



## **Structural Letter of Approval**

November 25, 2024  
Beam Solar Co  
1231 Shields Road Ste. 5  
Kernersville, NC 27284

**Eudell Coe Residence: 16 Railwood Cir, Fuquay-Varina, NC 27526**

Dear Sir/ Madam,

Terra Engineering Consulting (TEC) has performed a structural evaluation for the roof of the structure referenced above based on its existing and proposed load conditions. The attached calculations are based on the assumption that the existing structural components are in good condition and that they meet industry standards. The existing structure information is assumed based on the site visit documentation provided by the client (Beam Solar Co). The design information and assumptions that the calculations are based on are located in the attached References page. The design of the solar panel's mounting hardware is provided by others.

### **Design Method**

This engineering analysis was performed in accordance with ASCE 7-10 and 2018 North Carolina Residential Code (NCRC) design methods. In general, this design method is a comparison of the roof loads before and after the solar panel installation. The snow load in the area of the panels will be reduced due to the roof pitch and the solar panel's slippery surface, as justified in Section 7.4 in ASCE 7-10. Due to the reduction in snow load, the total roof loads and the stresses of the structural elements decrease after the solar panels are installed.

### **Results**

The total additional roof load of the solar panels system is 3 psf, and the typical 20 psf live load will not be present in the area of the panels, as defined per R324.4.1 in 2018 NCRC. The slippery surface snow load reduction allowed in Section 7.4 in ASCE 7-10 reduces the roof snow load in the area of the solar panels. The total combined vertical loads are reduced when considering the worst-case load combination (ASD). Regarding lateral wind loads, the solar panel structure is considered to be partially enclosed due to the low profile of the panels (3 to 6 inches) and airflow restrictions below the panels caused by the pv frame, wiring, conduit, and frame brackets. Because the system is considered to be 'partially enclosed' additional wind pressure on the structure is considered negligible. The addition of total PV system weight results in an increase of under 10% of the total roof weight, and meets the seismic requirements in Section 403.4 of 2018 NCEBC. See the attached calculations for further details.

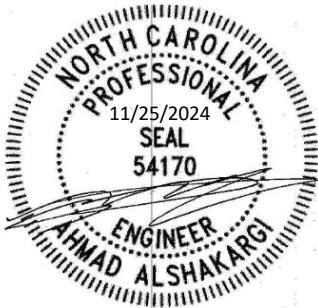
## Conclusions

TEC concludes that the installation of solar panels on existing roof will not affect the structure and allows it to remain unaltered under the applicable design standards. The calculations performed to support these conclusions are attached to this letter.

## General Instructions

1. The contractor shall comply with all Federal, State, County, City, local and OSHA mandated regulations and requirements. The most stringent shall govern.
2. Contractor shall keep an accurate set of As-Built plans.
3. The solar panel's racking system and mounting hardware shall be mounted in accordance with the manufacturer's most recent installation manual.
4. Connection: 5/16" lag screws 2.5" minimum penetration at 48" maximum spacing. Maximum overhang: 12".
5. Panel support connections shall be staggered to distribute load to adjacent trusses.
6. If during solar panel installation, the roof framing members appear unstable or deflect non-uniformly, our office should be notified before proceeding with the installation.
7. Structural observation or construction inspections will not be performed by TEC, Engineer-of-Record (EOR) nor their representatives.
8. TEC Solar assumes no responsibility for improper installation of the solar panels.

Best Regards,  
TEC Solar, PLLC



Ahmad Alshakargi, PE  
Civil (Structural) Engineer  
Firm License P-3037

## **References**

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### **Design Parameter**

Code: 2018 North Carolina Residential Code, ASCE 7-10

Risk Category: II

Ground Snow load: 15 psf

Roof Snow load: 10.4 psf

Design Wind Speed: 120 mph (3 sec gust) per ASCE 7-10

Existing roof dead load: 10.1 psf

Live Load: 20 psf (reducible where panels are located per R324.4.1 in 2018 NCRC).

Seismic Design Category: D2

Wind Exposure Category: C

### **Existing Roof Structure**

Roof framing: 2x4 Rafters at 24" O.C.

Roof material: Composite shingles

Roof slope: 23°

### **Solar Panels**

Weight: 3 psf



Date: 11/25/24  
 Client: Eudell Coe  
 Subject: Gravity load

**Gravity load calculations**

Snow load (S)

	Existing	w/ solar panels	
Roof slope (°):	23	23	
Ground snow load, pg (psf):	15	15	ASCE 7-10, Section 7.2
Terrain category:	C	C	ASCE 7-10, table 7-2
Exposure of roof:	Fully exposed	Fully exposed	ASCE 7-10, table 7-2
Exposure factor, Ce:	0.9	0.9	ASCE 7-10, table 7-2
Thermal factor, Ct:	1.1	1.1	ASCE 7-10, table 7-3
Risk Category:	II	II	ASCE 7-10, table 1.5-1

Minimum roof snow load, Pm, per ASCE 7-16 Section 7.3.4: Is.Pg (where Pg is <= 20 psf), 20.Is (where Pg is > 20psf),  
 Minimum roof snow load

Importance Factor, Is:	1	1	ASCE 7-10, table 1.5-2
Flat roof snow load, pf (psf):	10.4	10.4	ASCE 7-10, equation 7.3-1
Minimum roof snow load, pm (psf):	20	20	ASCE 7-10, equation 7.3-4

Roof Surface type:	Other	Unobstructed slippery surface	ASCE 7-10, Section 7.4
Roof slope factor, Cs:	1	0.78	ASCE 7-10, figure 7-2b

$$P_s = C_s p_f \quad (7.4-1)$$

ASCE 7-10, equation 7.4-1 Design

Sloped roof snow load, ps [psf]: 10.4 8.1 Snow Load (S)

Roof dead load (D)

Roof pitch/12	5.1		
Composite shingles	3 psf	1/2" Gypsum clg.	0 psf
1/2" plywood	1.5 psf	insulation	0.8 psf
Framing	3 psf	M, E & Misc	1 psf

Roof DL without PV arrays 10.1 psf  
 PV Array DL 3 psf

Roof live load (Lr)

	Existing	w/ solar panels	
Roof Live Load	20	0	R324.4.1 in 2018 NCRC

**ASD Load combination:**

	Existing	With PV array	
D [psf]	10.1	13.1	ASCE 7-10, Section 2.4.1
D+L [psf]	10.1	13.1	ASCE 7-10, Section 2.4.1
D+[Lr or S or R] [psf]	30.1	21.2	ASCE 7-10, Section 2.4.1
D+0.75L+0.75[Lr or S or R] [psf]	25.1	19.2	ASCE 7-10, Section 2.4.1
<u>Maximum gravity load [psf]:</u>	30.1	21.2	
Ratio proposed load to existing load:		70.46%	

**The stresses due to gravity load in the area of the solar panels is reduced, allowing the structure to remain unaltered.**



Date: 11/25/24  
 Client: Eudell Coe  
 Subject: Wind load and Connection

**Wind Pressure Calculations**

$$p = q_p((GC_p) - (GC_{pi})) \quad (30.9-1)$$

Basic wind speed (mph)	120		
Risk category	II		
Exposure category	C		
Roof type	Gable		
Figure for GCp values	ASCE 7-10 Figure 30.3-2A-I		
	Zone 1	Zone 2	Zone 3
GCp (neg)	-0.9	-1.7	-2.6
GCp (pos)	0.5	0.5	0.5
zg (ft)	900 (ASCE 7-10 Table 26.11-1)		
$\alpha$	9.5 (ASCE 7-10 Table 26.11-1)		
Kzt	1 (ASCE 7-10 Equation 26.8-1)		
Kh	0.94 (ASCE 7-10 Table 26.10-1)		
Kd	0.85 (ASCE 7-10 Table 26.6-1)		
Velocity Pressure, qh (psf)	29.45 (ASCE 7-10 Equation 26.10-1)		
Gcpi	0 (ASCE 7-10 Table 26.13-1)		

(only changes if structure located on a hill or ridge)

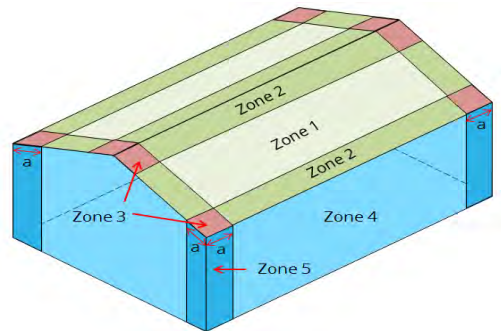
	Zone 1	Zone 2	Zone 3
W Pressure, (neg) [psf]	-26.51	-50.07	-76.58
W Pressure, (pos) [psf]	14.73	14.73	14.73
W Pressure, (Abs. max) [psf]	26.51	50.07	76.58

**Connection Calculations (Lag bolts)**

Capacity

Connection type:	Lag screw		
Embedment (in):	2.5		
Framing grade:	DFL#2	G:	0.5
Capacity [lbs/in]:	266 (2018 NDS table 12.2A)		
Number of screws:	1		
Total capacity [lbs]:	665.00		

Lag screw diameter: 5/16



Demand

Anchor spacing: 48 in  
 Anchor spacing in roof corners: 48 in

Zone	(0.6 W Pressure, psf), see Note 1	Max. tributary area (ft^2)	Max Uplift force (lbs)
1	15.9	11	175.0
2	30.0	11	330.5
3	45.9	11	505.4

**Connection Meets Demand**

Note 1: 0.6W results from dominant ASD combo [0.6D+0.6W] (ASCE 7-10 2.4.1).

# HOUSE PHOTO

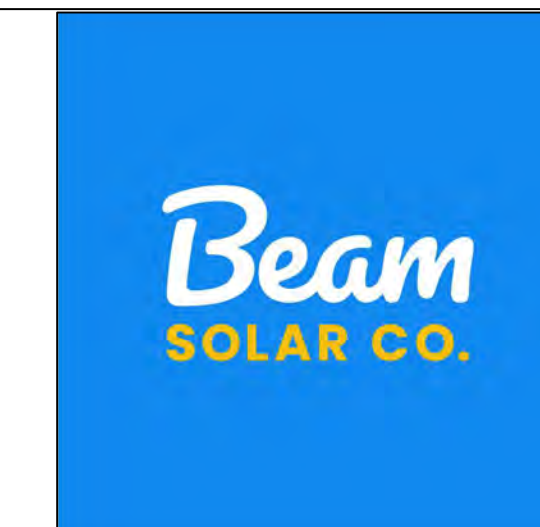


# VICINITY MAP



# SHEET INDEX

PV-100.00	TITLE SHEET
PV-200.00	SITE PLAN
PV-300.00	GENERAL NOTES
PV-400.00	ROOF PLAN
PV-500.00	DETAIL DRAWINGS
PV-501.00	DETAIL DRAWINGS
PV-600.00	3 LINE DIAGRAM
PV-700.00	SPECS & CALCS
PV-800.00	WARNING LABELS
MSD	DATA SHEETS
BOM	BILL OF MATERIALS



BEAM SOLAR CO.  
1231 SHIELDS ROAD  
STE. 5  
KERNERSVILLE, NC 27284

**SCOPE OF WORK:**

TO INSTALL OF A 12 MODULE ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 16 RAILWOOD CT THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

EUELLE COE  
RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

**DRAWN BY: CHARLENE A**

**DATE: 2024-11-25**

**REVISION:**

NO.	DESCRIPTION	DATE

**TITLE SHEET**

**PV-100.00**

**GENERAL PROJECT INFO:**

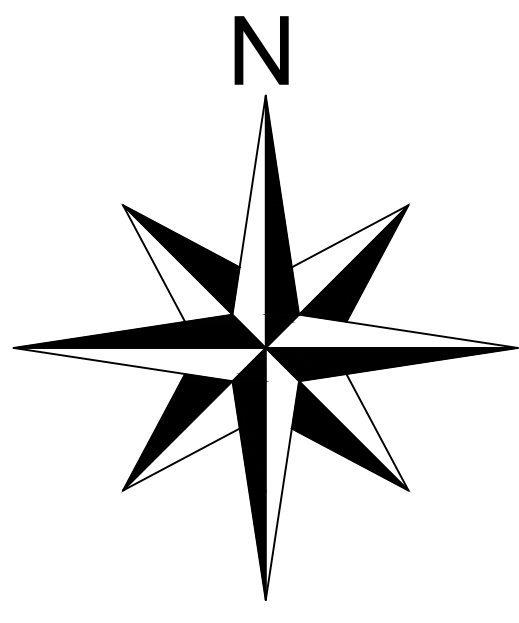
UTILITY COMPANY	DUKE
CITY	FUQUAY-VARINA
AHJ	COUNTY OF HARNETT
DC SYSTEM	5.040 KWDC
AC SYSTEM	3.480 KWAC
MODULE	Q.TRON BLK M-G2+ 420W MODULES
INVERTER	ENPHASE IQ8PLUS-72-2-US (240V)
MICROINVERTER	

**GOVERNING CODES:**

2018 NORTH CAROLINA BUILDING CODE  
2018 NORTH CAROLINA RESIDENTIAL CODE  
2018 NORTH CAROLINA EXISTING BUILDING CODE  
2015 INTERNATIONAL FIRE CODE  
2017 NATIONAL ELECTRIC CODE



The mounting hardware is provided by manufacturer and is out of scope of this review. Structural observation or construction inspection will not be performed by TEC, Engineer of Record (EOR) nor their representatives.



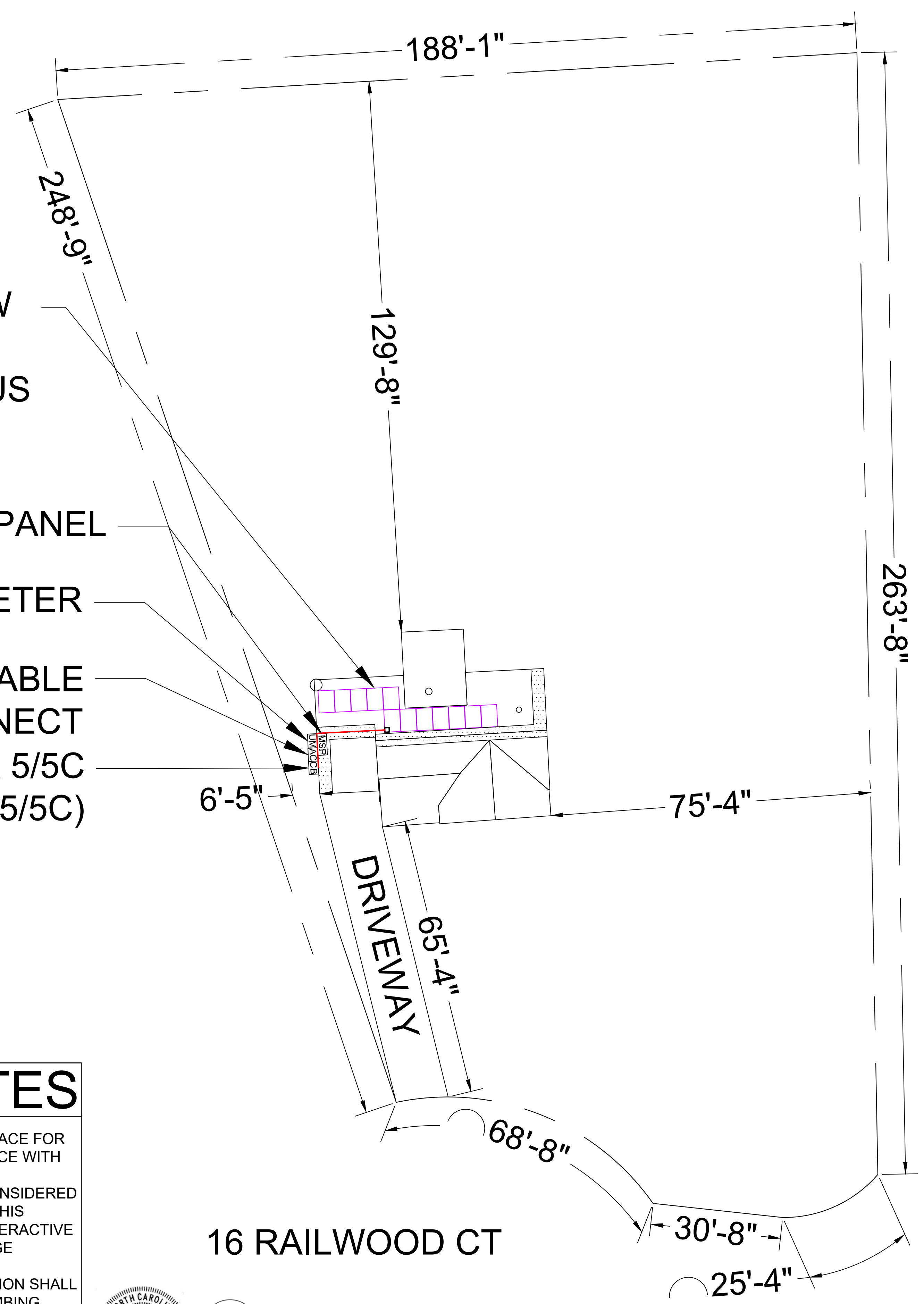
(12) Q.TRON BLK M-G2+ 420W  
MODULES  
(12) ENPHASE IQ8PLUS-72-2-US  
(240V) MICROINVERTERS

(E) MAIN SERVICE PANEL

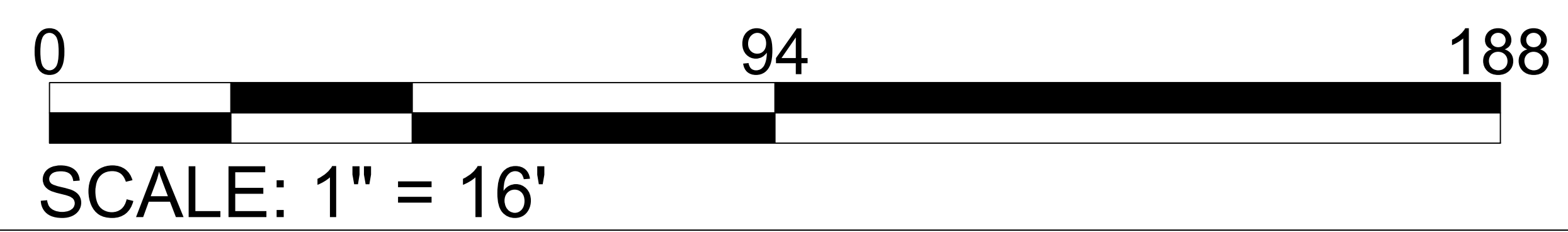
(E) UTILITY METER

(N) VISIBLE LOCKABLE  
LABELED AC DISCONNECT

(N) ENPHASE IQ COMBINER 5/5C  
(X-AM1-IQ-240-5/5C)



16 RAILWOOD CT



LEGEND	
UM	UTILITY METER
MSP	MAIN SERVICE PANEL
PM	PRODUCTION METER
AC	AC DISCONNECT
CB	COMBINER PANEL

**SITE NOTES**

- A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
- THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS AN UTILITY INTERACTIVE SYSTEM WITH NO STORAGE BATTERIES.
- THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
- PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION [NEC 110.26]



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RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

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**SITE PLAN**

PV-200.00

**GENERAL NOTES:**

- THESE CONSTRUCTION DOCUMENTS HAVE BEEN BASED ON FIELD INSPECTIONS AND OTHER INFORMATION AVAILABLE AT THE TIME. ACTUAL FIELD CONDITIONS MAY REQUIRE MODIFICATIONS IN CONSTRUCTION DETAILS.
- ARCHITECT HAS NOT BEEN RETAINED TO SUPERVISE ANY CONSTRUCTION OR INSTALLATION OF ANY EQUIPMENT AT SITE.
- CONTRACTOR SHALL FURNISH ALL LABOR, MATERIAL, EQUIPMENT, TOOLS, OBTAINS ALL PERMITS, LICENSES AND PAY ALL REQUIRED FEES AND COMPLETE INSTALLATION.
- CONTRACTOR HAS THE FULL RESPONSIBILITY TO CHECK AND VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK. ANY WORK STARTED BEFORE CONSULTATION AND ACCEPTANCE BY THE ENGINEER SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE SUBJECT TO CORRECTION BY THEM WITHOUT ADDITIONAL COMPENSATION.
- DAMAGE CAUSED TO THE EXISTING STRUCTURE, PIPES, DUCTS, WINDOWS, WALL, FLOORS, ETC. SHALL BE REPAIRED TO THE ORIGINAL CONDITION OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST.
- THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR THE PROPER INSTALLATION AND COMPLETION OF THE WORK WITH APPROVED MATERIALS. NO CHANGES ARE TO BE MADE WITHOUT THE CONSULTATION AND APPROVAL OF THE ARCHITECT. CONTRACTOR SHALL OBTAIN BUILDING PERMIT. NO WORK TO START UNLESS BUILDING PERMIT IS PROPERLY DISPLAYED.
- ALL WORKMANSHIP AND MATERIALS SHALL BE OF FIRST QUALITY AND IN COMPLIANCE WITH THE REQUIREMENTS OF THE NC BUILDING CODE, THE DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ALL PERTINENT AGENCIES.
- IT IS ESSENTIAL THAT ALL WORK PROCEED WITH THE MAXIMUM COOPERATION OF ALL PARTIES AND WITH MINIMUM INTERFERENCE TO THE OCCUPANTS WITHIN THE BUILDING. THE OWNER'S DIRECTIONS IN THIS REGARD SHALL BE FULLY COMPLIED WITH.
- ALL EXPOSED PLUMBING, HVAC, ELECTRICAL DUCTWORK, PIPING AND CONDUITS ARE TO BE PAINTED BY GENERAL CONTRACTOR. THE CONTRACTOR SHALL PERFORM THE WORK IN STRICT CONFORMANCE WITH THE LOCAL LAWS, REGULATIONS AND THE NATIONAL ELECTRIC CODE.
- THE CONTRACTOR SHALL OBTAIN ALL PERMITS, APPROVALS, AFFIDAVITS, CERTIFICATIONS, ETC. AND PAY ALL FEES AS REQUIRED BY THE LOCAL AUTHORITIES. CONTRACTORS SHALL OBTAIN FIRE CERTIF. UPON COMPLETION OF WORK.

**ELECTRICAL NOTES:**

- THE EQUIPMENT AND ALL ASSOCIATED WIRING AND INTERCONNECTION SHALL BE INSTALLED ONLY BY QUALIFIED PEOPLE. A QUALIFIED PERSON IS ONE WHO HAS SKILLS AND KNOWLEDGE RELATED TO THE CONSTRUCTION AND OPERATION OF THE ELECTRICAL EQUIPMENT AND INSTALLATIONS AND HAS RECEIVED SAFETY TRAINING TO RECOGNIZE AND AVOID THE HAZARDS INVOLVED. (NEC 690.4(E) AND 705.6)
- LOCAL UTILITY PROVIDER SHALL BE NOTIFIED PRIOR TO USE AND ACTIVATION OF ANY SOLAR PHOTOVOLTAIC INSTALLATION. FOR A LINE SIDE TAP CONNECTION, UTILITY NEEDS TO BE NOTIFIED WELL IN ADVANCE TO COORDINATE BUILDING ELECTRICAL SHUT OFF.
- NEW CONDUIT ROUTING SHOWN IS ESSENTIALLY SCHEMATIC. SUBCONTRACTOR SHALL LAY OUT RUNS TO SUIT FIELD CONDITIONS AND THE COORDINATION REQUIREMENTS OF OTHER TRADES.
- ARRAY WIRING SHOULD NOT BE READILY ACCESSIBLE EXCEPT TO QUALIFIED PERSONNEL.
- ALL EXTERIOR CONDUIT, FITTINGS, AND BOXES SHALL BE WATERTIGHT AND APPROVED FOR USE IN WET LOCATIONS. (NEC 314.15A).
- WIRING METHODS FOR PV SYSTEM CONDUCTORS AREN'T PERMITTED WITHIN 10 IN. OF THE ROOF DECKING OR SHEATHING EXCEPT WHERE LOCATED DIRECTLY BELOW THE ROOF SURFACE THAT'S COVERED BY PV MODULES AND ASSOCIATED EQUIPMENT WIRING
- BACK-FED BREAKER MUST BE AT THE OPPOSITE END OF BUS BAR FROM THE MAIN BREAKER OR MAIN LUG SUPPLYING CURRENT FROM THE UTILITIES.
- ALL CONDUCTORS AND WIRE TIES EXPOSED TO SUNLIGHT ARE LISTED AS UV RESISTANT.
- CONTRACTOR SHALL FOLLOW ALL ELECTRICAL EQUIPMENT LABELING REQUIREMENTS IN NEC 690 AND IFC 2021 · PV SOURCE, OUTPUT AND INVERTER CIRCUITS SHALL BE IDENTIFIED AT ALL POINTS OF TERMINATION, CONNECTION, AND SPLICES. THE MEANS OF ID CAN BE SEPARATE COLOR CODING, MARKING TAPE, TAGGING ETC. (NEC 690.4).
- MEASURE THE LINE-TO-LINE AND LINE-TO-NEUTRAL VOLTAGE OF ALL SERVICE ENTRANCE CONDUCTORS PRIOR TO INSTALLING ANY SOLAR EQUIPMENT. THE VOLTAGES FOR THE 240VAC RATED.



**WIRING AND CONDUIT NOTES:**

- ALL CONDUIT SIZES AND TYPES, SHALL BE LISTED FOR ITS PURPOSE AND APPROVED FOR THE SITE APPLICATIONS
- ALL PV CABLES AND HOMERUN WIRES BE #10AWG \*USE-2, PV WIRE, OR PROPRIETARY SOLAR CABLING SPECIFIED BY MFR, OR EQUIVALENT; ROUTED TO SOURCE CIRCUIT COMBINER BOXES AS REQUIRED
- ALL CONDUCTORS AND OCPD SIZES AND TYPES SPECIFIED ACCORDING TO [NEC 690.8 (A)(1) & (B)(1)], [NEC 240] [NEC 690.7] FOR MULTIPLE CONDUCTORS
- ALL PV DC CONDUCTORS IN CONDUIT EXPOSED TO SUNLIGHT SHALL BE DERATED ACCORDING TO [NEC TABLE 310.15 (B)(2)(C)] BLACK ONLY\*\*
- EXPOSED ROOF PV DC CONDUCTORS SHALL BE USE-2, 90°C RATED, WET AND UV RESISTANT, AND UL LISTED RATED FOR 600V, UV RATED SPIRAL WRAP SHALL BE USED TO PROTECT WIRE FROM SHARP EDGES
- PHASE AND NEUTRAL CONDUCTORS SHALL BE DUAL RATED THHN/THWN-2 INSULATED, 90°C RATED, WET AND UV RESISTANT, RATED FOR 600V PER NEC 2008 OR 1000V PER NEC 2011
- 4-WIRE DELTA CONNECTED SYSTEMS HAVE THE PHASE WITH THE HIGHER VOLTAGE TO GROUND MARKED ORANGE OR IDENTIFIED BY OTHER EFFECTIVE MEANS
- ALL SOURCE CIRCUITS SHALL HAVE INDIVIDUAL SOURCE CIRCUIT PROTECTION VOLTAGE DROP LIMITED TO 2%
- AC CONDUCTORS >4AWG COLOR CODED OR MARKED: PHASE A OR L1- BLACK, PHASE B OR L2- RED, PHASE C OR L3- BLUE, NEUTRAL- WHITE/GRAY



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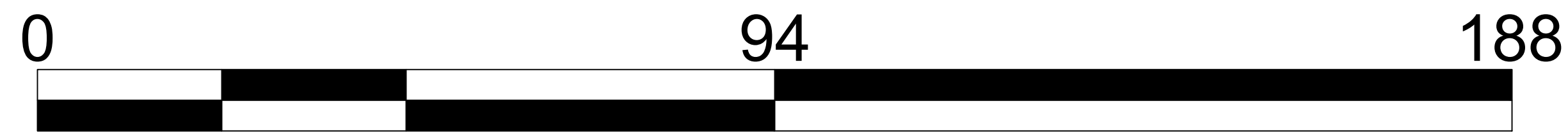
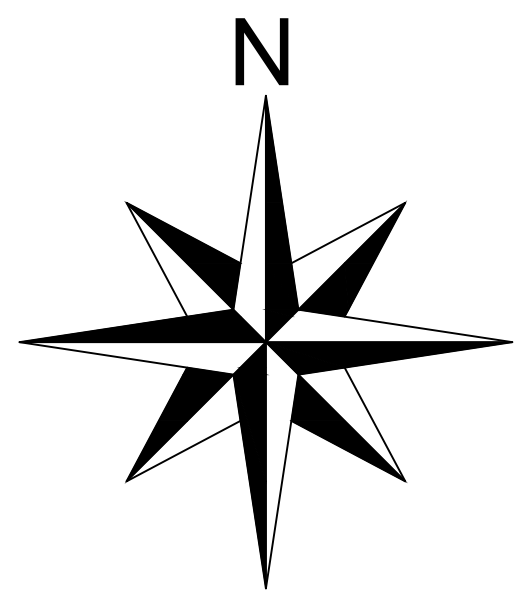
**REVISION:**

NO.	DESCRIPTION	DATE

**GENERAL NOTES**

**PV-300.00**

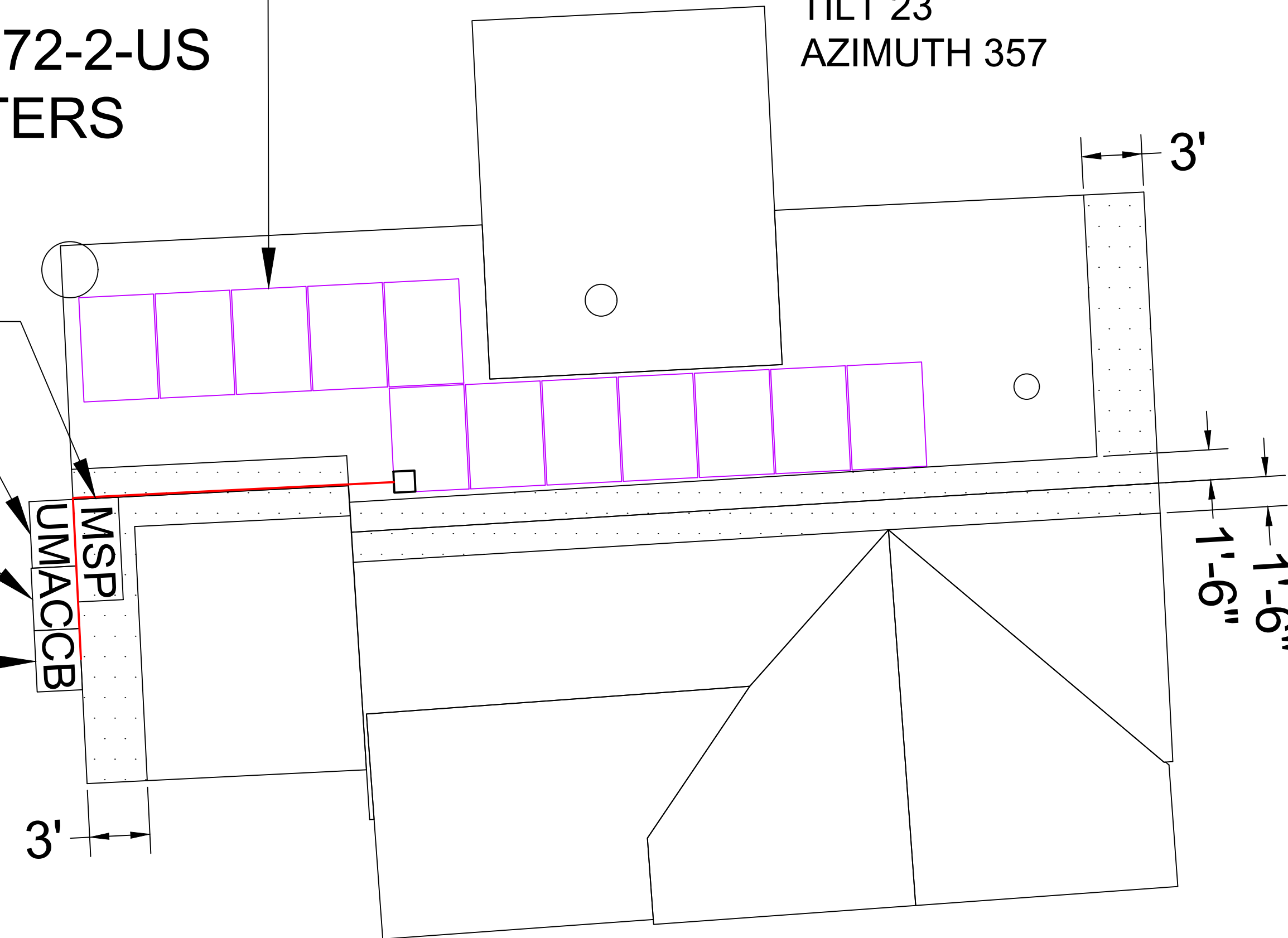




(12) Q.TRON BLK M-G2+ 420W  
MODULES  
(12) ENPHASE IQ8PLUS-72-2-US  
(240V) MICROINVERTERS

ROOF SECTION 1  
COUNT 12  
TILT 23  
AZIMUTH 357

(E) MAIN SERVICE PANEL  
(E) UTILITY METER  
(N) VISIBLE LOCKABLE  
LABELED AC DISCONNECT  
(N) ENPHASE IQ COMBINER 5/5C  
(X-AM1-IQ-240-5/5C)



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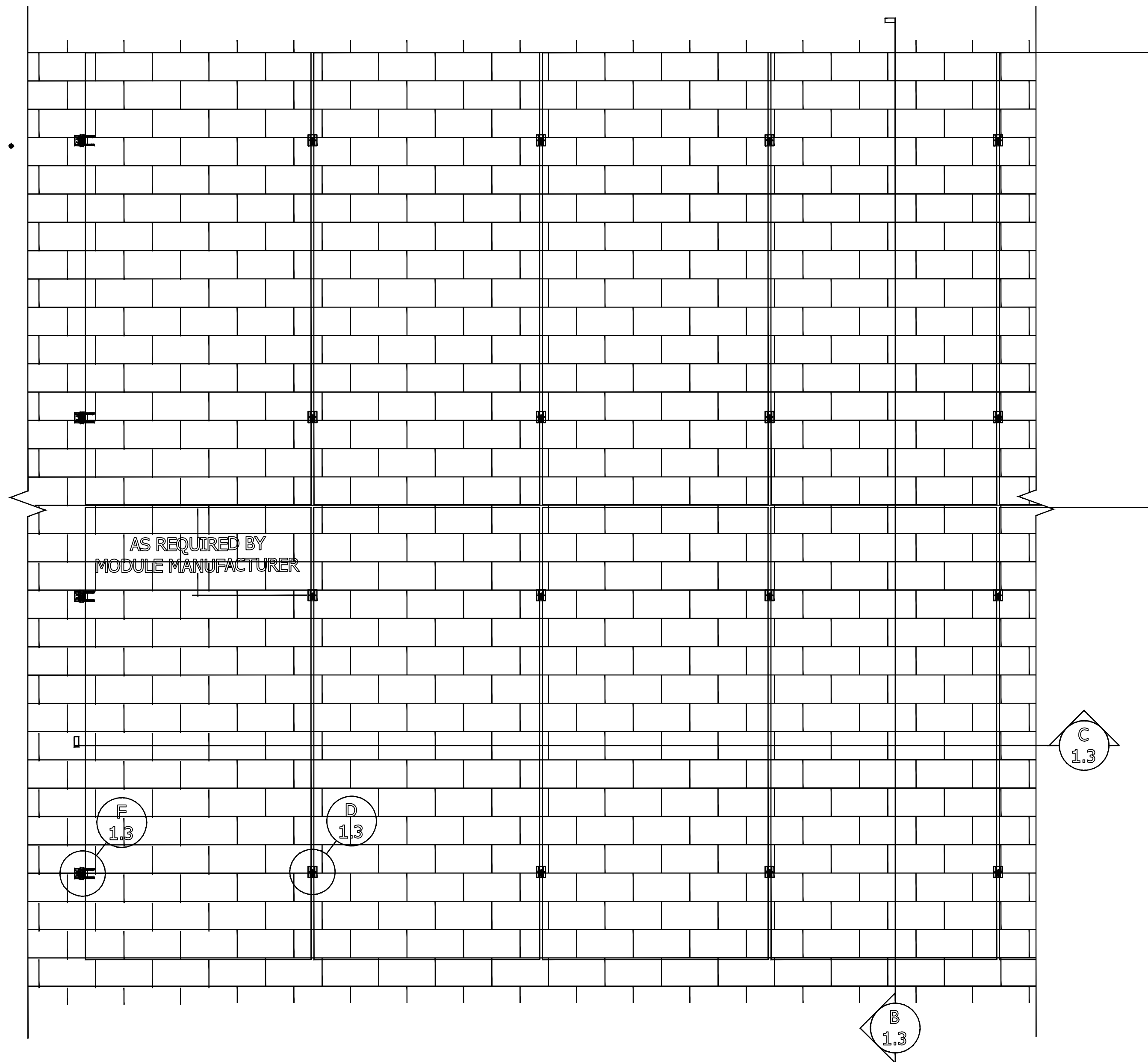
ROOF PLAN

PV-400.00

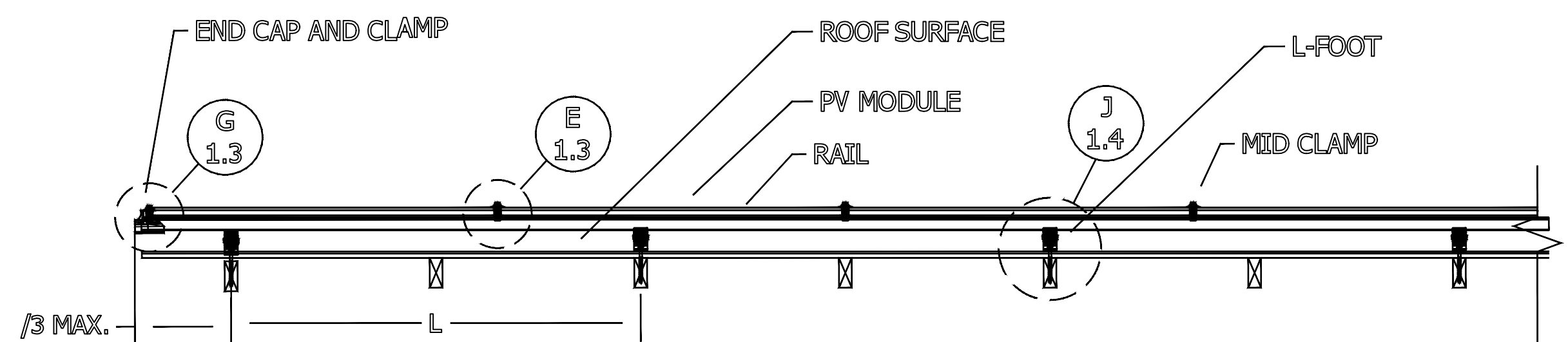
DESIGN SPECIFICATION		MOUDLE TYPE, DIMENSIONS, & WEIGHT	
RISK CATEGORY:	II	NUMBER OF MODULES:	12 MODULES
CONSTRUCTION:	SFD	MODULE TYPE:	Q.TRON BLK M-G2+ 420W MODULES
ZONING:	RES	MODULE WEIGHT:	46.74 LBS
SNOW LOAD (ASCE 7-16):	15 PSF	MODULE DIMENSIONS:	67.8" (L) x 44.65" (W) = 21.02 SF
EXPOSURE CATEGORY:	B	UNIT WEIGHT OF AREA:	2.22 PSF
WIND SPEED (ASCE 7-16):	117 Vmph		



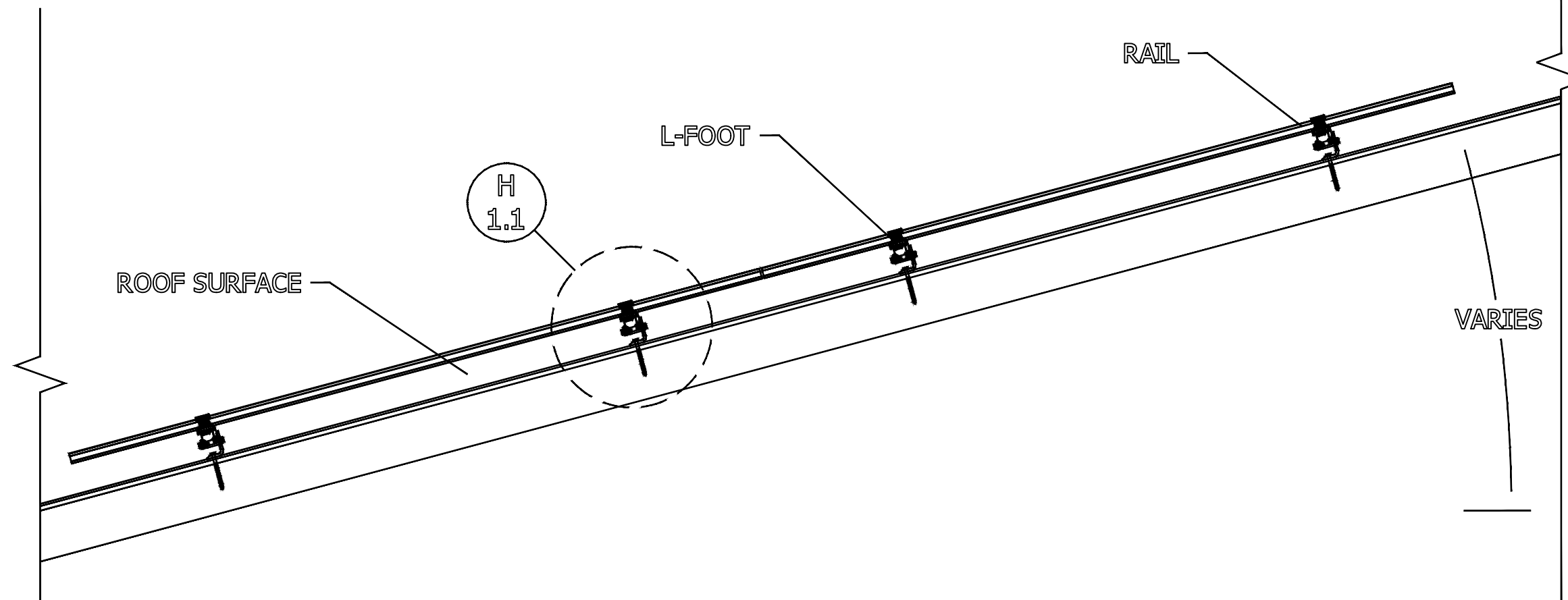
SCALE: 1" = 5'



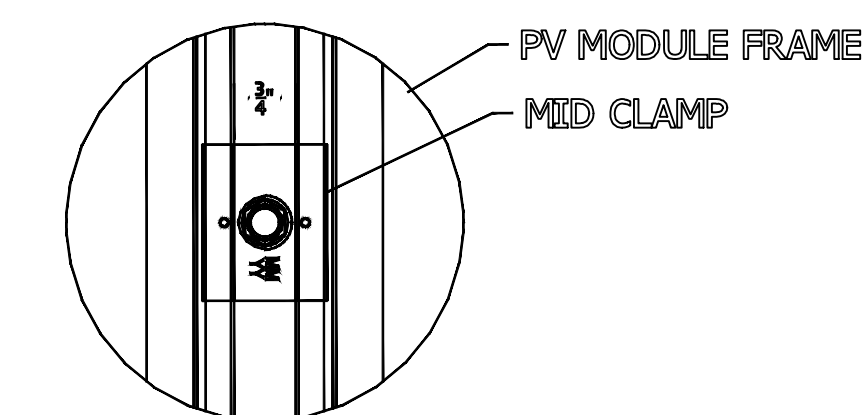
**A** PLAN VIEW, COMP ASSEMBLY, PORTRAIT MODULE  
Scale: 1"=1'-0"



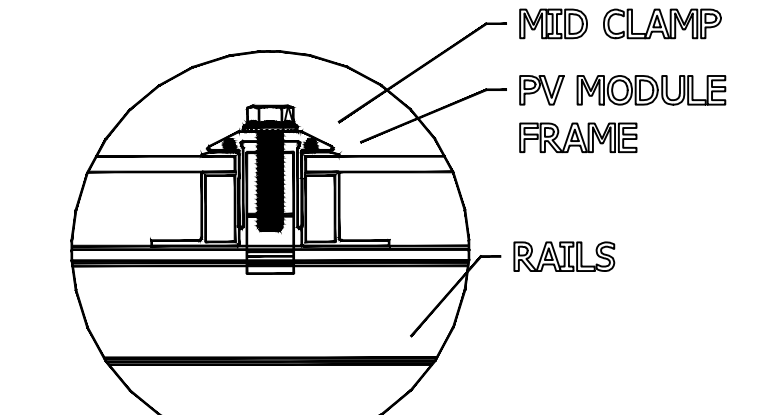
**C** FRONT VIEW, COMP ASSEMBLY, PORTRAIT MODULE  
Scale: 1"=1'-0"



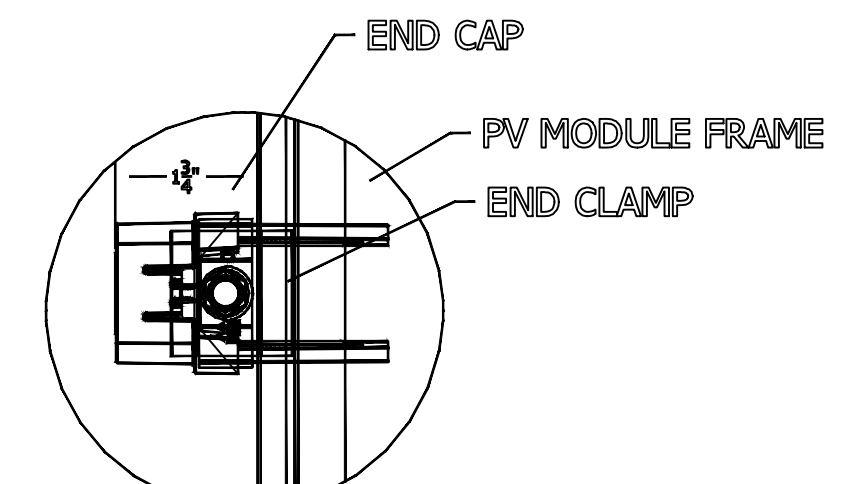
**B** SIDE VIEW, COMP ASSEMBLY, PORTRAIT MODULE  
Scale: 1"=1'-0"



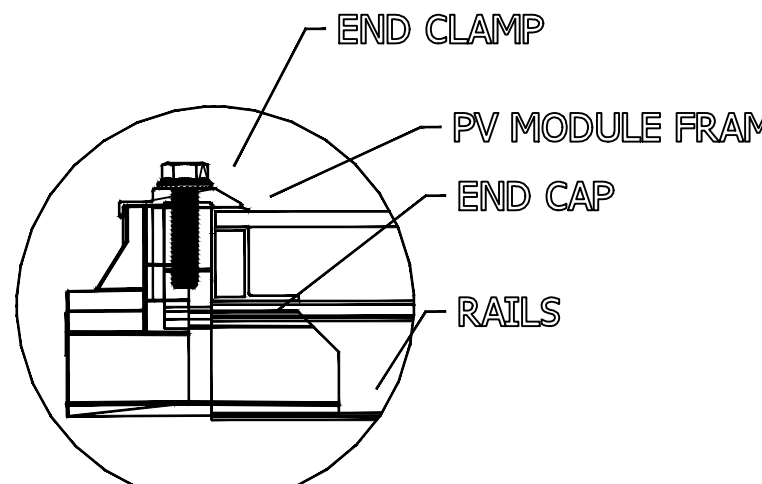
**D** DETAIL, MID CLAMP PLAN  
Scale: 6"=1'-0"



**E** DETAIL, MID CLAMP FRONT  
Scale: 6"=1'-0"



**F** DETAIL, END CAP AND CLAMP PLAN  
Scale: 6"=1'-0"



**G** DETAIL, END CAP AND CLAMP FRONT  
Scale: 6"=1'-0"

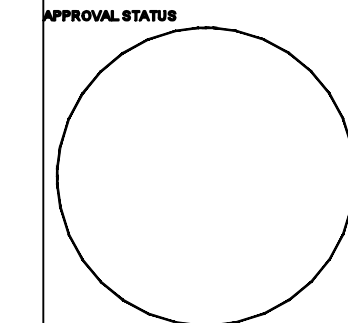


11/25/2024  
TEC Solar, PLLC  
8470 W Magna Main St Unit 311, Magna, UT 84044  
North Carolina Firm License P-3037  
The mounting hardware is provided by manufacturer and is out of scope of this review. Structural observation or construction inspection will not be performed by TEC, Engineer-of-Record (EOR) nor their representatives.



CLIENT NAME	ECOFASTEN
PROJECT NAME	SLOPED ROOF MOUNT SYSTEM
PROJECT ADDRESS	
SYSTEM KW/DC	

WIND SPEED, MPH	
SNOW LOAD, PSF	
EXPOSURE CAT	
RISK CAT	
MODULE TYPE	
MODULE WDC	
MODULE CITY	



REV	DESCRIPTION	DATE

SHEET NAME  
SLOPED ROOF PV SYSTEM  
DETAILS: L-FOOT  
COMP  
ASSEMBLY -  
PORTRAIT  
JOB NO. 1.1 SR  
ISSUE DATE SEP 2021  
SHEET NO. ECO 1.3  
SHEET SIZE 24X36



BEAM SOLAR CO.  
1231 SHIELDS ROAD  
STE. 5  
KERNERSVILLE, NC 27284

SCOPE OF WORK:

TO INSTALL OF A 12 MODULE ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 16 RAILWOOD CT THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

EUELLE COE  
RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

DRAWN BY: CHARLENE A

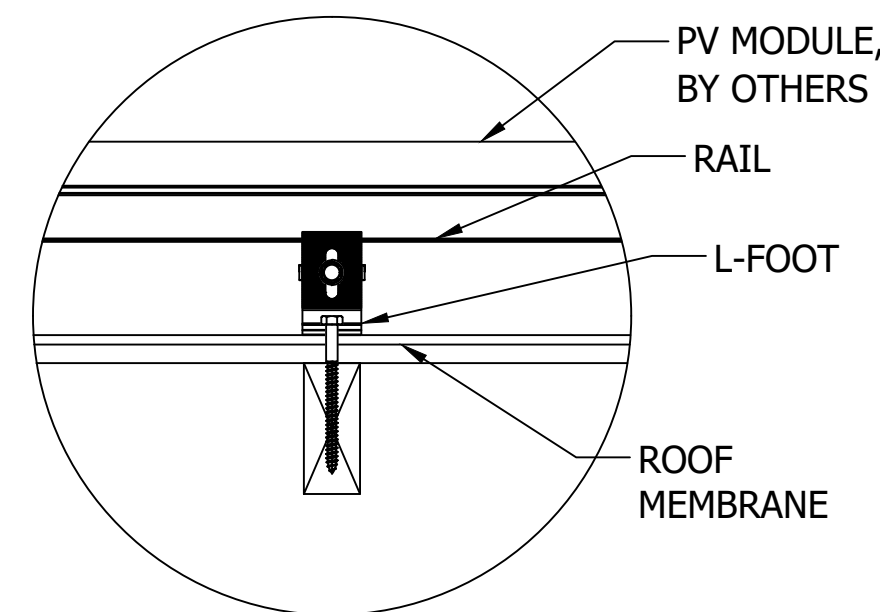
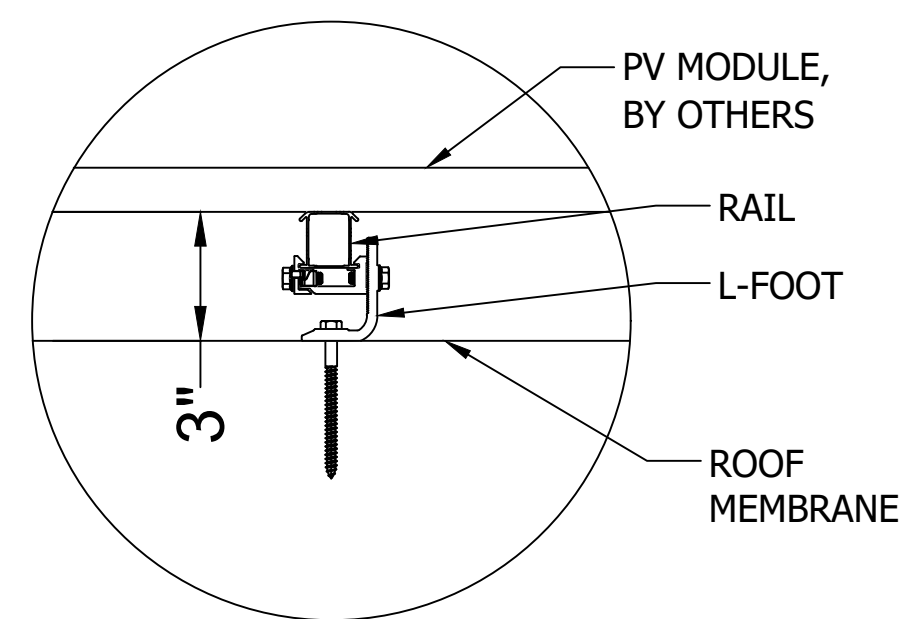
DATE: 2024-11-25

REVISION:

NO.	DESCRIPTION	DATE

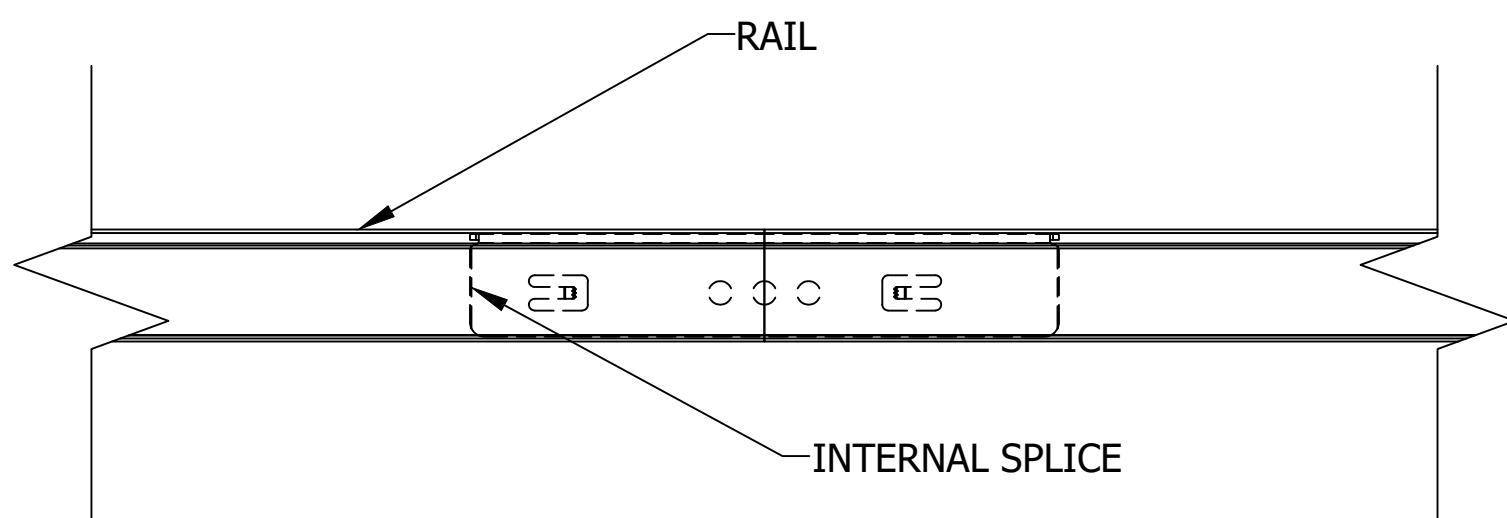
DETAIL  
DRAWINGS

PV-500.00

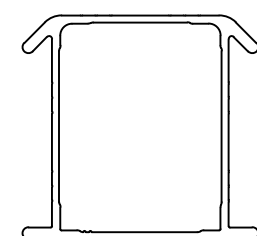


H SMART FOOT DETAIL SIDE  
Scale: 3"=1'-0"

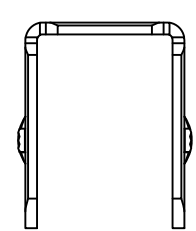
J SMART FOOT DETAIL FRONT  
Scale: 3"=1'-0"



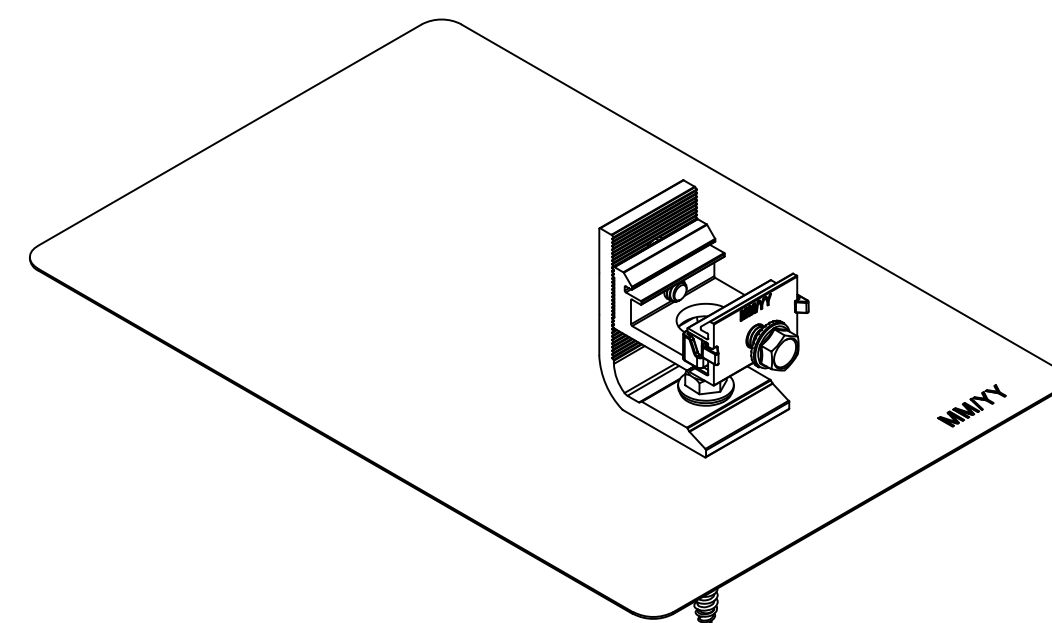
K DETAIL, SPLICE CONNECTION  
6"=1'-0"



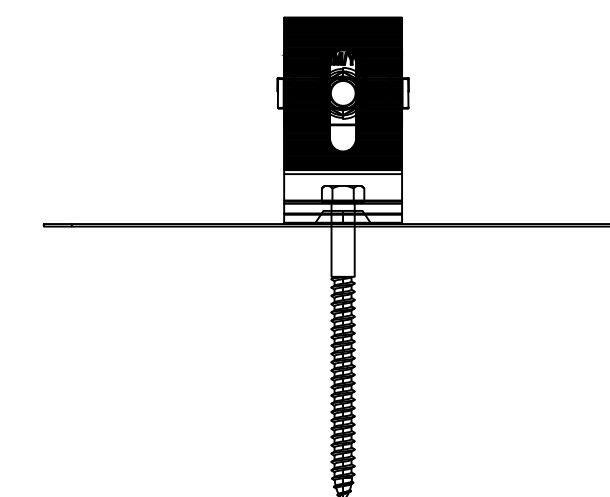
L DETAIL, RAIL  
1'-0"=1'-0"



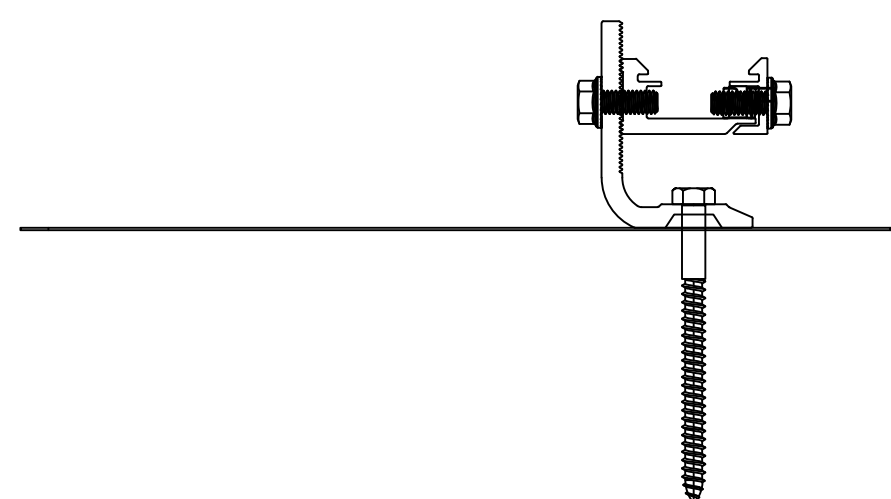
M DETAIL, SPLICE  
1'-0"=1'-0"



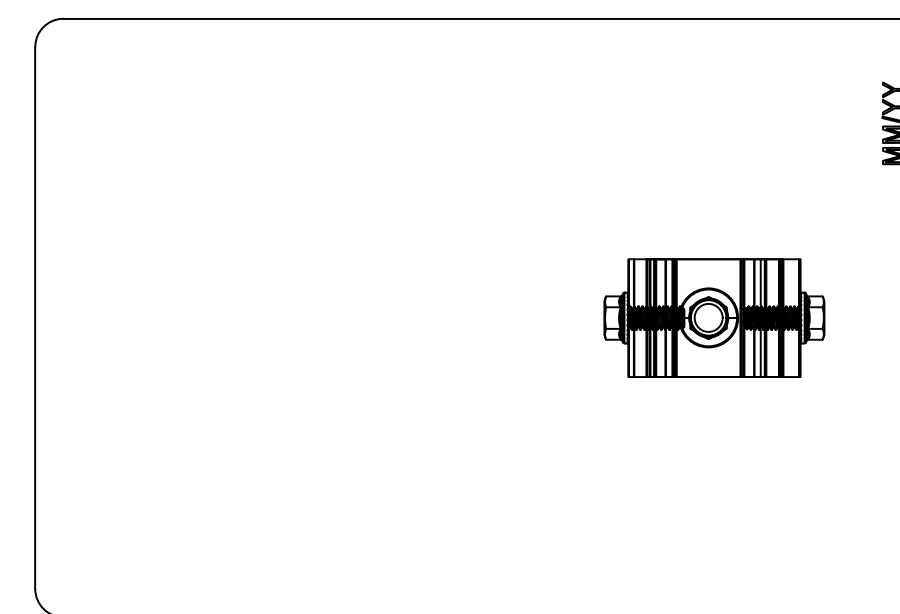
N ECOFASTEN SMART FOOT



O ECOFASTEN SMART FOOT, FRONT VIEW



P ECOFASTEN SMART FOOT, SIDE VIEW



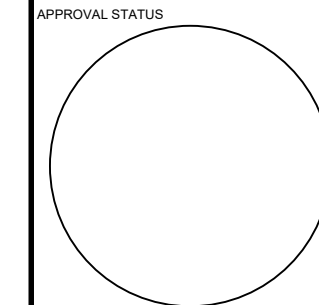
Q ECOFASTEN SMART FOOT, PLAN VIEW

TEC SOLAR  
 STRUCTURAL ENGINEER  
 11/25/2024  
 TEC Solar, PLLC  
 8470 W Magna Main St Unit 311, Magna, UT 84044  
 North Carolina Firm License P-3037  
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EcoFasten  
 AT ESDEC COMPANY  
 4141 W VAN BUREN ST. SUITE 2  
 PHOENIX, AZ 85009  
 877-858-3947 ECOFASTENSOLAR.COM

CLIENT NAME	ECOFASTEN
PROJECT NAME	SLOPED ROOF MOUNT SYSTEM
PROJECT ADDRESS	
SYSTEM KW/DC	

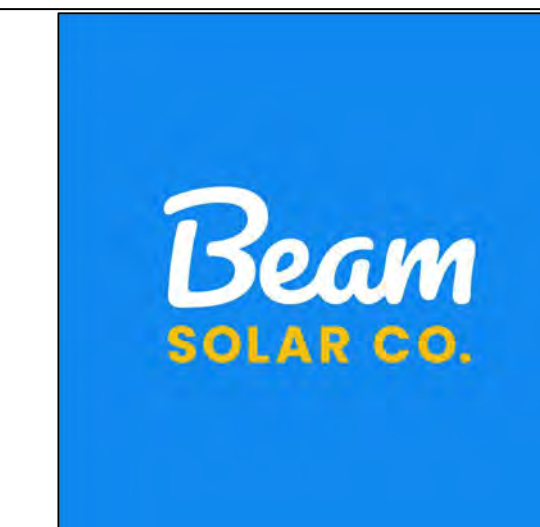
WIND SPEED, MPH	
SNOW LOAD, PSF	
EXPOSURE CAT	
RISK CAT	
MODULE TYPE	
MODULE W/DC	
MODULE QTY	



REV	DESCRIPTION	DATE

SHEET NAME  
 SLOPED ROOF  
 PV SYSTEM  
 DETAILS: L-FOOT  
 DETAILS

JOB NO.	3,1 SR
ISSUE DATE	SEP 2021
SHEET NO.	ECO 1.4
SHEET SIZE	24X36



BEAM SOLAR CO.  
 1231 SHIELDS ROAD  
 STE. 5  
 KERNERSVILLE, NC 27284

SCOPE OF WORK:

TO INSTALL OF A 12 MODULE ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 16 RAILWOOD CT THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

EUDELL COE  
 RESIDENCE  
 16 RAILWOOD CT  
 FUQUAY-VARINA, NC 27526  
 (1252)722-2550  
 MCCORMICKTLG@OUTLOOK.COM  
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DRAWN BY: CHARLENE A

DATE: 2024-11-25

REVISION:

NO.	DESCRIPTION	DATE

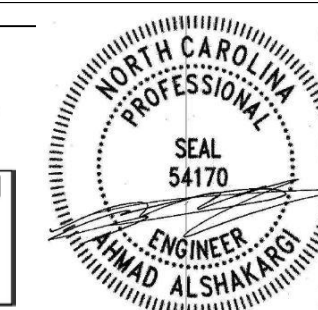
DETAIL  
 DRAWINGS

PV-501.00



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11-26-2024

**SOLAR MODULE SPECIFICATIONS**

MANUFACTURER/ MODEL	Q.TRON BLK M-G2+ 420W MODULES
VMP	32.54 V
IMP	12.91 A
VOC	38.75 V
ISC	13.58 A
TEMP. COEFF. VOC	-0.24 %/C°
MODULE DIMENSION	67.8" (L) x 44.65" (W)
PANEL WATTAGE	420 W

**INVERTER SPECIFICATIONS**

MANUFACTURER/ MODEL	ENPHASE IQ8PLUS-72-2-US (240V) MICROINVERTER
MAX DC SHORT CIRCUIT CURRENT	20 A
CONTINUOUS OUTPUT CURRENT	1.21 A (240 VAC)

**AMBIENT TEMPERATURE SPECS**

RECORD LOW TEMP	-12 °C
AMBIENT TEMP (HIGH TEMP 2%)	34 °C
CONDUIT HEIGHT	7/8"
ROOF TOP TEMP	56 °C
CONDUCTOR TEMPERATURE RATE	90 °C
MODULE TEMPERATURE COEFFICIENT OF VOC	-0.24 %/C°

**ARRAY WEIGHT (DEAD LOAD CALCS)**

NUMBER OF MODULES	12
MODULE WEIGHT	46.74 LBS
TOTAL MODULE (ARRAY) WEIGHT	560.88 LBS
NUMBER OF ATTACHMENT POINTS	50
MOUNTING SYSTEM WEIGHT (PER MODULE)	0 LBS
MOUNTING SYSTEM WEIGHT	0 LBS
WEIGHT AT EACH ATTACHMENT POINT (ARRAY WEIGHT / NUMBER OF ATTACHMENT POINT)	14.02 LBS
MODULE AREA (67.8" x 44.65")	21.02 SF
TOTAL ARRAY AREA	252.24 SF
DISTRIBUTED LOAD (TOTAL SYSTEM WEIGHT / TOTAL ARRAY AREA)	2.22 PSF
TOTAL ROOF AREA	2072.85 SF
TOTAL PERCENTAGE OF ROOF COVERED ((TOTAL ARRAY AREA / TOTAL ROOF AREA)*100)	12.17%



BEAM SOLAR CO.  
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**SCOPE OF WORK:**

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**DRAWN BY: CHARLENE A**

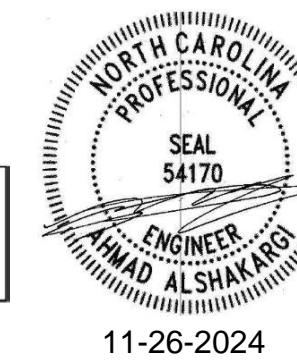
**DATE: 2024-11-25**

**REVISION:**

NO.	DESCRIPTION	DATE

**SPECS AND  
CALCS**

**PV-700.00**



**1** **WARNING**

**ELECTRIC SHOCK HAZARD**  
DO NOT TOUCH TERMINALS  
TERMINALS ON BOTH LINE AND  
LOAD SIDES MAY BE ENERGIZED IN  
THE OPEN POSITION

**LABEL LOCATION:**  
POINT OF INTERCONNECTION,  
(PER CODE: NEC 690.16(B))

**2** **WARNING - Electric Shock Hazard**  
No user serviceable parts inside  
Contact authorized service provider for assistance

**LABEL LOCATION:**  
INVERTER, JUNCTION BOXES (ROOF),  
(PER CODE: NEC 690.13.G.3 & NEC  
690.13.G.4)

**3** **WARNING: DUAL POWER SOURCE**  
DUAL POWER SOURCE

**LABEL LOCATION:**  
POINT OF INTERCONNECTION  
(PER CODE: NEC 705.15(C) & NEC 690.59)

**4** **WARNING: PHOTOVOLTAIC  
POWER SOURCE**

**LABEL LOCATION:**  
CONDUIT, COMBINER BOX  
(PER CODE: NEC690.31(2))

**ADHESIVE FASTENED SIGNS:**

- THE LABEL SHALL BE SUITABLE FOR THE ENVIRONMENT WHERE IT IS INSTALLED
- WHERE REQUIRED ELSEWHERE IN THIS CODE, ALL FIELD APPLIED LABELS, WARNINGS, AND MARKINGS SHOULD COMPLY WITH ANSI Z535.4 [NEC 110.21(B) FIELD MARKING].
- ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT [IFC 605.11.1.3]

**5** **PHOTOVOLTAIC SYSTEM AC DISCONNECT**  
RATED AC OUTPUT CURRENT 14.52 AMPS  
NOMINAL OPERATING AC VOLTAGE 240 VOLTS

**LABEL LOCATION:**  
POINT OF INTERCONNECTION,  
(PER CODE: NEC 690.54)

**6** **WARNING**  
INVERTER OUTPUT CONNECTION DO NOT  
RELOCATE THIS OVERCURRENT DEVICE

**LABEL LOCATION:**  
POINT OF INTERCONNECTION,  
(PER CODE: NEC 705.12(B)(3)(2))  
[Not required if panelboard is rated not less than sum of ampere ratings of all overcurrent devices supplying it]

**7** **CAUTION: SOLAR ELECTRIC  
SYSTEM CONNECTED**

**LABEL LOCATION:**  
POINT OF INTERCONNECTION,  
(PER CODE: NEC 690.15, 690.13(B))  
INVERTER

**8** **SOLAR PV SYSTEM EQUIPED  
WITH RAPID SHUTDOWN**

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

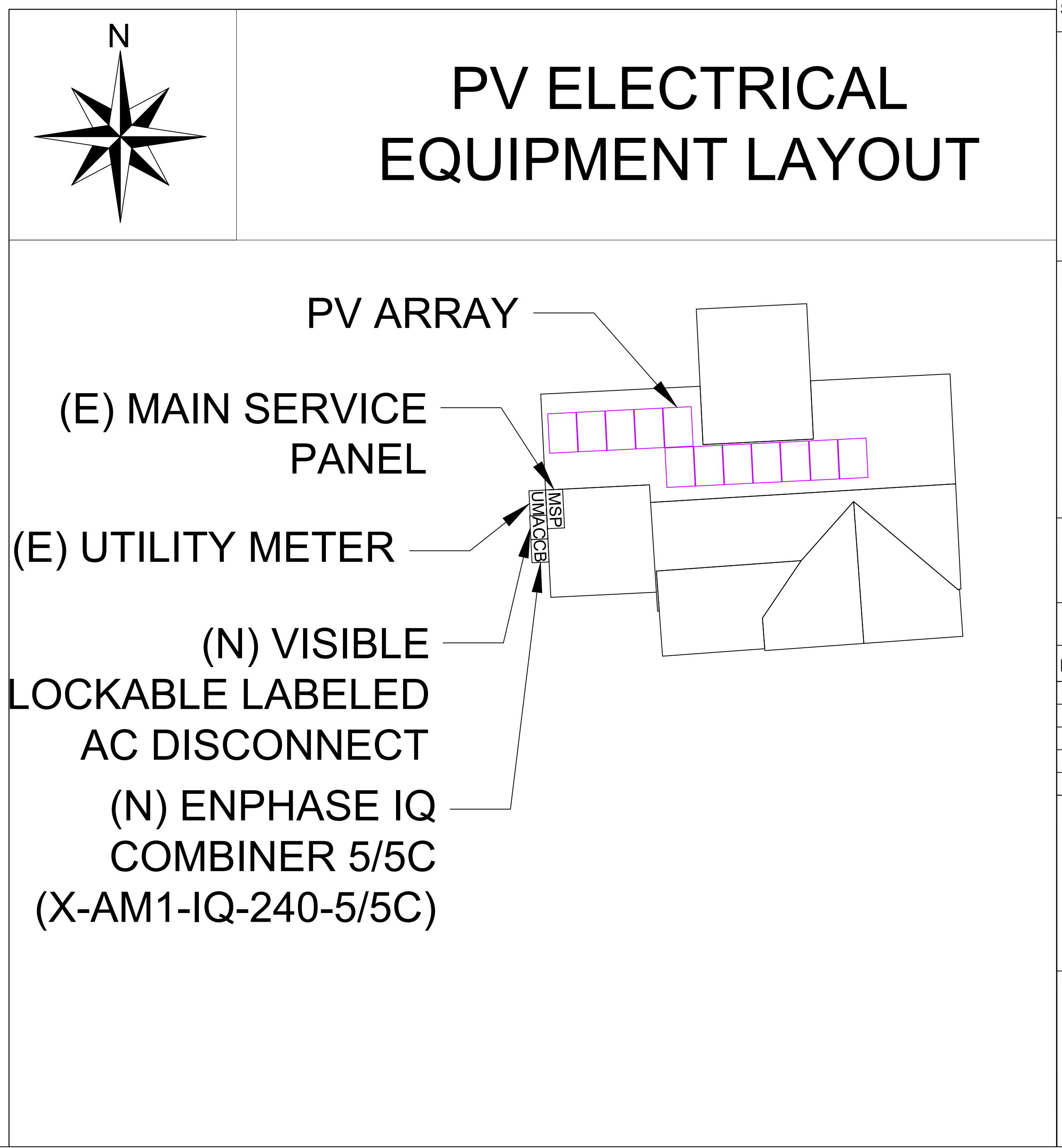
**LABEL LOCATION:**  
LABEL PER NEC 690.56(C)- PROVIDE  
AT AC DISCONNECT FOR RAPID  
SHUTDOWN COMPLIANT SYSTEM

**9** **CAUTION: SOLAR CIRCUIT**

**LABEL LOCATION:**  
MARKINGS PLACED ON ALL INTERIOR AND EXTERIOR DC  
CONDUIT, RACEWAYS, ENCLOSURES, AND CABLE ASSEMBLIES AT  
LEAST EVERY 10 FT, AT TURNS AND ABOVE/BELOW  
PENETRATIONS AND ALL COMBINER/JUNCTION BOXES. (PER CODE:  
IFC 605.11.1.4)

**10** **CAUTION**  
POWER TO THIS SERVICE IS  
ALSO SUPPLIED FROM  
ON-SITE SOLAR/ WIND  
GENERATION  
  
AC SYSTEM DISCONNECT

**11** **CAUTION**  
ALTERNATE POWER SUPPLY  
AC SYSTEM DISCONNECT



BEAM SOLAR CO.  
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SCOPE OF WORK:  
  
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RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

DRAWN BY: CHARLENE A  
DATE: 2024-11-25

REVISION:

NO.	DESCRIPTION	DATE

**WARNING LABELS**

PV-800.00

# Q.TRON BLK M-G2+ SERIES



415-440 Wp | 108 Cells  
22.5% Maximum Module Efficiency

MODEL Q.TRON BLK M-G2+



## High performance Qcells N-type solar cells

Q.ANTUM NEO Technology with optimized module layout boosts module efficiency up to 22.5%.



## A reliable investment

Inclusive 25-year product warranty and 25-year linear performance warranty<sup>1</sup>.



## Enduring high performance

Long-term yield security with Anti LeTID Technology, Anti PID Technology<sup>2</sup>, Hot-Spot Protect.



## Extreme weather rating

High-tech aluminium alloy frame, certified for high snow (8100 Pa) and wind loads (3600 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.

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

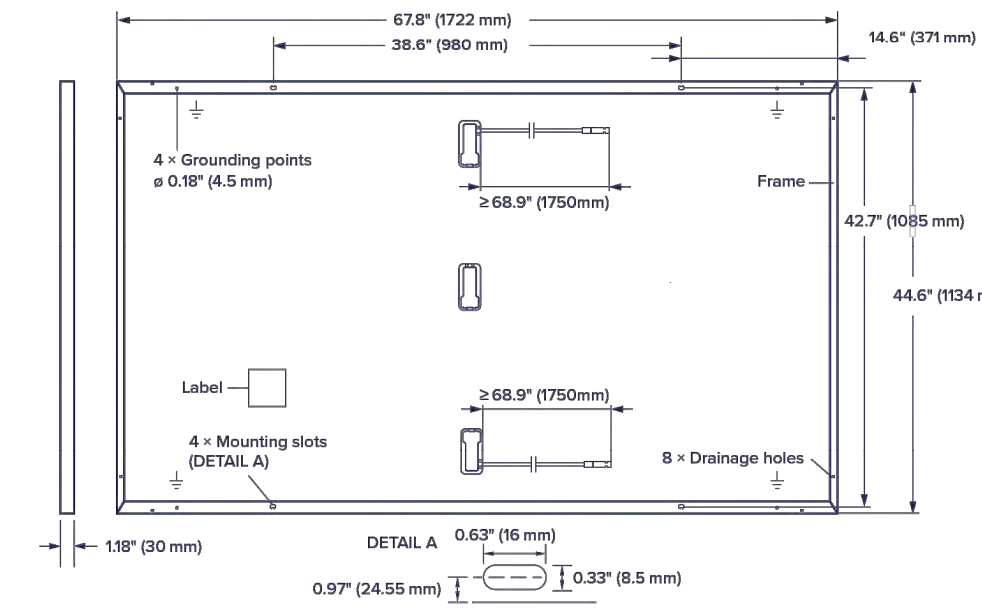
The ideal solution for:  
Rooftop arrays on residential buildings



## Q.TRON BLK M-G2+ SERIES

### Mechanical Specification

Format	67.8 in × 44.6 in × 1.18 in (including frame) (1722 mm × 1134 mm × 30 mm)
Weight	46.7 lbs (21.2 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 × 18 monocrystalline Q.ANTUM NEO 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), Protection class IP67, with bypass diodes
Cable	4 mm <sup>2</sup> Solar cable; (+) ≥ 68.9 in (1750 mm), (-) ≥ 68.9 in (1750 mm)
Connector	Stäubli MC4; IP68



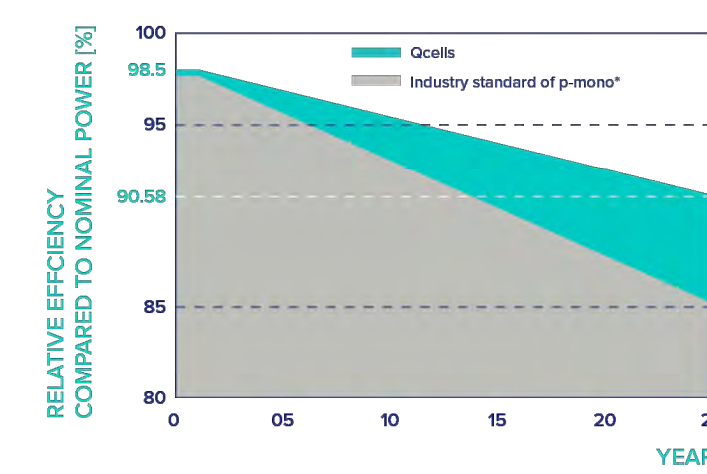
### Electrical Characteristics

POWER CLASS	415	420	425	430	435	440	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5W/-0W)							
Power at MPP <sup>1</sup>	P <sub>MPP</sub> [W]	415	420	425	430	435	440
Short Circuit Current <sup>1</sup>	I <sub>SC</sub> [A]	13.49	13.58	13.66	13.74	13.82	13.90
Open Circuit Voltage <sup>1</sup>	V <sub>OC</sub> [V]	38.47	38.75	39.03	39.32	39.60	39.88
Current at MPP	I <sub>MPP</sub> [A]	12.83	12.91	12.98	13.05	13.13	13.20
Voltage at MPP	V <sub>MPP</sub> [V]	32.34	32.54	32.74	32.94	33.14	33.33
Efficiency <sup>1</sup>	η [%]	≥21.3	≥21.5	≥21.8	≥22.0	≥22.3	≥22.5

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>2</sup>							
Power at MPP	P <sub>MPP</sub> [W]	313.7	317.5	321.2	325.0	328.8	332.6
Short Circuit Current	I <sub>SC</sub> [A]	10.87	10.94	11.00	11.07	11.14	11.20
Open Circuit Voltage	V <sub>OC</sub> [V]	36.50	36.77	37.04	37.31	37.58	37.84
Current at MPP	I <sub>MPP</sub> [A]	10.10	10.15	10.21	10.27	10.33	10.38
Voltage at MPP	V <sub>MPP</sub> [V]	31.07	31.26	31.46	31.65	31.84	32.03

<sup>1</sup>Measurement tolerances P<sub>MPP</sub> ±3%; I<sub>SC</sub> V<sub>OC</sub> ±5% at STC; 1000 W/m<sup>2</sup>, 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • <sup>2</sup>800 W/m<sup>2</sup>, NMOT, spectrum AM 1.5

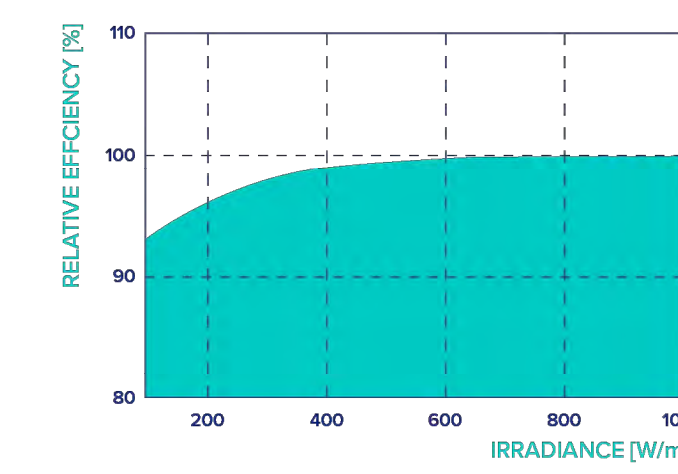
### Qcells PERFORMANCE WARRANTY



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

<sup>\*</sup>Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

### PERFORMANCE AT LOW IRRADIANCE



TEMPERATURE COEFFICIENTS		TEMPERATURE COEFFICIENTS			
Temperature Coefficient of I <sub>SC</sub>	α [%/K]	+0.04	Temperature Coefficient of V <sub>OC</sub>	β [%/K]	-0.24
Temperature Coefficient of P <sub>MPP</sub>	γ [%/K]	-0.30	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3 °C)

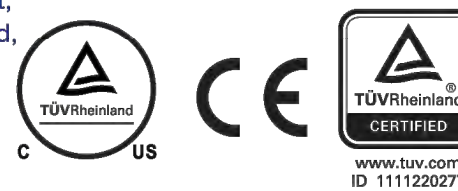
### Properties for System Design

Maximum System Voltage	V <sub>sys</sub> [V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	25	Fire Rating based on ANSI/UL 61730	C / TYPE 2
Max. Design Load, Push/Pull <sup>3</sup>	[lbs / ft <sup>2</sup> ]	113 (5400 Pa)/50 (2400 Pa)	Permitted Module Temperature on Continuous Duty	-40 °F up to +185 °F (-40 °C up to +85 °C)
Max. Test Load, Push/Pull <sup>3</sup>	[lbs / ft <sup>2</sup> ]	169 (8100 Pa)/75 (3600 Pa)		

<sup>3</sup> See Installation Manual

### Qualifications and Certificates

UL61730-1 & UL61730-2, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells).



<sup>\*</sup>Contact your Qcells Sales Representative for details regarding the module's eligibility to be Buy American Act (BAA) compliant.

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. 300 Spectrum Center Drive, Suite 500, Irvine, CA 92618, USA | TEL: +1 949 748 59 96 | EMAIL: na.support@qcells.com | WEB: www.qcells.com/us



Find product meeting needs at QR code above

Specifications subject to technical changes © Qcells Q.TRON BLK M-G2+ Series\_415-440\_2024-08\_Rev 04\_NA



BEAM SOLAR CO.  
1231 SHIELDS ROAD  
STE. 5  
KERNERSVILLE, NC 27284

### SCOPE OF WORK:

TO INSTALL OF A 12 MODULE ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 16 RAILWOOD CT THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

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TMK: ----

DRAWN BY: CHARLENE A

DATE: 2024-11-25

### REVISION:

NO.	DESCRIPTION	DATE

DATA SHEETS

MSD



## IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has superfast 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 IQ Battery, 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 Shutdown Equipment and conform with various regulations, when installed according to manufacturer's instructions.

\*Only when installed with IQ System Controller 2, meets UL 1741.  
\*\*IQ8 and IQ8Plus support split-phase, 240V installations only.

### 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) and IEEE 1547:2018 (UL 1741-SB)

### Note:

IQ8 Microinverters cannot be mixed together with previous generations of Enphase microinverters (IQ7 Series, IQ6 Series, etc) in the same system.

## IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		108-60-2-US	108PLUS-72-2-US
Commonly used module pairings <sup>1</sup>	W	235 – 350	235 – 440
Module compatibility		60-cell / 120 half-cell	54-cell / 108 half-cell, 60-cell / 120 half-cell, 66-cell / 132 half-cell and 72-cell / 144 half-cell
MPPT voltage range	V	27 – 37	27 – 45
Operating range	V	16 – 48	16 – 58
Min. / Max. start voltage	V	22 / 48	22 / 58
Max. input DC voltage	V	50	60
Max. continuous input DC current	A	10	12
Max. input DC short-circuit current	A		25
Max. module I <sub>sc</sub>	A		20
Overvoltage class DC port			II
DC port backfeed current	mA		0
PV array configuration		1 x 1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)		108-60-2-US	108PLUS-72-2-US
Peak output power	VA	245	300
Max. continuous output power	VA	240	290
Nominal (L-L) voltage / range <sup>2</sup>	V	240 / 211 – 264	
Max. continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	47 – 68	
AC short circuit fault current over 3 cycles	Arms	2	
Max. units per 20 A (L-L) branch circuit <sup>3</sup>		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.7	
CEC weighted efficiency	%	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 (H x W x D)		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, IEEE 1547:2018 (UL 1741-SB), FCC Part 15 Class B, ICES-0003 Class B, CAN / CSA-C22.2 NO.1071-01 This product is UL Listed as PV Rapid Shutdown 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) Pairing PV modules with wattage above the limit may result in additional clipping losses. See the compatibility calculator at <https://link.enphase.com/module-compatibility>. (2) Nominal voltage range can be extended beyond nominal if required by the utility. (3) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.



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STE. 5  
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### SCOPE OF WORK:

TO INSTALL OF A 12 MODULE ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 16 RAILWOOD CT THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

EUELL COE  
RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

DRAWN BY: CHARLENE A

DATE: 2024-11-25

### REVISION:

NO.	DESCRIPTION	DATE

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X-IQ-AMI-240-5  
X-IQ-AMI-240-5C

### IQ Combiner 5/5C

The IQ Combiner 5/5C consolidates interconnection equipment into a single enclosure and streamlines IQ Series Microinverters and IQ Gateway installation by providing a consistent, pre-wired solution for residential applications. IQ Combiner 5/5C uses wired control communication and is compatible with IQ System Controller 3/3G and IQ Battery 5P.

The IQ Combiner 5/5C, along with IQ Series Microinverters, IQ System Controller 3/3G, and IQ Battery 5P provides you with a complete grid-agnostic Enphase Energy System.



**IQ Series Microinverters**  
The high-powered smart grid-ready IQ Series Microinverters (IQ6, IQ7, and IQ8 Series) dramatically simplify the installation process.



**IQ System Controller 3/3G**  
Provides microgrid interconnection device (MID) functionality by automatically detecting grid failures and seamlessly transitioning the home energy system from grid power to backup power.



**IQ Battery 5P**  
Fully integrated AC battery system. Includes six field-replaceable IQBD-BAT Microinverters.



**IQ Load Controller**  
Helps prioritize essential appliances during a grid outage to optimize energy consumption and prolong battery life.



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MECHANICAL DATA	
Dimensions (WxHxD)	37.2 cm x 49.5 cm x 19.8 cm (14.7" x 19.5" x 6.6") Height is 21.0" (53.3 cm) with mounting brackets
Weight	7.5 kg (16.5 lb)
Ambient temperature range	-40°C to 40°C (-40°F to 105°F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	<ul style="list-style-type: none"> <li>20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors</li> <li>60 A breaker branch input: 4 to 1/2 AWG copper conductors</li> <li>Main lug combined output: 10 to 2 1/2 AWG copper conductors</li> <li>Neutral and ground: 14 to 1/2 copper conductors</li> <li>Always follow local code requirements for conductor sizing</li> </ul>
Communication (in-premise connectivity)	Built-in CTRL board for wired communication with IQ Battery 5P and IQ System Controller 3/3G. Integrated Power Line Communication for IQ Series Microinverters
Altitude	Up to 2,600 meters (8,530 feet)
COMMUNICATION INTERFACES	
Integrated Wi-Fi	802.11b/g/n (dual band 2.4 GHz/5 GHz), for connecting the Enphase cloud via the internet
Wi-Fi range (recommended)	10 m
Bluetooth	BLE4.2, 10 m range to configure Wi-Fi SSID
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included), for connecting to the Enphase Cloud via the internet
Mobile Connect	CELLMODEM-MI-06-SP-05 or CELLMODEM-MI-06-AT-05 (included with IQ Combiner 5C)
Digital I/O	Digital input/output for grid operator control
USB 2.0	For Mobile Connect
Access point (API) mode	For connection between the IQ Gateway and a mobile device running the Enphase Installer App
Metering ports	Up to two Consumption CTs, one IQ Battery CT, and one Production CT
Power line communication	90-100 kHz
Web API	Refer to <a href="https://developer.v4.enphase.com">https://developer.v4.enphase.com</a>
Local API	Refer to <a href="#">guide for local API</a>
COMPLIANCE	
IQ Combiner	UL 1741, CAN/CSA C22.2 No. 1071, Title 47 CFR, Part 15, Class B, ICES 003
IQ Gateway	UL 60961-1/CAN/CSA 22.2 No. 61010-1, IEEE 1547, 2018 (UL 1741-58, 3 <sup>rd</sup> Ed.) IEEE 2030.5/CSIP Compliant Production metering: ANSI C12.20 accuracy class 0.5 (PV production)
COMPATIBILITY	
IQ System Controller 3/3G	SC2000RMC240V30L, SC2000RMC240V30R
IQ Battery 5P	IQBATTERY-5P-IP-NA
Microinverter	IQ6, IQ7, and IQ8 Series Microinverters

IQC-5-5C-DSH-00007-2.0-EN-US-2023-09-27

### IQ Combiner 5/5C

MODEL NUMBER	
IQ Combiner 5 (X-IQ-AMI-240-5)	IQ Combiner 5 with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 accuracy class 0.5), consumption monitoring (± 2.5%) and IQ Battery monitoring (± 2.5%). Includes a silver solar shield to deflect heat.
IQ Combiner 5C (X-IQ-AMI-240-5C)	IQ Combiner 5C with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 accuracy class 0.5), consumption monitoring (± 2.5%) and IQ Battery monitoring (± 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-MI-06-SP-05). Includes a silver solar shield to deflect heat.
WHAT'S IN THE BOX	
IQ Gateway printed circuit board	IQ Gateway is the platform for total energy management for comprehensive, remote maintenance and management of the Enphase IQ System
Busbar	120A busbar with support for 1x IQ Gateway breaker and 4x 20A breaker for installing IQ Series Microinverters and IQ Battery 5P
IQ Gateway breaker	Circuit breaker, 2-pole, 10 A/15 A
Production CT	Pre-wired revenue-grade solid core CT, accurate up to 0.5%
Consumption CT	Two consumption metering clamp CTs, shipped with the box, accurate up to 2.5%
IQ Battery CT	One battery metering clamp CT, shipped with the box, accurate up to 2.5%
CTRL board	Control board for wired communication with IQ System Controller 3/3G and the IQ Battery 5P
Enphase Mobile Connect (only with IQ Combiner 5C)	4G-based LTE-M cellular modem (CELLMODEM-MI-06-SP-05) with a 5-year T-Mobile data plan
Accessories kit	Spare control headers for CTRL board
ACCESSORIES AND REPLACEMENT PARTS (NOT INCLUDED, ORDER SEPARATELY)	
CELLMODEM-MI-06-SP-05	4G-based LTE-M cellular modem with a 5-year T-Mobile data plan
CELLMODEM-MI-06-AT-05	4G-based LTE-M cellular modem with a 5-year AT&T data plan
Circuit breakers (off-the-shelf)	Supports Eaton BR230, BR235, BR230, BR230, BR240, BR250, and BR260 circuit breakers. Supports Eaton BR2206, BR2306, and BR240B circuit breakers compatible with hold-down kit
Circuit breakers (provided by Enphase)	BRK-10A-2-240V, BRK-15A-2-240V, BRK-20A-2P-240V, BRK-15A-2P-240V-S, and BRK-20A-2P-240V-S (More details in "Accessories" section)
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 5/5C
XA-ENV2-PCBA-5	IQ Gateway replacement printed circuit board (PCB) for Combiner 5/5C
X-IQ-NA-HD-125A	Hold-down kit compatible with Eaton BR-B series circuit breakers (with screws)
ELECTRICAL SPECIFICATIONS	
Rating	80 A
System voltage	120/240 VAC, 60 Hz
Busbar rating	125 A
Fault current rating	10 kAIC
Maximum continuous current rating (input from PV/storage)	64 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series distributed generation (DG) breakers only (not included)
Maximum total branch circuit breaker rating (input)	80 A of distributed generation/95 A with IQ Gateway breaker included
IQ Gateway breaker	10 A or 15 A rating GE/Siemens/Eaton included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption metering CT (CT-200-CLAMP)	A pair of 200 A clamp-style current transformers is included with the box
IQ Battery metering CT	200 A clamp-style current transformer for IQ Battery metering, included with the box

\* 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.)

IQC-5-5C-DSH-00007-2.0-EN-US-2023-09-27

### Revision history

REVISION	DATE	DESCRIPTION
DSH-00007-2.0	September 2023	Included Bluetooth specifications
DSH-00007-1.0	May 2023	Initial release



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EUELLE COE  
RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

DRAWN BY: CHARLENE A

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### REVISION:

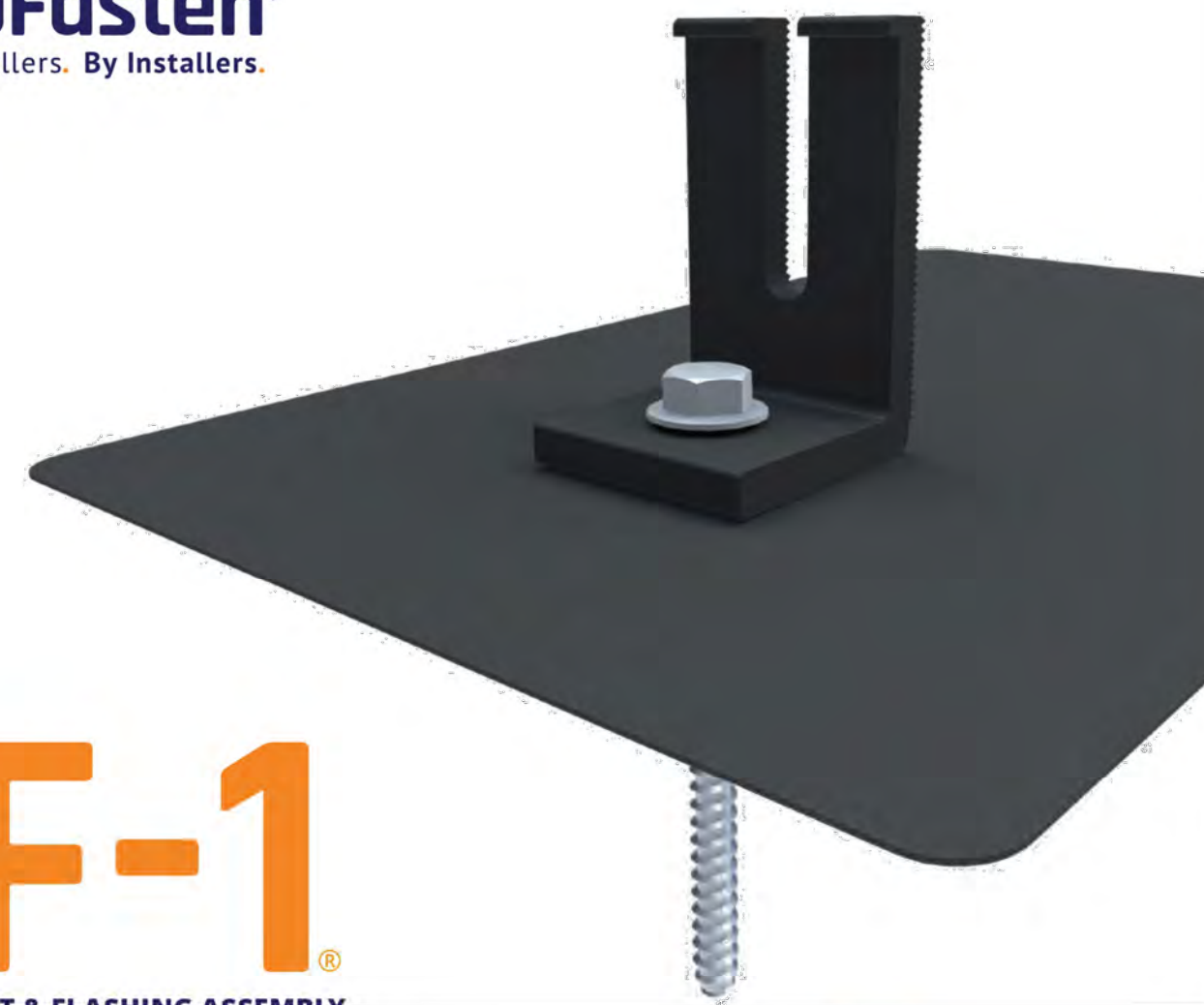
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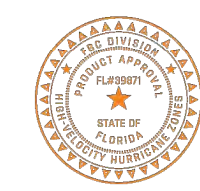
# GF-1

## COMPLETE MOUNT & FLASHING ASSEMBLY

GF-1 is our most versatile solution for composition shingle roofs. The flashing installs with a single fastener for a quick and easy installation. When the GF-1 Flashing with Grommet is paired with EcoFasten compression bracket, a watertight seal is created, maintaining the integrity of the roof.

### FEATURES & BENEFITS

- Patented watertight technology
- Installs without removing shingles
- One lag bolt for a single-penetration attachment point
- Compatible with a variety of EcoFasten compression brackets
- Florida Product Approved for any combination of 8"x12" GF-1 flashing with the ClickFit L-foot & Lag Screw



**VERSATILE WATERTIGHT MOUNT THAT INSTALLS IN SECONDS**

ECOFASTENSOLAR.COM

## PRODUCT CUT SHEET



### CF UNIV L-FOOT MLL 3"

PART NUMBER	DESCRIPTION
2012022	CF UNIV L-FOOT MLL 3"

ITEM NO.	DESCRIPTION
1	CLICKFIT L FOOT ASSEMBLY

1) CLICKFIT L FOOT ASSEMBLY

Material	Aluminum/Stainless Steel
Finish	Mill

REV.- CS1



## GF-1

COMPLETE MOUNT & FLASHING ASSEMBLY

## CONFIGURATION OPTIONS

### 1. CHOOSE YOUR FLASHING:



GF-1 Flashing, 8"x10", 8"x12", Black Finish

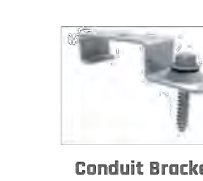
### 2. CHOOSE YOUR BRACKET:



ClickFit Universal L-Foot 3", Mill Finish



Open Slot L-Foot 3", Black Anodized



Conduit Bracket Comp



RockIt Smart Slide 4", Anodized Block

VIEW THE COMPLETE PARTS LIST

LEARN HOW TO USE OUR PRODUCTS  
CLICK HERE: [ELEVATELEARNING.COM](https://www.elevatelearning.com)

4141 W. VAN BUREN ST, SUITE 2, PHOENIX AZ 85009  
1-877-859-3947 | [INFO@ECOFASTENSOLAR.COM](mailto:INFO@ECOFASTENSOLAR.COM)

VERSION 2.1

## PRODUCT CUT SHEET



### LAG SCREW SS .313X4" W/BW (50)

PART NUMBER	DESCRIPTION
3016017	LAG SCREW SS .313X4" W/BW (50)

ITEM NO.	DESCRIPTION
1	LAG SCREW, 5/16-4", THREAD 3", EPDM BACKED WASHER

1) LAG SCREW, 5/16-4", THREAD 3", EPDM BACKED WASHER

Material	Stainless Steel/EPDM
Finish	Mill

REV.- CS1



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EUELLE COE  
RESIDENCE  
16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
[MCCORMICKTLG@OUTLOOK.COM](mailto:MCCORMICKTLG@OUTLOOK.COM)  
TMK: ----

DRAWN BY: CHARLENE A

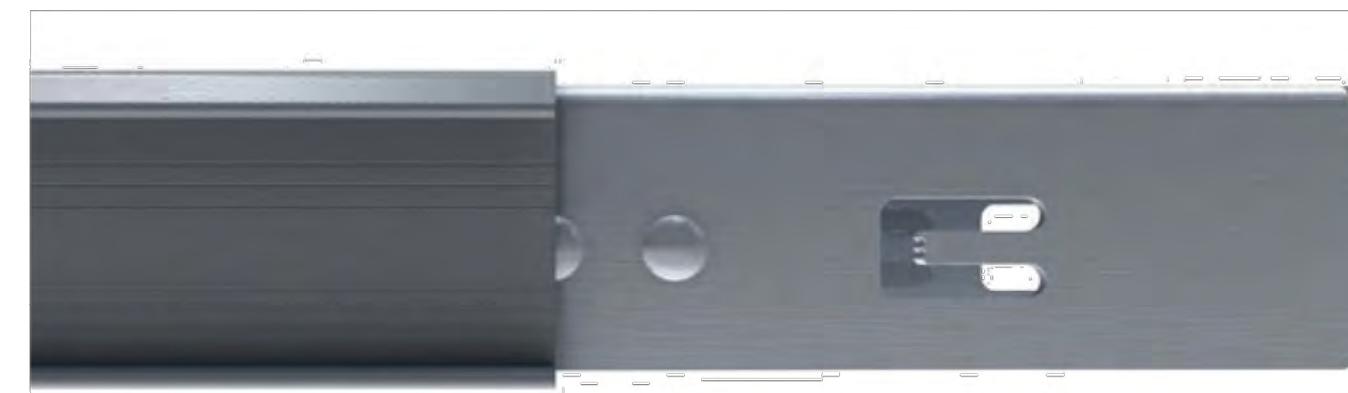
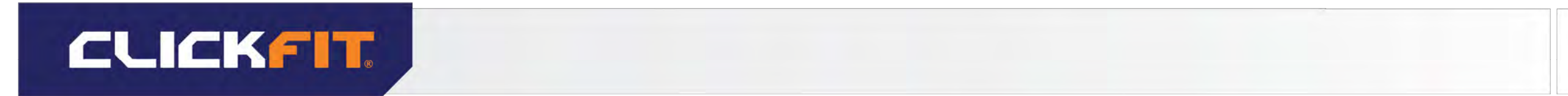
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### REVISION:

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**INTERNAL SPLICE**

Tool-free bonded Internal Splice installs in seconds.

**EBOS ACCESSORIES**

Secure Module Level Power Electronics to the top of the rail using the ClickFit MLPE Mount. PV wires can be managed using the ClickFit Wire Clip and the ClickFit Wire Management Clamp.

*Additional eBoS accessories are available.*



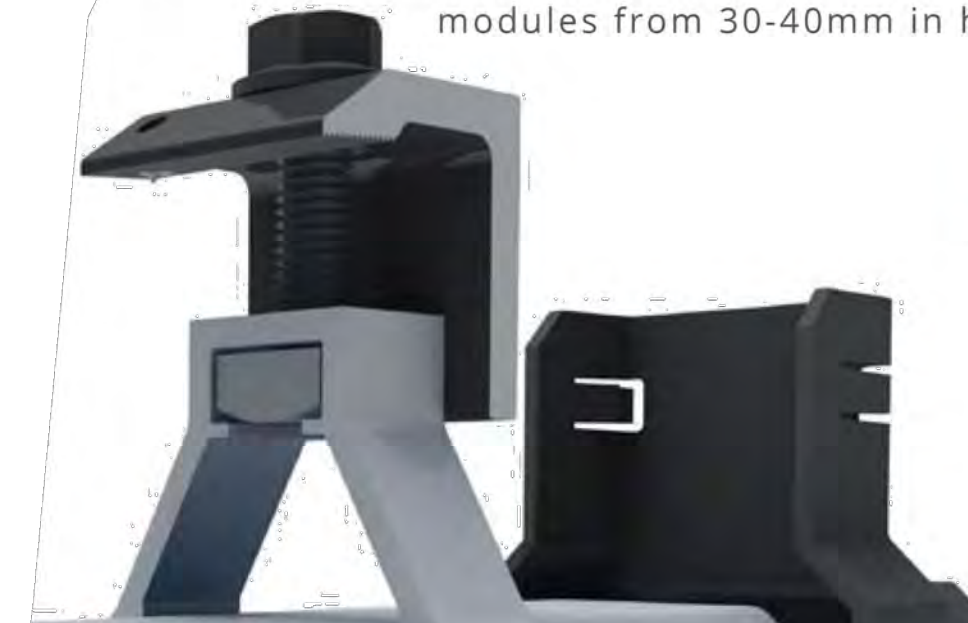
**MID CLAMP**

Click-on Mid Clamp features integrated bonding pins and fits module frames from 30-50 mm-in-height.



**END CLAMP**

One Click-on End Clamp fits modules from 30-40mm in height.



**END CAP**

Slide-on End Cap provide an aesthetic finish and allow for End Clamps to be accurately positioned on the rail in seconds.



**RAIL**

The ClickFit rail clicks into our proprietary composition shingle & tile L-foot and is tightened in place with a pre-installed bolt.



**CLICKFIT**

**COMPLETE RAIL-BASED RACKING SYSTEM**

ClickFit is one of the fastest installing rail-based systems in the industry. Thanks to its Click-In rail assembly, the rails can be connected to any of EcoFasten's composition shingle, tile, and standing seam metal roof mounts in seconds without the need for fasteners or tools. The ClickFit system is made of robust materials and coated steel, to ensure corrosion-resistance and longevity. ClickFit conforms to UL 2703 and has been tested in extreme weather conditions including wind, fire, and snow.

**FEATURES & BENEFITS**

- Pre-installed rail fastening bolt
- Fully integrated bonding
- Click-On Mid & End Clamps
- Compatible with a variety of EcoFasten roof attachments
- Florida Product Approved for composition shingle roofs



**FAST INSTALLING SYSTEM FEATURING CLICK-IN RAIL ASSEMBLY**

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16 RAILWOOD CT  
FUQUAY-VARINA, NC 27526  
(1252)722-2550  
MCCORMICKTLG@OUTLOOK.COM  
TMK: ----

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**EUDELL COE'S SUNCO BILL OF MATERIALS**

**ELECTRICAL**

ITEM	MANUFACTURER MODEL NO.	QTY
MODULE	Q.TRON BLK M-G2+ 420W MODULES	12
INVERTER	ENPHASE IQ8PLUS-72-2-US (240V) MICROINVERTER	12
JUNCTION BOX	600VDC NEMA 3R UL LISTED JUNCTION BOX	1
COMBINER	ENPHASE COMBINER X-IQ-AM1-240-5C	1
COMBINER BREAKER	20A	1
BATTERY	N/A	N/A
CONTROLLER	N/A	N/A
SMART SWITCH	N/A	N/A
AC DISCONNECT	EATON DG221URB (30A) NON-FUSED DISCONNECT	1
AC DISCONNECT FUSES	N/A	N/A
PV BREAKER	20A BREAKER	1
Q-CABLE	ENPHASE CABLE Q-12-20-200	16
SEALING CAP	ENPHASE Q-SEAL-10	3
TERM CAPS	ENPHASE Q-TERM-10	1



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**RACKING**

ITEM	MANUFACTURER MODEL NO.	QTY
FLASHING / DOCK	ECOFASTEN CF GF-1 GLV FLASHING 8" x 10" / CF UNIV L-FOOT MLL 3" 3012020 / 2012022	0 / 0
RAILING	ECOFASTEN CLICKFIT STD RAIL 2012025	2
RAIL SPLICE	ECOFASTEN CF RAIL SPLICE 2012013	0
T BOLT	N/A	N/A
ENDS	ECOFASTEN CF END CLAMP 30-40MM BLK 2099022	0
MIDS	ECOFASTEN CF MID CLAMP SHORT BLK 2099039	0
MICROINVERTER BOLT	ECOFASTEN CF MLPE MOUNT 2012019	12
LAG SCREWS	ECOFASTEN LAG SCREW SS .313X4" W/BW 3016017	0
GROUND LUGS/ MODULE JUMPER	ECOFASTEN MODULE JUMPER 4011011 / GROUND LUG (NON ECOFASTEN)	1 / 1

EUDELL COE  
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**BILL OF MATERIALS**

**MISC**

ITEM	MANUFACTURER MODEL NO.	QTY
LABELS	TITAN PV LABELS PCKT	1
MISC	N/A	N/A

**BOM**