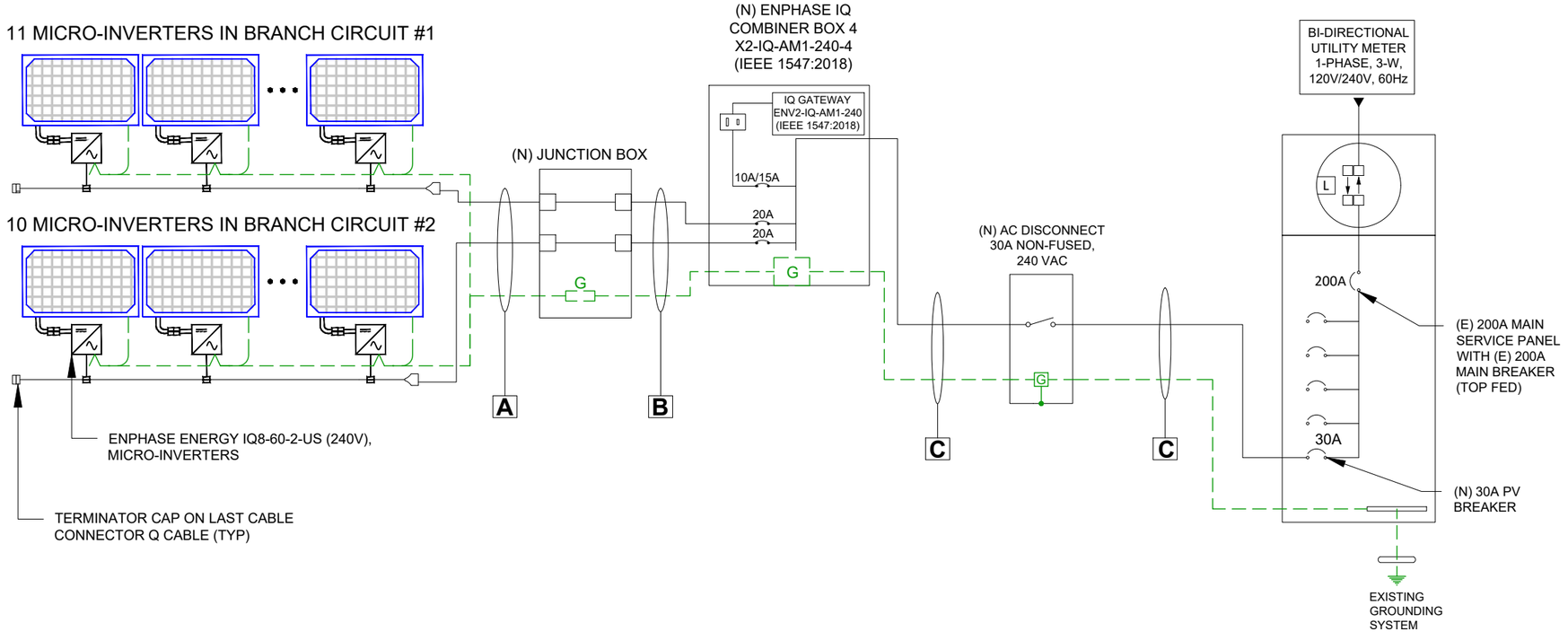
RECORD LOW TEMP	AMBIENT TEMP (HIGH TEMP 2%)	CONDUCTOR TEMPERATURE RATE (ON ROOF)	CONDUCTOR TEMPERATURE RATE (OFF ROOF)
-10°	36°	90°	75°

INVERTER SPECIFICATIONS

MANUFACTURER / MODEL #	QUANTITY	NOMINAL OUTPUT VOLTAGE	NOMINAL OUTPUT CURRENT
ENPHASE ENERGY IQ8-60-2-US (240V)	21	240 VAC	1.0A

INTERCONNECTION
120% RULE - NEC 705.12(B)(2)(3)(b)

UTILITY FEED + SOLAR BACKFEED
200A + 30A = 230A
BUSS RATING x 120%
200A x 120% = 240A



WIRE TAG	CONDUIT	WIRE QTY	WIRE GAUGE	WIRE TYPE	TEMP. RATING	WIRE AMPACITY (A)	TEMP. DERATE	CONDUIT FILL DERATE	DERATED AMPACITY (A)	INVERTER QTY.	DESIGN CURRENT (A)	GROUND SIZE	GROUND WIRE TYPE
A	OPEN AIR	2	12 AWG	Q-CABLES	90°C	30	0.91	N/A	27.30	11	13.75	06 AWG	BARE CU GND
B	3/4" EMT	4 2	10 AWG 12 AWG	THWN-2 NM-B CABLES WHERE RUN INDOORS	90°C	40 30	0.91	0.8	29.12 21.84	11	13.75	10 AWG	THWN-2
C	3/4" EMT	3	10 AWG	THWN	75°C	35	0.88	1.0	30.80	21	26.25	10 AWG	THWN

1 ELECTRICAL LINE DIAGRAM WITH CALCULATION

SCALE: NTS

LIGHTING ELECTRIC
230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
ELECTRICAL LINE DIAGRAM WITH CALCULATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-4

⚠ WARNING

ELECTRIC SHOCK HAZARD

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

LABEL LOCATION:
AC & DC DISCONNECT AND SUB PANEL
(PER CODE: NEC 690.13(B))

⚠ WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:
MAIN SERVICE PANEL & NET METER
(PER CODE: NEC 705.12(D)(3), NEC 705.12(B)(3-4) & NEC 690.59)

PHOTOVOLTAIC

AC DISCONNECT

LABEL LOCATION:
AC DISCONNECT
NEC 690.13(B)

⚠ CAUTION

PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LABEL LOCATION:
MSP
(PER CODE: NEC 690.13 (F), NEC 705.12(B)(3-4) & NEC 690.59)

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL LOCATION:
RAPID SHUTDOWN
(PER CODE: NEC 690.56(C)(3)

PHOTOVOLTAIC SYSTEM AC DISCONNECT
RATED AC OPERATING CURRENT 1.0 AMPS
AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:
AC DISCONNECT & INVERTER
(PER CODE: NEC690.54)

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

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

WARNING:PHOTOVOLTAIC POWER SOURCE

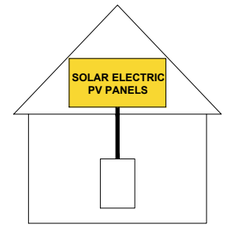
LABEL LOCATION:
CONDUIT, COMBINER BOX
(PER CODE: NEC 690.31(G)(3)

MAIN PHOTOVOLTAIC SYSTEM DISCONNECT

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

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

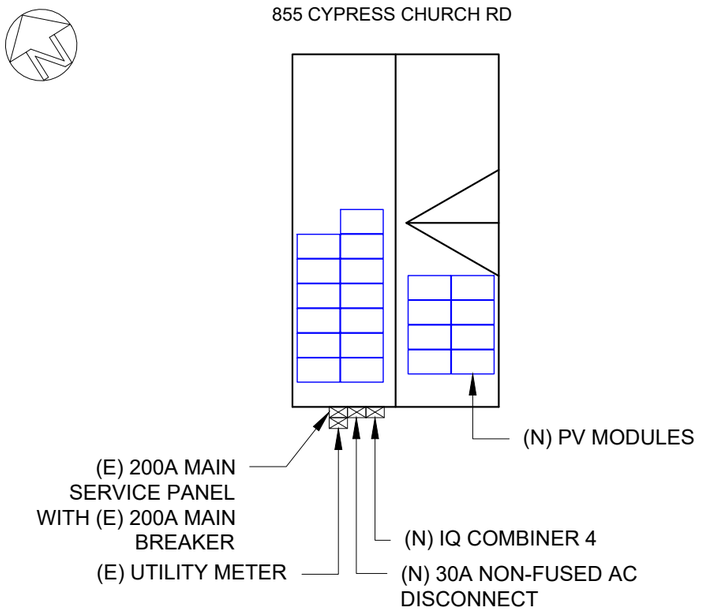
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUTDOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY



LABEL LOCATION:
AC DISCONNECT, DC DISCONNECT, POINT OF INTERCONNECTION
(PER CODE: 605.11.3.1(1) & 690.56(C)(1)(a))

CAUTION !

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



LIGHTING ELECTRIC
230 Blacksnake Rd,
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VERSION

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855 CYPRESS CHURCH RD,
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SHEET NAME
WARNING LABELS & PLACARD

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-5

Q.PEAK DUO BLK ML-G10+ SERIES

385 - 410 Wp | 132 Cells
20.9 % Maximum Module Efficiency

MODEL Q.PEAK DUO BLK ML-G10+

6 busbar cell technology

12 busbar cell technology

Breaking the 20 % efficiency barrier

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9 %.

A reliable investment

Inclusive 25-year product warranty and 25-year linear performance warranty[1].

Enduring high performance

Long-term yield security with Anti LeTID Technology, Anti PID Technology[2] and Hot-Spot Protect.

Extreme weather rating

High-tech aluminium alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa).

Innovative all-weather technology

Optimal yields, whatever the weather with excellent low-light and temperature behaviour.

The most thorough testing programme in the industry

Qcells is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.

[1] See data sheet on rear for further information.
[2] APT test conditions according to IEC / TS 62804-1:2015, method A (−1500 V, 96 h)

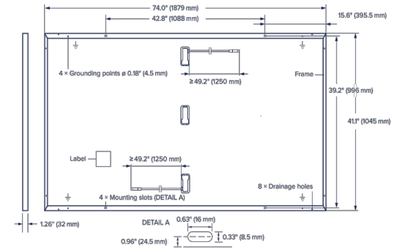
The ideal solution for:

Rooftop arrays on residential buildings

Q.PEAK DUO BLK ML-G10+ SERIES

Mechanical Specification

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodised aluminium
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 49.2 in (1250 mm), (−) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

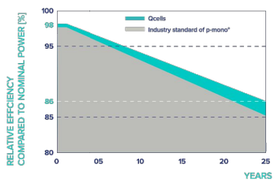


Electrical Characteristics

POWER CLASS			385	390	395	400	405	410
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)								
Minimum	Power at MPP[1]	P_{MPP} [W]	385	390	395	400	405	410
Minimum	Short Circuit Current[1]	I_{SC} [A]	11.04	11.07	11.10	11.14	11.17	11.20
Minimum	Open Circuit Voltage[1]	V_{OC} [V]	45.19	45.23	45.27	45.30	45.34	45.37
Minimum	Current at MPP	I_{MPP} [A]	10.59	10.65	10.71	10.77	10.83	10.89
Minimum	Voltage at MPP	V_{MPP} [V]	36.36	36.62	36.88	37.13	37.39	37.64
Minimum	Efficiency[1]	η [%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6	≥20.9
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]								
Minimum	Power at MPP	P_{MPP} [W]	288.8	292.6	296.3	300.1	303.8	307.6
Minimum	Short Circuit Current	I_{SC} [A]	8.90	8.92	8.95	8.97	9.00	9.03
Minimum	Open Circuit Voltage	V_{OC} [V]	42.62	42.65	42.69	42.72	42.76	42.79
Minimum	Current at MPP	I_{MPP} [A]	8.35	8.41	8.46	8.51	8.57	8.62
Minimum	Voltage at MPP	V_{MPP} [V]	34.59	34.81	35.03	35.25	35.46	35.68

[1] Measurement tolerances P_{MPP} ±3 %; I_{SC}; V_{OC} ±5 % at STC: 1000 W/m², 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • [2] 800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

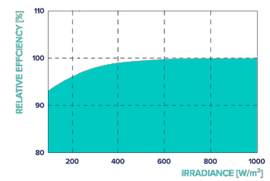


At least 98 % of nominal power during first year. Thereafter max. 0.5 % degradation per year. At least 93.5 % of nominal power up to 10 years. At least 86 % of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	109 ± 5.4 (43 ± 3 °C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating		[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull[3]		[lbs / ft²]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]		[lbs / ft²]	113 (5400 Pa) / 84 (4000 Pa)		

[3] See Installation Manual

Qualifications and Certificates

UL 61730, CE-compliant,
Quality Controlled PV - TÜV Rheinland,
IEC 61215:2016, IEC 61730:2016,
U.S. Patent No. 9,893,215 (solar cells),

Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com

LIGHTING ELECTRIC
230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-6

ENPHASE.

DATA SHEET

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.

Enphase 25 year limited warranty

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.

UL CERTIFIED SAFETY

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

IQ8SE-DS-0001-01-EN-US-2021-10-19

Easy to install

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

High productivity and reliability

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

Microgrid-forming

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

IQ8 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[1]
Commonly used module pairings[2]	W	235 – 350	235 – 440	260 – 460	295 – 500	320 – 540+	295 – 500+
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	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[3] [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[4]	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					
Max units per 20 A (L-L) branch circuit[5]		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					
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/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.					

(1) 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-2021-10-19

LIGHTING ELECTRIC
230 Blacksnake Rd,
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VERSION

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855 CYPRESS CHURCH RD,
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APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME

SPEC SHEETS

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-7

Data Sheet
Enphase Networking

IQ Combiner 4/4C

X-IQ-AM1-240-4C
X2-IQ-AM1-240-4C (IEEE 1547:2018)

X-IQ-AM1-240-4
X2-IQ-AM1-240-4 (IEEE 1547:2018)

The **IQ Combiner 4/4C** with IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure. It 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 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
- Supports Wi-Fi, Ethernet, or cellular connectivity
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

Simple

- Mounts on single stud with centered brackets
- Supports bottom, back and side conduit entry
- Allows up to four 2-pole branch circuits for 240VAC 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
- X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C comply with IEEE 1547:2018 (UL 1741-SB, 3rd Ed.)

UL LISTED

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE

IQ Combiner 4/4C

MODEL NUMBER	
IQ Combiner 4 X-IQ-AM1-240-4 X2-IQ-AM1-240-4 (IEEE 1547:2018)	IQ Combiner 4 with 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 and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C X-IQ-AM1-240-4C X2-IQ-AM1-240-4C (IEEE 1547:2018)	IQ Combiner 4C with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 ± 0.5%) and consumption monitoring (± 2.5%). Includes 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)
Supported microinverters	IQ6, IQ7, and IQ8. (Do not mix IQ6/7 Microinverters with IQ8)
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 - 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
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)
X-IQ-NA-HD-125A	Hold-down kit for Eaton circuit breaker with screws
Consumption monitoring CT (CT-200-SPLIT/CT-200-CLAMP)	A pair of 200A split core current transformers
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240VAC, 60 Hz
Eaton BR series busbar rating	125A
Max. continuous current rating	65A
Max. continuous current rating (input from PV/storage)	64A
Max. fuse/circuit rating (output)	90A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation/95A with IQ Gateway breaker included
IQ Gateway breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200A solid core pre-installed and wired to IQ Gateway
MECHANICAL DATA	
Dimensions (WxHxD)	37.5 cm x 49.5 cm x 16.8 cm (14.75 in x 19.5 in x 6.63 in). Height is 53.5 cm (21.06 in) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40°C to +46°C (-40°F to 115°F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20A to 50A breaker inputs: 14 to 4 AWG copper conductors • 60A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors • Always follow local code requirements for conductor sizing.
Altitude	Up to 3,000 meters (9,842 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	IEEE 802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Mobile Connect cellular modem is required for all Enphase Energy System installations.
Ethernet	Optional, IEEE 802.3, Cat5E (or Cat6) UTP Ethernet cable (not included)
COMPLIANCE	
Compliance, IQ Combiner	CA Rule 21 (UL 1741-SA) IEEE 1547:2018 - UL 1741-SB, 3rd Ed. (X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C) CAN/CSA C22.2 No. 107.1, Title 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

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SPEC SHEETS

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ANSI B
11" X 17"

SHEET NUMBER
PV-8

Data Sheet
Enphase Q Cable Accessories
REGION: Americas

Enphase Q Cable Accessories

The **Enphase Q Cable™** and accessories are part of the latest generation Enphase IQ System™. These accessories provide simplicity, reliability, and faster installation times.

Enphase Q Cable

- Two-wire, double-insulated Enphase Q Cable is 50% lighter than the previous generation Enphase cable
- New cable numbering and plug and play connectors speed up installation and simplify wire management
- Link connectors eliminate cable waste

Field-Wireable Connectors

- Easily connect Q cables on the roof without complex wiring
- Make connections from any open connector and center feed any section of cable within branch limits
- Available in male and female connector types

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE.

Enphase Q Cable Accessories

CONDUCTOR SPECIFICATIONS	
Certification	UL3003 (raw cable), UL 9703 (cable assemblies), DG cable
Flame test rating	FT4
Compliance	RoHS, OIL RES I, CE, UV Resistant, combined UL for Canada and United States
Conductor type	THHN/THWN-2 dry/wet
Disconnecting means	The AC and DC bulkhead connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.

Q CABLE TYPES / ORDERING OPTIONS				
Connectorized Models	**Size / Max Nominal Voltage**	**Connector Spacing**	**PV Module Orientation**	**Connector Count per Box**
Q-12-10-240	12 AWG / 277 VAC	1.3 m (4.2 ft)	Portrait	240
Q-12-17-240	12 AWG / 277 VAC	2.0 m (6.5 ft)	Landscape (60-cell)	240
Q-12-20-200	12 AWG / 277 VAC	2.3 m (7.5 ft)	Landscape (72-cell)	200

ENPHASE Q CABLE ACCESSORIES		
Name	**Model Number**	**Description**
Raw Q Cable	Q-12-RAW-300	300 meters of 12 AWG cable with no connectors
Field-wireable connector (male)	Q-CONN-10M	Make connections from any open connector
Field-wireable connector (female)	Q-CONN-10F	Make connections from any Q Cable open connector
Cable Clip	Q-CLIP-100	Used to fasten cabling to the racking or to secure looped cabling
Disconnect tool	Q-DISC-10	Disconnect tool for Q Cable connectors, DC connectors, and AC module mount
Q Cable sealing caps (female)	Q-SEAL-10	One needed to cover each unused connector on the cabling
Terminator	Q-TERM-10	Terminator cap for unused cable ends
Enphase EN4 to MC4 adaptor[1]	ECA-EN4-S22	Connect PV module using MC4 connectors to IQ micros with EN4 (TE PV4-S SOLARLOK). 150mm/5.9" to MC4.
Enphase EN4 non-terminated adaptor[1]	ECA-EN4-FW	For field wiring of UL certified DC connectors. EN4 (TE PV4-S SOLARLOK) to non-terminated cable. 150mm/5.9"
Enphase EN4 to MC4 adaptor (long)[1]	ECA-EN4-S22-L	Longer adapter cable for EN4 (TE PV4-S SOLARLOK) to MC4. Use with split cell modules or PV modules with short DC cable. 600mm/23.6"
Replacement DC Adaptor (MC4)	Q-DCC-2	DC adaptor to MC4 (max voltage 100 VDC)
Replacement DC Adaptor (UTX)	Q-DCC-5	DC adaptor to UTX (max voltage 100 VDC)

1. Qualified per UL subject 9703.

TERMINATOR
Terminator cap for unused cable ends, sold in packs of ten (Q-TERM-10)

SEALING CAPS
Sealing caps for unused aggregator and cable connections (Q-BA-CAP-10 and Q-SEAL-10)

DISCONNECT TOOL
Plan to use at least one per installation, sold in packs of ten (Q-DISC-10)

CABLE CLIP
Used to fasten cabling to the racking or to secure looped cabling, sold in packs of one hundred (Q-CLIP-100)

To learn more about Enphase offerings, visit **enphase.com**

2020-06-26

ENPHASE.

LIGHTING ELECTRIC
230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

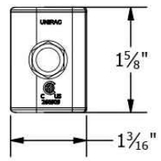
SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

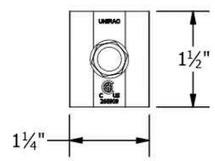
SHEET NUMBER
PV-9

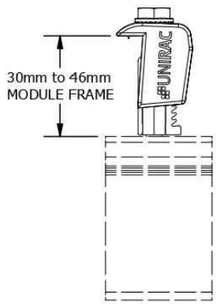
PART # TABLE	
P/N	DESCRIPTION
302045M	UNIVERSAL AF MID CLAMP - MILL
302045D	UNIVERSAL AF MID CLAMP - DRK
302050M	UNIVERSAL AF END CLAMP - MILL
302050D	UNIVERSAL AF END CLAMP - DRK

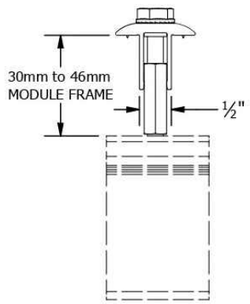
UNIVERSAL AF END CLAMP



UNIVERSAL AF MID CLAMP

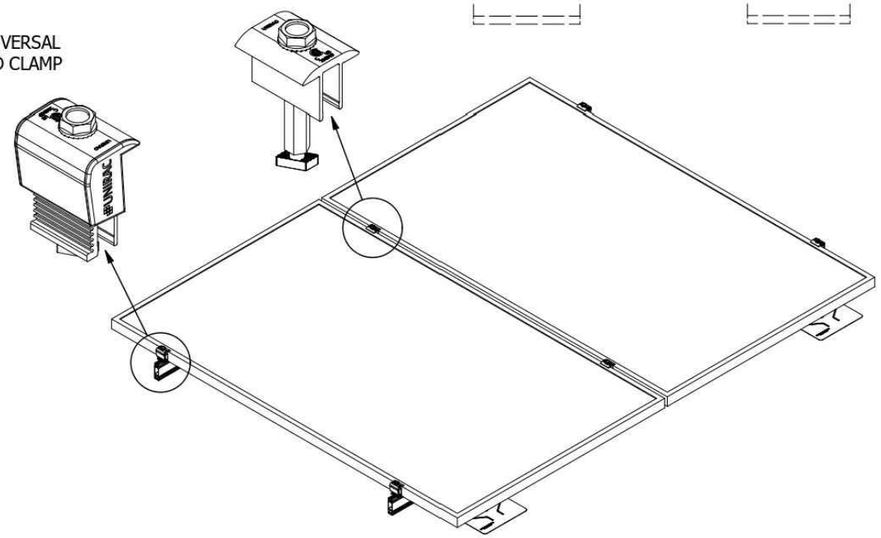






UNIVERSAL MID CLAMP

UNIVERSAL END CLAMP



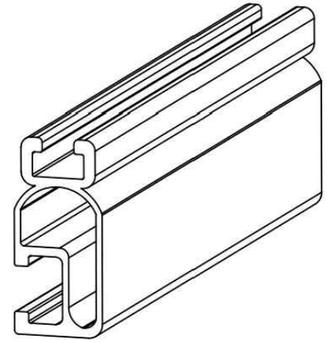
UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

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

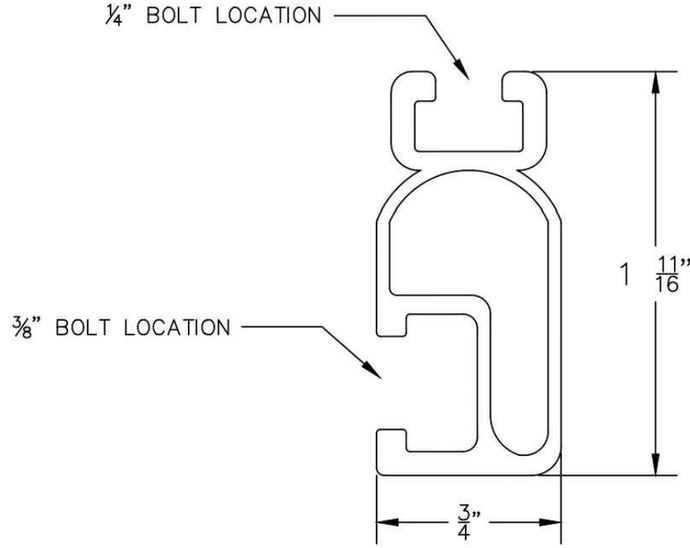
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

SM-A01B
SHEET



¼" BOLT LOCATION



Standard Rail Lengths:
168"
240"

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

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	LIGHT RAIL
REVISION DATE:	October 2016

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

SM-P02
SHEET

LIGHTING ELECTRIC

230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-10

FLASHKIT PRO

UNIRAC
FEATURING SHED & SEAL TECHNOLOGY

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 **FLASH**KIT 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

THE COMPLETE ROOF ATTACHMENT SOLUTION

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

FLASHKIT PRO

INSTALLATION GUIDE

UNIRAC
FEATURING SHED & SEAL TECHNOLOGY

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

INSTALL **FLASH**KIT 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 **FLASH**KIT 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-torqueing 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.

FASTER INSTALLATION. 25-YEAR WARRANTY.

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

LIGHTING ELECTRIC
230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

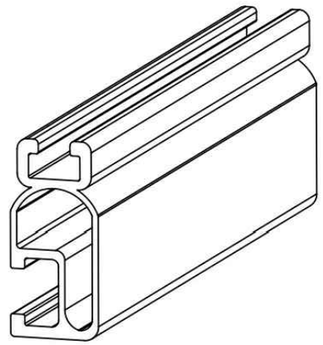
PROJECT NAME

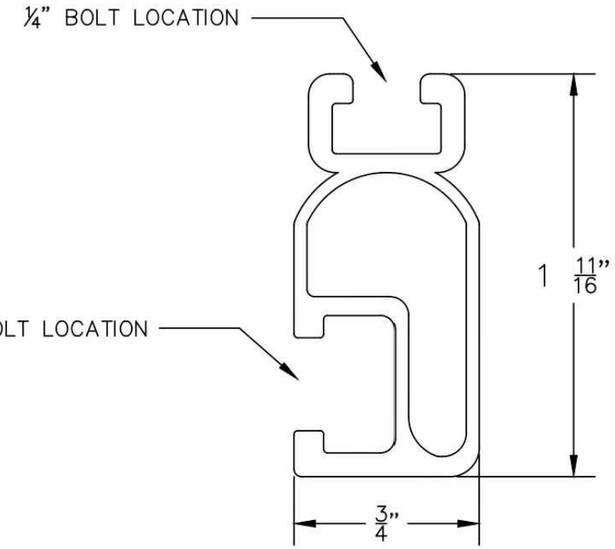
KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11





Standard Rail Lengths:
168"
240"

UNIRAC	
1411 BROADWAY BLVD NE ALBUQUERQUE, NM 87102 USA	
WWW.UNIRAC.COM	
PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	LIGHT RAIL
REVISION DATE:	October 2016
DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL	
PRODUCT PROTECTED BY ONE OR MORE US PATENTS	
LEGAL NOTICE	
SM-P02	
SHEET	

PART # TABLE	
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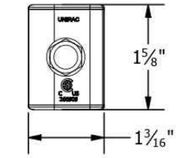
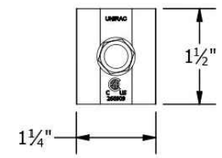
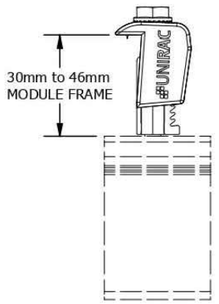
302045D	UNIVERSAL AF MID CLAMP - DRK
302050M	UNIVERSAL AF END CLAMP - MILL
302050D	UNIVERSAL AF END CLAMP - DRK

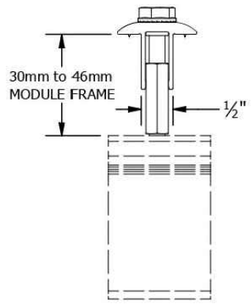
UNIVERSAL AF END CLAMP



UNIVERSAL AF MID CLAMP

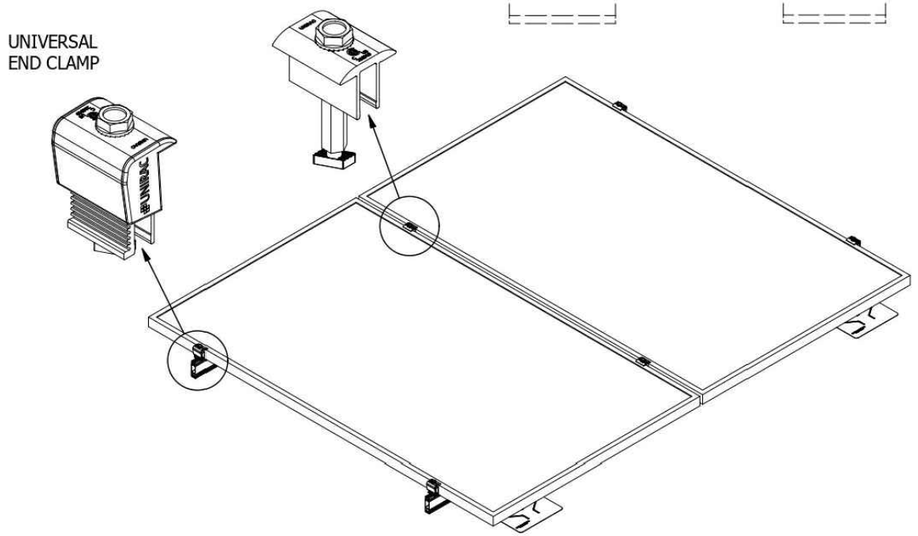






UNIVERSAL MID CLAMP

UNIVERSAL END CLAMP



UNIRAC	
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	

LIGHTING ELECTRIC

230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

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PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11.1

SM SOLAR MOUNT — CODE COMPLIANCE NOTES — INSTALLATION GUIDE — C PAGE

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 UL2703. SOLARMOUNT has achieved system level performance for steep sloped roofs. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes ⩾ 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, and Mitigation Requirements are listed below:

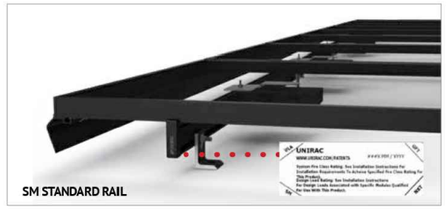
Rail Type	Module Fire Types	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required
Standard & HD Rails	1, 2, 3 with Metal Frame, 10 with Metal Frame, 19, 22, 25, 29, & 30	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Light Rail	1 & 2	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Standard, Light, & HD Rails	4 & 5	Class A, Class B & Class C	East-West	Landscape OR Portrait	Trim installation per Solar Mount Installation Guide
			North-South	Landscape OR Portrait	

This racking system may be used to ground and/or mount a PV module complying with UL1703 or UL61730 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

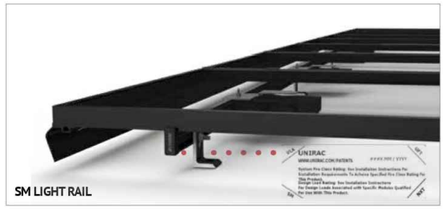
UL2703 CERTIFICATION MARKING LABEL

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.

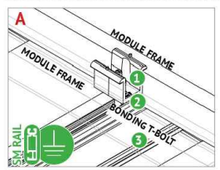


SM STANDARD RAIL



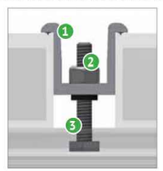
SM LIGHT RAIL

SM SOLAR MOUNT — BONDING CONNECTION GROUND PATHS — INSTALLATION GUIDE — 0 PAGE

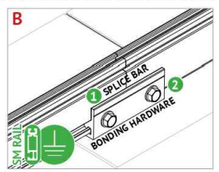


BONDING MIDCLAMP ASSEMBLY

1. Aluminum mid clamp with stainless steel bonding pins that pierce module frame anodization to bond module to module through clamp
2. Stainless steel nut bonds aluminum clamp to stainless steel T-bolt
3. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to SM rail



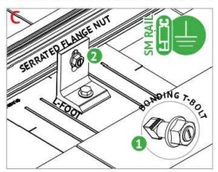
BONDING MIDCLAMP ASSEMBLY



BONDING RAIL SPLICE BAR

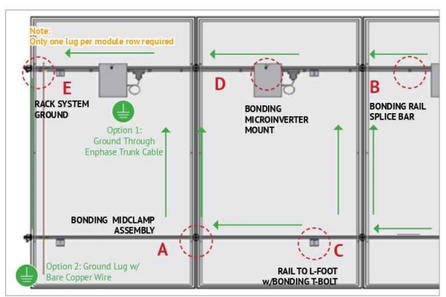
1. Bonding Hardware creates bond between splice bar and each rail section
2. Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

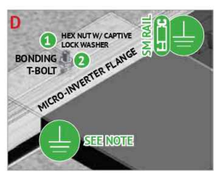
Note : Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.



RAIL TO L-FOOT w/BONDING T-BOLT

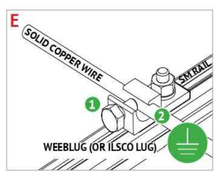
1. Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail





BONDING MICROINVERTER MOUNT

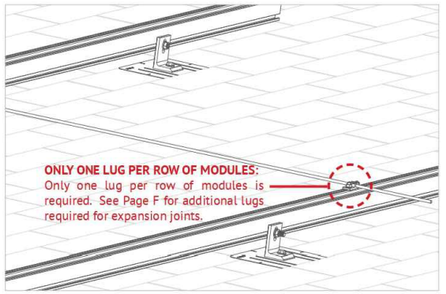
1. Hex nut with captive lock washer bonds metal microinverter flange to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail. **System ground including racking and modules may be achieved through the trunk cable of approved microinverter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



RACK SYSTEM GROUND

1. WEEB washer dimples pierce anodized rail to create bond between rail and lug
2. Solid copper wire connected to lug is routed to provide final system ground connection. **NOTE: Ilsco lug can also be used when secured to the side of the rail. See page K for details**

SM SOLAR MOUNT — STANDARD SYSTEM GROUNDING — INSTALLATION GUIDE — K PAGE



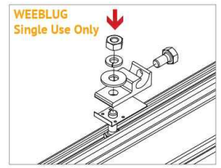
GROUNDING LUG MOUNTING DETAILS:

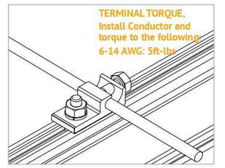
Details are provided for both the WEEB and Ilsco products. The WEEBLug has a grounding symbol located on the lug assembly. The Ilsco lug has a green colored set screw for grounding indication purposes. Installation must be in accordance with NFPA NEC 70, however the electrical designer of record should refer to the latest revision of NEC for actual grounding conductor cable size.

Required if not using approved integrated grounding microinveters

GROUNDING LUG - BOLT SIZE & DRILL SIZE		
GROUND LUG	**BOLT SIZE**	**DRILL SIZE**
WEEBLug	1/4"	N/A - Place In Top SM Rail Slot
ILSCO Lug	#10-32	7/32"

- Torque value depends on conductor size.
- See product data sheet for torque value.



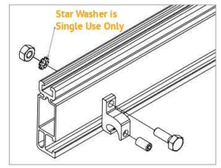


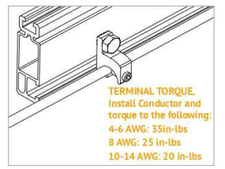
WEEBLUG CONDUCTOR - UNIRAC P/N 008002S:

Apply Anti Seize and insert a bolt in the aluminum rail and through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug.

TORQUE VALUE 10 ft lbs. (See Note on PG. A)

See product data sheet for more details, Model No. WEEB-LUG-6.7





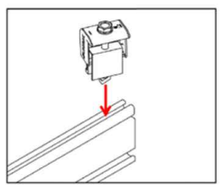
ILSCO LAY-IN LUG CONDUCTOR - UNIRAC P/N 008009P: Alternate Grounding Lug - Drill, deburr hole and bolt thru both rail walls per table.

TORQUE VALUE 5 ft lbs. (See Note on PG. A)

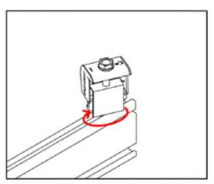
See ILSCO product data sheet for more details, Model No. GBL-4DBT.

NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION

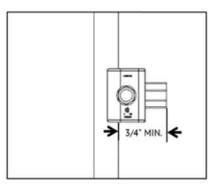
SM SOLAR MOUNT — APPENDIX C — UNIVERSAL AF ENDCLAMP INSTALLATION GUIDE — A PAGE



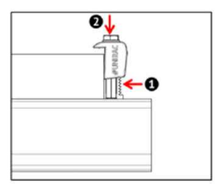
1. Position clamp to align T-bolt with rail slot. Lower clamp and Insert T-bolt into rail slot.



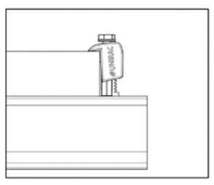
2. Rotate clamp clockwise 2/3 of a turn to engage T-bolt inside rail slot.



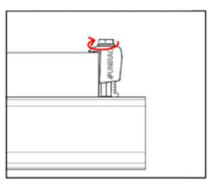
3. Place module at least 3/4" from end of rail and position clamp against module frame.



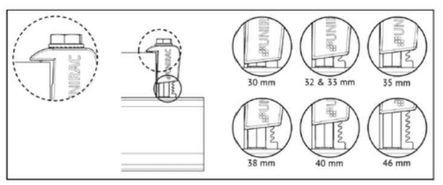
4. While applying pressure to hold the clamp against the module, push down on the module side of the clamp cap.



5. When the cap contacts the module frame, release and it will re-engage to the clamp base.



6. Tighten bolt and torque to 15 ft-lbs.



7. 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.

LIGHTING ELECTRIC

230 Blacksnake Rd,
Stanley, NC 28164-1622
LICENSE : NC-29517

VERSION

DESCRIPTION	DATE	REV
INITIAL RELEASE	08/02/2023	UR

PROJECT NAME

KEVIN FLESSERT
855 CYPRESS CHURCH RD,
CAMERON, NC 28326 USA
APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME

SPEC SHEETS

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

PV-12

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

C US

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

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/ft²)	113.5
Upward Design Load (lb/ft²)	50.7
Down-Slope Load (lb/ft²)	16.13

Test Loads:

Downward Load (lb/ft²)	170.20
Upward Load (lb/ft²)	76.07
Down-Slope Load (lb/ft²)	24.2

LIGHTING ELECTRIC
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APN# 099554 0017
UTILITY: N/A
AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-13

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:

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

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

SM SOLAR MOUNT

APPENDIX A System Certification | C PAGE

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
LG Electronics (cont.)	LGxxxN2T-J5 LGxxx(N1K/N1W/N2T/N2W)-L5 LGxxx(M1C/N1C/Q1C/Q1K)-N5 LGxxx(N1C/N1K/N2W/Q1C/Q1K)-V5 LGxxxN3K-V6
LONGi	LR4-60(HPB/HPH) LR4-72(HPH) LR6-60 LR6-60(BK/HPB/HPH/HV/PB/PE/PH) LR6-72 LR6-72(BK/HV/PB/PE/PH) RealBlack LR4-60HPB RealBlack LR6-60HPB
Meyer Burger	Meyer Burger Black, Meyer Burger White
Mission Solar Energy	MSE Mono, MSE Perc
Mitsubishi	MIE & MLE Series
Neo Solar Power Co.	D6M Series
Panasonic	VBHNxxxSA06/SA06B/SA11/SA11B VBHNxxxSA15/SA15B/SA16/SA16B, VBHNxxxKA, VBHNxxxKA03/04, VBHNxxxSA17/SA17G/SA17E/SA18/SA18E, VBHNxxxZA01/ZA02/ZA03/VBHNxxxZA04 EVPVxxx EVPVxxx(H/K/PK)
Peimar	SGxxxM (FB/BF) SMxxxM

Manufacture	Module Model / Series
Phono Solar	PSxxxM1-20/U PSxxxM1H-20/U PSxxxM1-20UH PSxxxM1H-20UH
Phono Solar (cont.)	PSxxxM1-20/UH PSxxxM1H-20/UH PSxxxM-24/T PSxxxMH-24/T PSxxxM-24/TH PSxxxMH-24/TH
Prism Solar	P72 Series
Q.Cells	Plus, Pro, Peak, G3, G4, Peak G5(SC) , G6(+)(SC)(AC), G7, G8(+), Plus, Pro, Peak L-G2, L-G4, L-G5 Peak L-G5, L-G6, L-G7, L-G8(BFF) Q.PEAK DUO(BLK)-G6+ Q.PEAK DUO BLK-G6+/TS Q.PEAK DUO (BLK)-G7 Q.PEAK DUO L-(G7/G7.1/G7.2/G7.3/G7.7) Q.PEAK DUO (BLK) G8(+) Q.PEAK DUO L-(G8/G8.1/G8.2/G8.3) Q.PEAK DUO L-G8.3 (BFF/BFG/BGT) Q.PEAK DUO (BLK) ML-G9(+) Q.PEAK DUO XL-(G9/G9.2/G9.3) Q.PEAK DUO XL-G9.3/BFG Q.PEAK DUO-G10+ Q.PEAK DUO BLK G10(+) Q.PEAK DUO BLK G10+/AC Q.PEAK DUO (BLK) ML-G10(a)(+)

Manufacture	Module Model / Series
Q.Cells (cont.)	Q.PEAK DUO XL-(G10/G10.2/G10.3/G10.c/G10.d) Q.PEAK DUO XL-G10.3/BFG Q.PEAK DUO XL-G10.d/BFG Q.PEAK DUO XL-(G11.2/G11.3) Q.PEAK DUO XL-G11.3/BFG
REC	RECxxxAA (BLK/Pure) RECxxxNP (N-PEAK) RECxxxNP2 (Black) RECxxxPE, RECxxxPE72 RECxxxTP, RECxxxTP72 RECxxxTP2(M/BLK2) RECxxxTP2S(M)72 RECxxxTP3M (Black) RECxxxTP4 (Black)
Renesola	All 60-cell modules
Risen	RSM Series
S-Energy	SN72 & SN60 Series
SEG Solar	SEG-xxx-BMD-HV
Seraphim	SEG-(6PA/6PB/6MA/6MA-HV/6MB/E01/E11) SRP-(6QA/6QB) SRP-xxx-6MB-HV, SRP-320-375-BMB-HV, SRP-xxx-BMC-HV, SRP-390-450-BMA-HV, SRP-xxx-BMZ-HV, SRP-390-405-BMD-HV
Sharp	NU-SA & NU-SC Series
Silfab	SLA-M, SLA-P, SLG-M, SLG-P & BC Series SILxxx(BL/NL/NT/HL/ML/BK/NX/NU/HC)

- 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**

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AHJ: HARNETT COUNTY

SHEET NAME
SPEC SHEETS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-14

CERTIFICATE OF COMPLIANCE

Certificate Number	20211109-E341165
Report Reference	E341165-20210317
Issue Date	2021-11-09
Issued to:	Enphase Energy Inc. 1420 N. McDowell Blvd. Petaluma, CA 94954-6515
This is to certify that representative samples of	Grid Support, Utility Interactive Supporting Energy Storage, Multimode, Bi-directional Microinverters Models IQ8-60, IQ8PLUS-72, IQ8M-72, IQ8A-72, IQ8H-208-72, IQ8H-240-72, may be f/b -2, -5, -E, or -M, may be f/b -ACM, f/b -US, may be f/b -NM, may be f/b -RMA, may be f/b -&, where "&" designates additional characters. Has been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	See Page 2
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

This *Certificate of Compliance* is provided as a courtesy to help our customers communicate product compliance information, as documented in our UL Follow-Up Services procedure. This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark shall be considered as being UL Certified and covered under UL's Follow-Up Services. Look for the UL Certification Mark on the product.

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Bruce Mahrenholz, Director North American Certification Program

UL LLC

CERTIFICATE OF COMPLIANCE

Certificate Number	20211109-E341165
Report Reference	E341165-20210317
Issue Date	2021-11-09

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Standards for Safety:

UL 62109-1, STANDARD FOR SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS - PART 1: GENERAL REQUIREMENTS, Edition 1, Revision Date 04/30/2019

IEC 62109-2, SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS - PART 2: PARTICULAR REQUIREMENTS FOR INVERTERS, Edition 1, Issue Date 06/2011

UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, Edition 2, Revision Date 06/10/2021, including the requirements in UL 1741 Supplement SA, sections as noted in the Technical considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

IEEE 1547.1, IEEE Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

CSA C22.2 No. 62109-1, Safety of Power Converters for Use in Photovoltaic Power Systems - Part 1: General Requirements, Edition 1, Issue Date 07/2016

CSA C22.2 No. 62109-2, Safety of Power Converters for Use in Photovoltaic Power Systems - Part 2: Particular Requirements for Inverters, Edition 1, Issue Date 07/2016

Bruce Mahrenholz, Director North American Certification Program

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