

**GENERAL NOTES**

1. ALL ELECTRICAL MATERIALS SHALL BE NEW AND LISTED BY RECOGNIZED ELECTRICAL TESTING LABORATORY

CUSTOM MADE EQUIPMENT SHALL HAVE COMPLETE TEST DATA SUBMITTED BY THE MANUFACTURER ATTESTING TO ITS SAFETY

2. OUTDOOR EQUIPMENT SHALL BE NEMA 3R RATED OR BETTER

3. ALL METALLIC EQUIPMENT SHALL BE GROUNDED

4. CONTRACTOR SHALL OBTAIN ELECTRICAL PERMITS PRIOR TO INSTALLATION AND SHALL COORDINATE ALL INSPECTIONS, TESTING COMMISSIONING AND ACCEPTANCE WITH THE CLIENT, UTILITY CO. AND CITY INSPECTORS AS NEEDED.

5. THE ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS OF SERVICE POINTS AND SERVICE SIZES WITH THE SERVING UTILITY COMPANY AND COMPLY WITH ALL UTILITY COMPANIES REQUIREMENTS.

6. DRAWINGS ARE DIAGRAMMATIC ONLY, ROUTING OF RACEWAYS SHALL BE OPTION OF THE CONTRACTOR UNLESS OTHERWISE NOTED AND SHALL BE COORDINATED WITH OTHER TRADES.

7. IF THE ROOF MATERIAL OR ROOF STRUCTURE NOT ADEQUATE FOR PV INSTALLATION, CALL ENGINEER PRIOR TO INSTALL. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THAT THE ROOF IS CAPABLE OF WITHSTANDING THE EXTRA WEIGHT.

8. IF THE DISTANCES FOR CABLE RUNS ARE DIFFERENT THAN SHOWN, THE CONTRACTOR SHALL NOTIFY THE ELECTRICAL ENGINEER TO VALIDATE THE WIRE SIZE. FINAL DRAWINGS WILL BE RED-LINED AND UPDATED AS APPROPRIATE.

9. WHENEVER A DISCREPANCY IN QUALITY OF EQUIPMENT ARISES ON THE DRAWING OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL MATERIAL AND SERVICES REQUIRED BY THE STRICTEST CONDITIONS NOTED ON THE DRAWINGS OR IN THE SPECIFICATIONS TO ENSURE COMPLETE COMPLIANCE AND LONGEVITY OF THE OPERABLE SYSTEM REQUIRED BY THE ARCHITECT/ENGINEERS.

10. ALL BROCHURES, OPERATION MANUALS, CATALOGS, SHOP DRAWINGS, ETC. SHALL BE HANDED OVER TO OWNER'S REPRESENTATIVE AT THE COMPLETION OF WORK

**PHOTOVOLTAIC NOTES:**

1. ROOFTOP MOUNTED PHOTOVOLTAIC PANELS AND MODULES SHALL BE TESTED, LISTED AND IDENTIFIED BY RECOGNIZED ELECTRICAL TESTING LABORATORY

2. SOLAR SYSTEM SHALL NOT COVER ANY PLUMBING OR MECHANICAL VENTS

3. MODULES AND SUPPORT STRUCTURES SHALL BE GROUNDED.

4. SOLAR INVERTER SHALL BE LISTED TO UL1741.

5. REMOVAL OF AN INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR AND THE PHOTOVOLTAIC SOURCE AND/OR OUTPUT CIRCUIT GROUNDED CONDUCTORS.

6. ALL PV MODULES AND ASSOCIATED EQUIPMENT AND WIRING SHALL BE PROTECTED FROM PHYSICAL DAMAGE

7. LIVE PARTS OF PV SOURCE CIRCUITS AND PV OUTPUT CIRCUITS OVER 150V TO GROUND SHALL NOT BE ACCESSIBLE TO OTHER THAN QUALIFIED PERSONS WHILE ENERGIZED.

8. INVERTER IS EQUIPED WITH INTEGRATED GFDI, THUS PROVIDING GROUND FAULT PROTECTION

9. ALL CONDUCTORS SHALL BE COPPER AND 90 DEG RATED

10. ALL ELECTRICAL EQUIPMENT SHALL BE LISTED BY A RECOGNIZED ELECTRICAL TESTING LABORATORY.

11. A SINGLE CONDUCTOR SHALL BE PERMITTED TO BE USED TO PERFORM THE MULTIPLE FUNCTIONS OF DC GROUNDING, AC GROUNDING AND BONDING BETWEEN AC AND DC SYSTEMS.

12. NON-CURRENT CARRYING METAL PARTS OF EQUIPMENT SHALL BE EFFECTIVELY BONDED TOGETHER. BOND BOTH ENDS OF RACEWAYS.



VICINITY MAP  
SCALE: NTS



SATELLITE MAP  
SCALE: NTS

**INDEX**

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**MAIN**

THE INSTALLATION OF SOLAR ARRAYS AND PHOTOVOLTAIC POWER SYSTEMS SHALL COMPLY WITH THE FOLLOWING CODES:

NATIONAL ELECTRICAL CODE 2017  
INTERNATIONAL RESIDENTIAL CODE 2018  
INTERNATIONAL BUILDING CODE 2018  
INTERNATIONAL ENERGY CONSERVATION CODE 2018

AS ADOPTED BY THE STATE OF NORTH CAROLINA

ALL OTHER ORDINANCE ADOPTED BY THE LOCAL GOVERNING AGENCIES

**PV SOLAR SYSTEM DETAILS**

SYSTEM SIZE: DC STC: 8.960KW  
SYSTEM SIZE: AC CEC: 8.066KW  
SOLAR MODULES: (28) Hanwha 320 watt  
INVERTERS: (28) Enphase IQ7 Microinverters

ELECTRICAL INFORMATION:  
EXISTING  
MAIN SERVICE PANEL BUS SIZE: 225A  
MAIN SERVICE BREAKER SIZE: 200A  
MOUNTING SYSTEM: IRONRIDGE

**BUILDING INFORMATION:**  
CONSTRUCTION TYPE: V-B  
OCCUPANCY: R3  
ROOF: Asphalt Shingle  
TRUSS : 2 X 4 @ 24" O.C.

Project Name:  
**Robert Grant**  
Property address:  
46 Silk Oak DR,  
Bunnlevel, NC 28323

**CONTRACTOR**





**Lighting Electric**

Address: 230 Blacksnake Rd  
Stanley, NC 28164

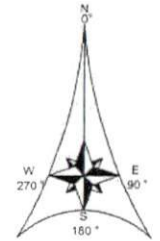
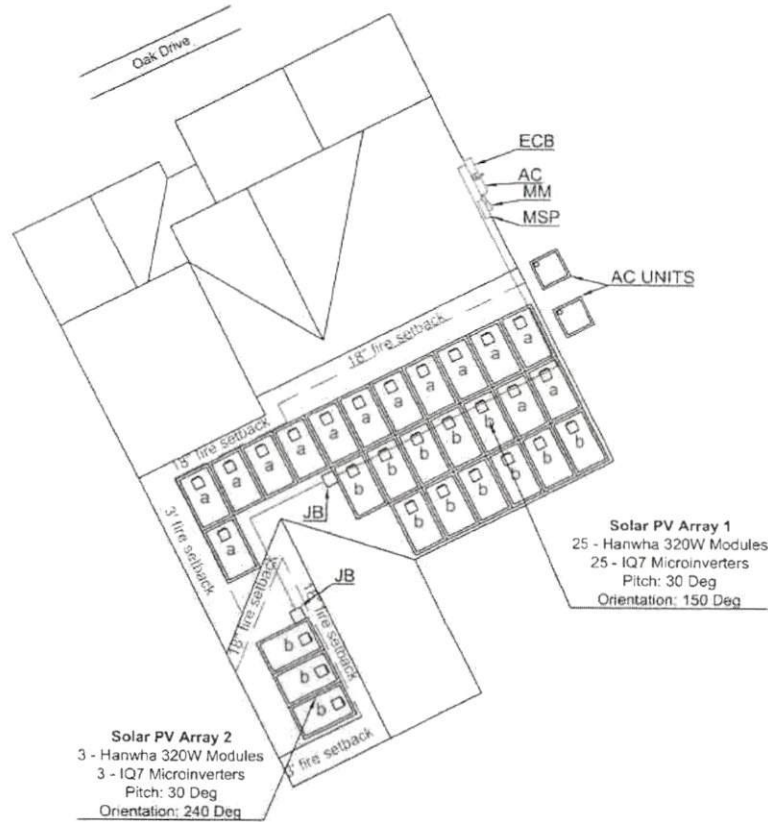
Phone: (704) 361-8011

**LIGHTING ELECTRIC**

DATE: 06/27/2022

INDEX	
MSP	(E) Main Service Panel
MM	(E) Main Meter
ECB	(N) Enphase Combiner Box
AC	(N) AC Disconnect
JB	(N) Junction Box
	MicroInverter
	Solar Module
	Conduit
	Setback

Total Roof Area: 2029  
 Total Module Area: 504  
 24.83% of Coverage



SCALE: 3/32" = 1'-0"

# 1 ROOF PLAN

Project Name:  
**Robert Grant**  
 Property address:  
 46 Silk Oak DR,  
 Bunnlevel, NC 28323

## CONTRACTOR

**Lighting Electric**  
 Address: 230 Blacksnake Rd  
 Starley, NC 28164  
 Phone: (704) 361-8011

## LIGHTING ELECTRIC

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ITEM	DESCRIPTION	QTY
1	PV MODULE Hanwha 320 Watt Q.PEAK DUO BLK-G5 Voc = 40.56V, Vmp = 33.80V Isc = 9.94A, Imp = 9.47A	28
2	INVERTERS ENPHASE IQ7 MICROINVERTERS IQ7-60-2-US (240V) PEAK PWR TRACKING VOLTAGE: = 27-37 V CEC EFFICIENCY: = 97.0 % ENCLOSURE: NEMA 6 MAXIMUM INPUT CURRENT: = 15 A MAXIMUM OUTPUT CURRENT: = 1 A MAXIMUM INPUT POWER: = 235 - 350W+ MAXIMUM OUTPUT POWER: = 240 VA	28
3	JUNCTION BOX 4"x4"x2" UL LISTED WATER TIGHT NEMA TYPE 3	2
4	AC DISCONNECT 60A 240V NON - FUSIBLE AC DISCONNECT	1
5	MAIN SERVICE PANEL (E) MAIN SERVICE PANEL 225A BUSBAR & 200A MAIN BREAKER	1
6	ENPHASE MONITORING (N)ENVOY 3G PV MONITORING SYSTEM	1
7	ENPHASE COMBINER BOX (N)ENPHASE IQ COMBINER 3 120/240V, NEMRA 3R	1
8	MAIN METER UTILITY METER	1

WIRE CHART						
#	MAX AMPS X NEC MULT = DESIGN AMPS	BREAKER SIZE (A)	WIRE TYPE	EGC	WIRE RATING X TEMP DERATE X CONDUCTOR DERATE = DERATED WIRE	CONDUIT SIZE
1	14 X 1.25 X 1 = 17.5A	20	(2) #12 AWG. ENPHASE Q CABLE	(1) #6 BARE SOLID COPPER GEC	30 X .71 X 1 = 21.3 >= 17.5	IN FREE AIR
2	14 X 1.25 X 1 = 17.5A	20	(4) #10 AWG. CU-THWN-2	(1) #8 AWG. CU-THWN-2 EGC	40 X .71 X .8 = 22.72 >= 17.5	3/4" EMT
3	28 X 1.25 X 1 = 35 A	40	(3) #8 AWG. CU-THWN-2	(1) #8 AWG. CU-THWN-2 EGC	55 X .91 X 1 = 50.05 >= 35	3/4" EMT

**KEY NOTES:**

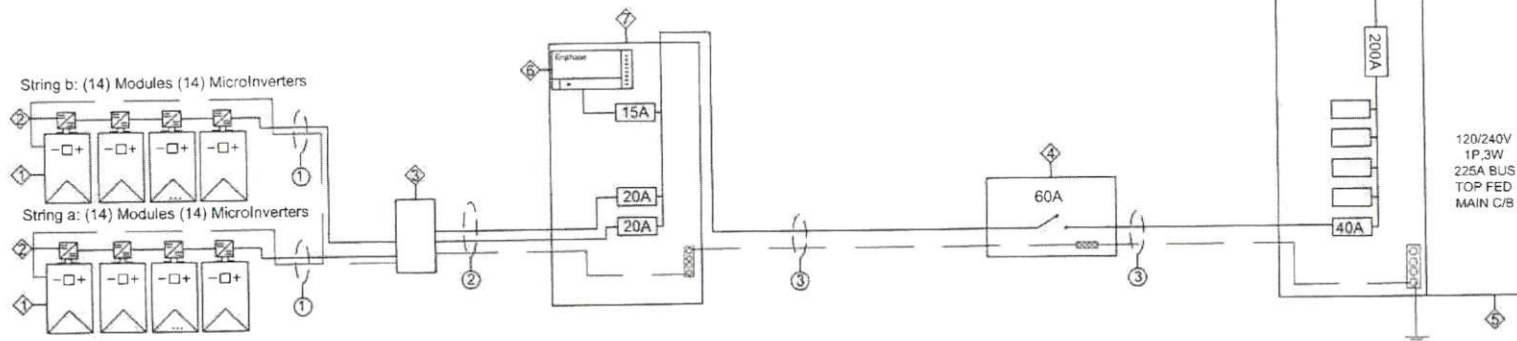
- SOLID BARE G.E.C (FREE-AIR) MOUNTED UNDER ARRAY
- PER NEC ARTICLE 690.35 INVERTER GROUND FAULT PROTECTION PROVIDED
- ALL GROUNDS AND NEUTRALS BONDED TO EXISTING GROUNDING CONDUCTOR W/IRREVERSIBLE CRIMP CONNECTOR.
- BACKFED BREAKERS MUST BE LOCATED @ OPPOSITE END OF BUS BAR FROM MAIN BREAKER OR MAIN LUG ON GRID SIDE. WHEN A BACKFED BREAKER IS THE METHOD OF UTILITY INTERCONNECTION, BREAKER SHALL NOT READ LINE.
- PER CEC 250.65(C); CONDUCTOR SPLICES ONLY ALLOWED WITH COMPRESSION CONNECTORS OR EXOTHERMIC WELDING
- ALL GROUNDS AND NEUTRALS BONDED TO EXISTING GROUNDING CONDUCTOR W/IRREVERSIBLE CRIMP CONNECTOR.
- VERIFY (E) UFER GROUND NEAR MSP. IF (E) UFER IS NOT ACCESSIBLE OR VERIFIABLE, INSTALL A NEW 5/8" Ø X 8' LONG GROUNDING ROD AND BOND SOLAR SYSTEM EQUIPMENT GROUNDING ACCORDINGLY.

ALL DC CONNECTORS TO MODULES OR INVERTERS MUST BE OF MATCHING MANUFACTURE BRAND AND STYLE. DO NOT USE 'COMPATIBLE' CONNECTORS WHICH HAVE NOT BEEN UL TESTED FOR COMPATIBILITY, PERFORMANCE AND FIRE DAMAGE MAY RESULT FROM MIS-MATCHED CONNECTOR USAGE  
NOTE: AC DISCONNECT VISIBLE AND LOCKABLE

AC SYSTEM SIZE CALCULATION						
Module PTC Rating (W)	x	NO. of Modules	x	Average Inverter CEC Efficiency	=	AC System Size
297	x	28	x	97%	=	8.066 kW AC

PERCENT OF VALUES	NUMBER OF CURRENT CARRYING CONDUCTORS IN EMT
.80	4-6
.70	7-9
.50	10-20

120% RULE CALCULATION PER NEC 705.12(D)(2)(3)		
MAIN BUSBAR RATING:	225	AMPS
MAIN SERVICE BREAKER RATING:	200	AMPS
PV BACKFEDDING CURRENT:	40	AMPS
BUSBAR X 120% - MAIN BREAKER	=	MAX PV BREAKER
270 - 200	=	70



## 2 SINGLE LINE DIAGRAM

Project Name:  
**Robert Grant**  
Property address:  
46 Silk Oak DR,  
Bunnlevel, NC 28323

### CONTRACTOR

#### Lighting Electric

Address: 230 Blacksnake Rd  
Stanley, NC 28154

Phone: (704) 361-8011

#### LIGHTING ELECTRIC

DATE: 06/27/2022

1

**CAUTION  
AUTHORIZED SOLAR  
PERSONNEL ONLY!**

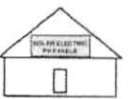
2

**PV LOAD CENTER SIZED FOR PV  
BREAKERS ONLY OR RENDERED UNABLE  
TO ACCEPT ANY ADDITIONAL LOADS.**

**(STICKER LOCATED  
ON THE PV SUB PANEL)**

**SOLAR PV SYSTEM EQUIPPED  
WITH RAPID SHUTDOWN**

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



Stickers will have red background & white lettering

3

**PV SUB-PANEL ONLY**

**(TO BE LOCATED ON  
SUB-PANEL ONLY  
WHEN SUB-PANEL IS  
DEDICATED FOR PV ONLY)**

4

**AC DISCONNECT  
AC PHOTOVOLTAIC POWER SOURCE  
RATED AC OUTPUT CURRENT: 35 A MAX  
NOMINAL AC OPERATING VOLTAGE: 240 Vac**

5

**THIS PANEL FED BY  
MULTIPLE SOURCES  
(UTILITY & SOLAR)**

6

**SOLAR**

**(STICKER LOCATED  
INSIDE PANEL  
NEXT TO SOLAR BREAKER)**

7

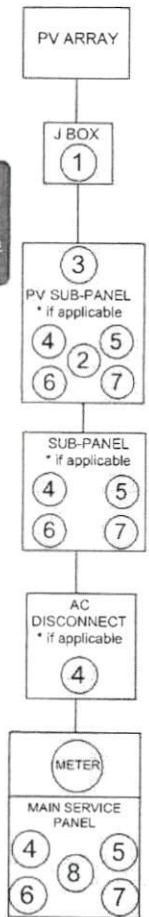
**WARNING!  
INVERTER OUTPUT CONNECTION. DO NOT  
RELOCATE THIS OVERCURRENT DEVICE**

**(STICKER LOCATED  
INSIDE PANEL  
BELOW PV BREAKER)**

8

**PHOTOVOLTAIC SYSTEM  
EQUIPPED WITH  
RAPID SHUT DOWN**

**(STICKER LOCATED  
ON THE MAIN SERVICE PANEL)**




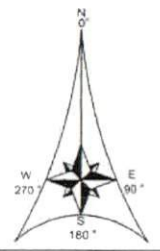
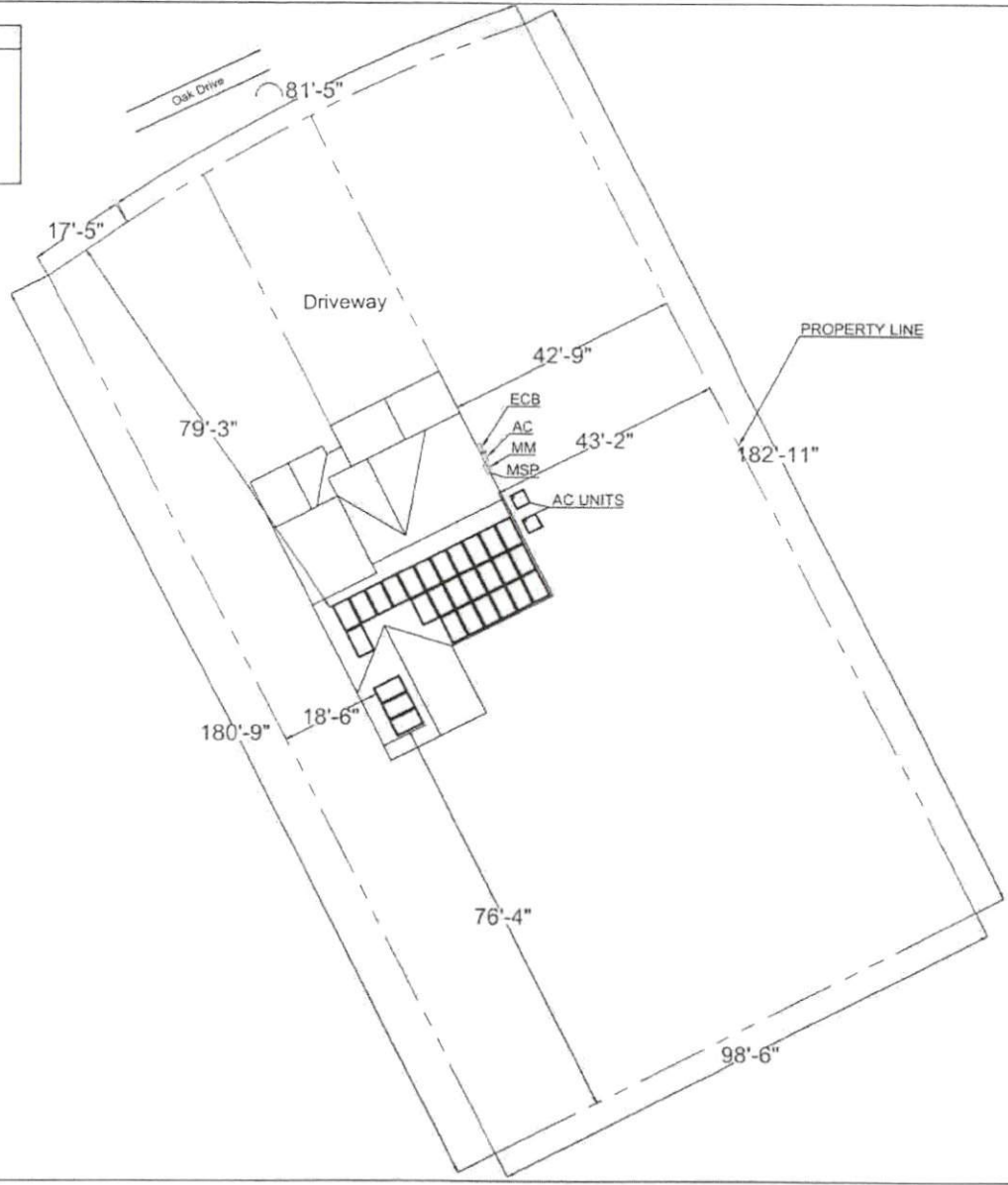
**MARKINGS, LABELS AND WIRING SIGNS**

- A. Purpose:** Provide emergency responders with appropriate warning and guidance with respect to isolating solar electric system.  
This can facilitate identifying energized electrical lines that connect solar panels to the inverter, as these should not be cut when venting for smoke removal
- B. Main Service Disconnect**
- Residential buildings - The marking main be placed within the main service disconnect. The marking shall be placed outside cover if the main service disconnect is operable with the service panel closed.
  - Commercial buildings - The marking shall be placed adjacent to the main service disconnect clearly visible from the location where the level is operated
- 3. Markings: Verbiage, Format and Type of Material**
- Verbiage: **CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED**
  - Format: White lettering on a red background. Minimum 3/8 inches letter height. All letters shall be capitalized. Arial or similar font, non bold.
  - Material: Reflective, weather resistant material suitable for the environment (use UL-969 as standard for weather rating). Durable adhesive materials meet this requirement.
- C. Marking Requirements on DC conduit, raceways, enclosures, cable assemblies, DC combiners and junction boxes:**
- Markings: Verbiage, Format and Type of Material
  - Placement: Markings shall be placed every 10 feet on all interior and exterior DC conduits, raceways, enclosures, and cable assemblies, at turns, above and for below penetrations, all DC combiners and junction boxes
  - Verbiage: **CAUTION: SOLAR CIRCUIT** Note: The format and type of material shall adhere to "V-3b, c" of this requirement.
- c. Inverters are not required to have caution markings**
- Marking is required on all interior and exterior DC conduit, raceways, enclosures, cable assemblies and junction boxes, combiner boxes and disconnects.
  - The materials used for marking shall be reflective, weather resistant material suitable for the environment.
- Minimum 3/8 "letter height; all upper case letters Arial or similar font; Red background with white lettering.
- Marking shall contain the words: **WARNING : PHOTOVOLTAIC POWER SOURCE**
  - Marking shall be placed adjacent to the main service disconnect in a location clearly visible from the location where the disconnect is operated.

**Permanent directory or plaque providing location of service disconnecting means and photovoltaic system disconnecting means, if not located at the same location.** (Plaques shall be metal or plastic, with engraved or machine printed letters, or electro-photo plating, in a contrasting color to the plaque. Plaques shall be permanently attached to the equipment or in the required location using an approved method that is suitable to withstand the environment to which it is exposed. Plaques and signage shall meet legibility, defacement, exposure and adhesion requirements of Underwriters Laboratories marking and labeling system 969(UL969).

<b>3</b>	<b>SIGNAGE</b>
<p><i>Project Name:</i> <b>Robert Grant</b></p> <p><i>Property address:</i> <b>46 Silk Oak DR, Bunnlevel, NC 28323</b></p>	
<p><b>CONTRACTOR</b></p> <p><b>Lighting Electric</b></p> <p><i>Address:</i> 230 Blacksnake Rd Stanley, NC 28164</p> <p><i>Phone:</i> (704) 361-8011</p>	
<p><b>LIGHTING ELECTRIC</b></p>	
<p>DATE: 06/27/2022</p>	

INDEX	
MSP	(E) Main Service Panel
MM	(E) Main Meter
ECB	(N) Enphase Combiner Box
AC	(N) AC Disconnect
	Solar Module



SCALE: 1/32" = 1'-0"

**4 SITE PLAN**

Project Name:  
**Robert Grant**  
 Property address:  
 46 Silk Oak DR,  
 Bunnlevel, NC 28323

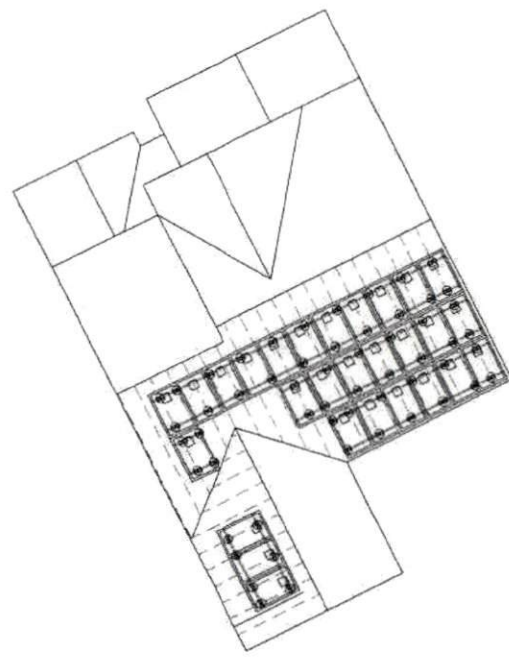
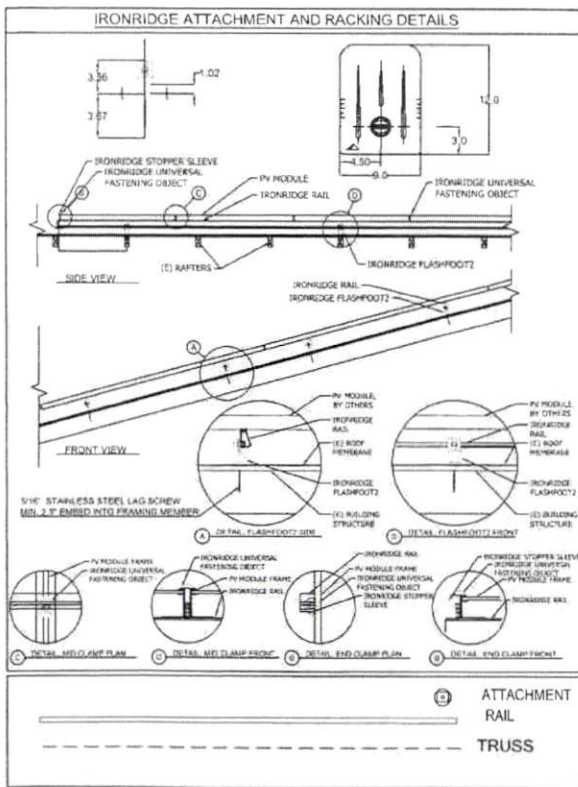
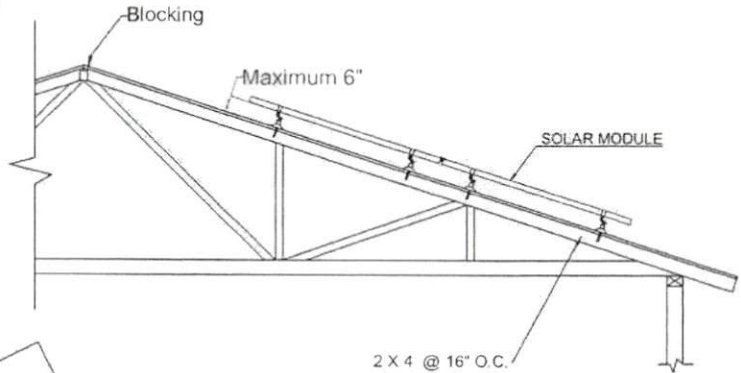
**CONTRACTOR**  
Lighting Electric  
 Address: 230 Blacksake Rd  
 Stanley, NC 28164  
 Phone: (704) 361-8011

**LIGHTING ELECTRIC**

DATE: 06/27/2022

MODULE WEIGHT (lbs)	41.2
# OF MODULES	28
TOTAL MODULE WEIGHT (lbs)	1153.6
RACK WEIGHT (lbs)	230.72
MICROINVERTERS WEIGHT (lbs)	66.64
TOTAL SYSTEM WEIGHT (lbs)	1450.96
# OF STANDOFFS	56
MAX SPAN BETWEEN STANDOFFS (in)	48
LOADING PER STANDOFF (lbs)	25.91
TOTAL AREA (sq. ft.)	504
LOADING (PSF)	2.87

1. IronRidge Racking System
  2. IronRidge FlashFoot 2 Attachment
  3. Roof attachment hardware to be mounted to existing structure (2 X 4 @ 24" O.C. TRUSS ) with 48" O.C. rail spans or less.
  4. Lag bolts are 5/16" X 3.5" stainless steel with 2.5" minimum embedment into the center of the roof
  5. Roof sheathed with 1/2" plywood and upper surface is faced with felt paper.
- Finished roof surface is One layer of Asphalt Shingle.



**5 ATTACHMENT LAYOUT**

Project Name:  
**Robert Grant**  
Property address:  
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Bunnlevel, NC 28323

**CONTRACTOR**

**Lighting Electric**  
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Stanley, NC 28164  
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**LIGHTING ELECTRIC**

DATE: 06/27/2022

## Enphase IQ 7 and IQ 7+ Microinverters

The high-powered smart grid-ready Enphase IQ 7 Micro™ and Enphase IQ 7+ Micro™ dramatically simplify the installation process while achieving the highest system efficiency.

Part of the Enphase IQ System, the IQ 7 and IQ 7+ Microinverters integrate with the Enphase IQ Envoy™, Enphase IQ Battery™, and the Enphase Enlighten™ monitoring and analysis software.

IQ Series Microinverters extend the reliability standards set forth by previous generations and undergo over a million hours of power-on testing, enabling Enphase to provide an industry-leading warranty of up to 25 years.

### Easy to Install

- Lightest and smallest
- Faster installation with improved, lighter hardware loading
- Built-in radio shutdown capability (NEC 2014 & 2017)

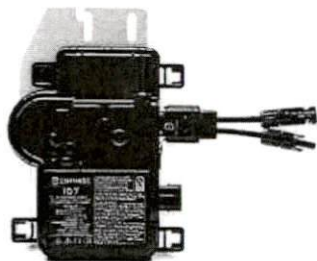
### Productive and Reliable

- Optimized for high-powered 50-cell and 72-cell modules
- More than a million hours of testing
- Class II double-insulated enclosure
- UL listed

### Smart Grid Ready

- Complies with advanced grid support voltage and frequency ride-through requirements
- Remotely updates to respond to changing grid requirements
- Configurable for varying grid profiles
- Meets CA Rule 21 (UL 1741-SA)

\* The IQ 7+ Micro inverter supports 72-cell modules.



To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)



## Enphase IQ 7 and IQ 7+ Microinverters

INPUT DATA (DC)	IQ7-60-2-US	IQ7PLUS-72-2-US
Commonly used module pairing <sup>1</sup>	225 W / 350 W*	235 W / 440 W*
Module compatibility	50-cell PV modules only	50-cell and 72-cell PV modules
Maximum input DC voltage	48 V	48 V
Peak power tracking voltage	27 V - 32 V	27 V - 45 V
Operating range	16 V - 48 V	16 V - 60 V
Min/Max start voltage	22 V - 48 V	22 V - 60 V
Max DC short circuit current (module I <sub>sc</sub> )	15 A	15 A
Overvoltage class DC port	0	0
DC port backfeed current	0 A	0 A
PV array configuration	1 x (string) 1 (string) No additional DC-side protection required	4C with protection requires max 20A per string input
OUTPUT DATA (AC)	IQ 7 Microinverters	IQ 7+ Microinverters
Peak output power	250 VA	295 VA
Maximum continuous output power	250 VA	295 VA
Nominal (L-L) voltage range <sup>2</sup>	240 V†	240 V†
	211.264 V	211.264 V
	180.229 V	180.229 V
Maximum continuous output current	1.0 A (240 V)†	1.25 A (240 V)†
	1.15 A (208 V)	1.1 A (240 V)†
	1.1 A (240 V)†	1.1 A (240 V)†
Nominal frequency	60 Hz	60 Hz
Calculated frequency range	47 - 63 Hz	47 - 63 Hz
AC short circuit fault current over 3 cycles	5.8 Arms	5.8 Arms
Maximum inrush per 20 A L-L (UL 1741-5A) <sup>3</sup>	15 (240 V)†	15 (240 V)†
Overvoltage class AC port	0	0
AC port backfeed current	0 A	0 A
Power factor setting	1.0	1.0
Power factor (adjustable)	0.85 leading - 0.95 lagging	0.85 leading - 0.95 lagging
EFFICIENCY	240 V	208 V
Peak efficiency	97.6 %	97.5 %
CCC weighted efficiency	97.0 %	97.0 %
MECHANICAL DATA		
Ambient temperature range	-40°C to +60°C	
Relative humidity range	5% to 100% (condensing)	
Connector type (IQ7-60-2-US & IQ7PLUS-72-2-US)	MCA (for Amphenol H4U TX with additional Q-DCC-5 adapter)	
Dimensions (W x H x D)	212 mm x 175 mm x 30.2 mm (terminal cover)	
Weight	1.08 kg (2.38 lbs)	
Coating	None (connector: No Fans)	
Approved for wet locations	Yes	
Inhalation degree	IP00	
Enclosure	Class II double-insulated, corrosion-resistant polymer enclosure	
Environmental category (UV exposure rating)	NEMA Type 5 enclosure	
FEATURES		
Communications	Power Line Communications (PLC)	
Monitoring	Enlighten Manager and MyEnlighten monitoring options. Both options require installation of an Enphase IQ Envoy.	
Disconnecting means	The AC and DC connectors have been evaluated and approved by UL for use as the load break disconnect required by NEC 590.	
Compliance	CA Rule 21 (UL 1741-SA) UL 5109†, UL 1741-ISEE (547 FOC Part 15 Class B - ICS-0995 Class B) CAN/CSA C22.2 NO. 107 (1-9) This product is UL listed as PV Rapid Shutdown Equipment and conforms with NEC 2014 and NEC 2017 section 690.12 and 2017 NEC 690.12 (5) Rule 64.218 Rapid Shutdown of PV Systems for AC and DC connections, when installed according to manufacturer's instructions.	

1. Not allowed by NEC code. See the compatibility calculator at [enphase.com/compatibility-calculator](http://enphase.com/compatibility-calculator)  
 2. Nominal voltage range may be exceeded beyond (without) required tolerance.  
 3. Complies with Rule 21 local requirements to define the use of disconnects as load break disconnects.

To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)

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## 6 INVERTER DATA SHEET

Project Name:  
**Robert Grant**  
Property address:  
**46 Silk Oak DR,  
Bunnlevel, NC 28323**

## CONTRACTOR

### Lighting Electric

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Phone: (704) 361-8011

## LIGHTING ELECTRIC

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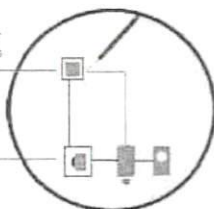
## Rapid shutdown is built-in

The 2014 edition of the National Electrical Code (NEC 2014) added new rapid shutdown requirements for PV systems installed on buildings. Enphase Microinverters fully meet rapid shutdown requirements in the new code without the need to install any additional electrical equipment.

**What's new in NEC 2014?**  
NEC 2014, Section 690.12 applies to PV conductors over 10 feet from the PV array and requires that the conductors be shut down to 30 volts and 240 mA or less within 10 seconds of rapid shutdown initiation.

### String inverters require work arounds for rapid shutdown

**Work around:**  
Specialized Rapid Shutdown electrical box installed on the roof within 10 feet of array.

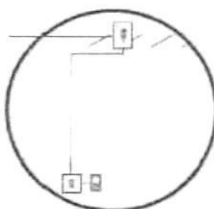


Residential String Inverter

**Work around:**  
Shutoff switch that is easily accessible to first responders on the ground.



**Work around:**  
String inverter installed on roof in hostile environment that string inverters are not built to survive in.

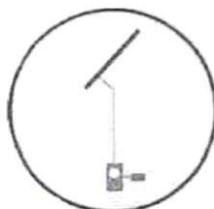


Commercial String Inverter

**Work around:**  
Extra conduct in inverter.

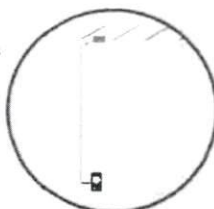
### Enphase comes standard with rapid shutdown capability

All Enphase microinverters, even those that were previously installed in series, meet rapid shutdown requirements, no additional equipment or work-around needed.



Residential Microinverter

Enphase microinverters can safely shut down automatically, leaving only low-voltage DC electricity isolated to the PV module.



Commercial Microinverter

To learn more, visit [enphase.com](http://enphase.com)



### Planning for Microinverter Installation

The Enphase IQ 7 Micro is compatible with 60-cell PV modules, and the IQ 7+ Micro and IQ 7A Micro support PV modules with 60 or 72 Cells. The IQ 7X requires a 96-cell PV module. All of them install quickly and easily. The microinverter housing is designed for outdoor installation and complies with the NEMA 250, type 6 environmental enclosure rating standard.



**NEMA 6 rating definition:** Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during occasional temporary submersion at a limited depth, and damage from external ice formation.

The Enphase Q Cable is available with connector spacing options to accommodate installation of PV modules in portrait or landscape orientation. For Enphase Q Cable ordering information, see "Enphase Q Cable Planning and Ordering" on page 27.

### Compatibility

The Enphase IQ Series Micros are electrically compatible with PV modules as listed in the following table. For specifications, see "Technical Data" on page 29 of this manual. You can refer to the Enphase Compatibility Calculator at: [enphase.com/en-us/support/module-compatibility](http://enphase.com/en-us/support/module-compatibility) to verify PV module electrical compatibility. To ensure mechanical compatibility, be sure to order the correct connector type for both microinverter and PV module from your distributor.



**WARNING:** Risk of fire. The PV module DC conductors must be labeled "PV Wire" or "PV Cable" to comply with NEC for Ungrounded PV Power Systems.

Microinverter model	Connector type	PV module cell count
IQ7-60-2-US	MC-4 locking type	Pair only with 60-cell modules
IQ7PLUS-72-2-US	MC-4 locking type	Pair with 60 or 72-cell modules
IQ7X-96-2-US	MC-4 locking type	Pair only with 96-cell modules
IQ7A-72-2-US	MC-4 locking type	Pair with 60 or 72-cell modules

### Grounding Considerations

The Enphase Microinverter models listed in this guide do not require grounding electrode conductors (GEC), equipment grounding conductors (EGC), or grounded conductor (neutral). Your Authority Having Jurisdiction (AHJ) may require you to bond the mounting bracket to the racking. If so, use UL2703 hardware or star washers. The microinverter itself has a Class II double-insulated rating, which includes ground fault protection (GFP). To support GFP, use only PV modules equipped with DC cables labeled PV Wire or PV Cable.

<b>7</b>	<b>RSD DATA SHEET</b>
<p>Project Name: <b>Robert Grant</b> Property address: 46 Silk Oak DR, Bunnlevel, NC 28323</p>	
<p><b>CONTRACTOR</b></p> <p><b>Lighting Electric</b> Address: 230 Blacksnake Rd Stanley, NC 28164 Phone: (704) 361-8011</p>	
<p><b>LIGHTING ELECTRIC</b></p>	
<p>DATE: 06/27/2022</p>	



powered by  
**Q.ANTUM DUO**

# Q.PEAK DUO BLK-G5 300-320

Q.ANTUM SOLAR MODULE

The new Q.PEAK DUO BLK-G5 solar module from Q CELLS impresses with its outstanding visual appearance and particularly high performance on a small surface thanks to the innovative Q.ANTUM DUO Technology. Q.ANTUM's world-record-holding cell concept has now been combined with state-of-the-art circuitry half cells and a six-busbar design, thus achieving outstanding performance under real conditions — both with low-intensity solar radiation as well as on hot, clear summer days.



**Q.ANTUM TECHNOLOGY. LOW LEVELIZED COST OF ELECTRICITY**  
Highly yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 19.3%.



**INNOVATIVE ALL-WEATHER TECHNOLOGY**  
Optimal yields, whatever the weather with excellent low-light and temperature behavior.



**ENDURING HIGH PERFORMANCE**  
Long-term yield security with Anti LID Technology, Anti-PID Technology<sup>1</sup>, Hot-Spot Protect and Traceable Quality Tru.Q™



**EXTREME WEATHER RATING**  
High-tech aluminum alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa) regarding IEC.



**A RELIABLE INVESTMENT**  
Inclusive 12-year product warranty and 25-year linear performance guarantee<sup>2</sup>.



**STATE OF THE ART MODULE TECHNOLOGY**  
Q.ANTUM DUO combines cutting edge cell separation and innovative wiring with Q.ANTUM Technology.

THE IDEAL SOLUTION FOR:



Engineered in Germany

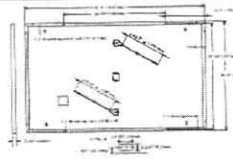


1 APT test conditions according to IEC TS 62884-1:2015, method B (-1500V, 168h)  
2 See data sheet on rear for further information

**Q CELLS**

## MECHANICAL SPECIFICATION

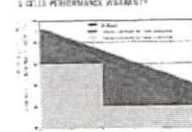
Format: 66.3 in x 39.4 in x 1.25 in (including frame)  
(1685 mm x 1000 mm x 32 mm)  
Weight: 41.2 lbs (18.7 kg)  
Front Cover: 0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology  
Back Cover: Composite film  
Frame: Black anodized aluminum  
Cell: 6 x 20 monocrystalline Q.ANTUM solar half cells  
Position box: 2.76-3.35 in x 1.97-2.76 in x 0.51-0.83 in  
(70.85 mm x 50.76 mm x 13.21 mm), Decentralized IP67  
Cable: Annular solar cable: (+) 2 x 4.3 in (1100 mm) (-) 2 x 4.3 in (1100 mm)  
Controller: Multi Contact MC4 (IP68)



## ELECTRICAL CHARACTERISTICS

POWER CLASS	300	305	310	315	320	
<b>MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC (POWER TOLERANCE +5 W / -0 W)</b>						
Power at MPP <sup>1</sup>	$P_{MPP}$ [W]	300	305	310	315	320
Short-Circuit Current <sup>1</sup>	$I_{sc}$ [A]	9.72	9.78	9.83	9.89	9.94
Open-Circuit Voltage <sup>1</sup>	$V_{oc}$ [V]	39.46	39.75	40.02	40.29	40.56
Current at MPP	$I_{MPP}$ [A]	9.25	9.31	9.36	9.41	9.47
Voltage at MPP	$V_{MPP}$ [V]	32.43	32.78	33.12	33.46	33.80
Efficiency <sup>1</sup>	$\eta$ [%]	>17.8	>18.1	>18.4	>18.7	>19.0
<b>MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT<sup>2</sup></b>						
Power at MPP	$P_{MPP}$ [W]	224.1	227.8	231.6	235.3	239.1
Short-Circuit Current	$I_{sc}$ [A]	7.83	7.88	7.92	7.97	8.01
Open-Circuit Voltage	$V_{oc}$ [V]	37.15	37.40	37.65	37.91	38.17
Current at MPP	$I_{MPP}$ [A]	7.28	7.37	7.37	7.41	7.45
Voltage at MPP	$V_{MPP}$ [V]	30.78	31.11	31.44	31.76	32.08

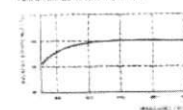
## Q CELLS PERFORMANCE ASSESSMENT<sup>3</sup>



At least 90% of nominal power during first year  
Thereafter max. 0.34% degradation per year  
At least 93.1% of nominal power up to 10 years  
At least 85% of nominal power up to 25 years.

All data within measurement tolerances  
Full warranty in accordance with the warranty terms of the Q CELLS solar organization of your respective country.

## 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 $I_{sc}$	$\alpha$ [%/K]	+0.04	Temperature Coefficient of $V_{oc}$	$\beta$ [%/K]	-0.28
Temperature Coefficient of $P_{MPP}$	$\gamma$ [%/K]	-0.37	Normal Operating Module Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3.0)

## PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage $V_{max}$	[V]	1000 (IEC) / 1000 (UL)	Safety Class	II
Maximum System Fuse Rating	[kA (AC)]	20	Fuse Rating	C (IEC) / TYPE 1 (UL)
Max. Design Load, Push / Pull (UL)	[lb/ft²]	75 (3500 Pa) / 55 (2640 Pa)	Permitted surface temperature on continuous duty	-40°F up to +185°F (-40°C up to +85°C)
Max. Test Load, Push / Pull (UL)	[lb/ft²]	313 (15400 Pa) / 84 (4000 Pa)	<sup>1</sup> See installation manual	

## QUALIFICATIONS AND CERTIFICATES

UL 1703, IEC 62108, IEC 61701, IEC 61702, IEC 61703, IEC 61704, IEC 61705, IEC 61706, IEC 61707, IEC 61708, IEC 61709, IEC 61710, IEC 61711, IEC 61712, IEC 61713, IEC 61714, IEC 61715, IEC 61716, IEC 61717, IEC 61718, IEC 61719, IEC 61720, IEC 61721, IEC 61722, IEC 61723, IEC 61724, IEC 61725, IEC 61726, IEC 61727, IEC 61728, IEC 61729, IEC 61730, IEC 61731, IEC 61732, IEC 61733, IEC 61734, IEC 61735, IEC 61736, IEC 61737, IEC 61738, IEC 61739, IEC 61740, IEC 61741, IEC 61742, IEC 61743, IEC 61744, IEC 61745, IEC 61746, IEC 61747, IEC 61748, IEC 61749, IEC 61750, IEC 61751, IEC 61752, IEC 61753, IEC 61754, IEC 61755, IEC 61756, IEC 61757, IEC 61758, IEC 61759, IEC 61760, IEC 61761, IEC 61762, IEC 61763, IEC 61764, IEC 61765, IEC 61766, IEC 61767, IEC 61768, IEC 61769, IEC 61770, IEC 61771, IEC 61772, IEC 61773, IEC 61774, IEC 61775, IEC 61776, IEC 61777, IEC 61778, IEC 61779, IEC 61780, IEC 61781, IEC 61782, IEC 61783, IEC 61784, IEC 61785, IEC 61786, IEC 61787, IEC 61788, IEC 61789, 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## FlashFoot2

### The Strongest Attachment in Solar

IronRidge FlashFoot2 raises the bar in solar roof protection. The unique water seal design is both elevated and encapsulated, delivering redundant layers of protection against water intrusion. In addition, the twist-on Cap perfectly aligns the rail attachment with the lag bolt to maximize mechanical strength.

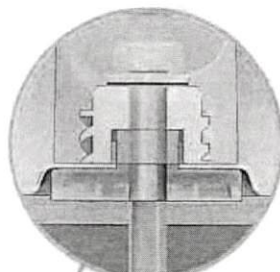
#### Twist-On Cap

FlashFoot2's unique Cap design encapsulates the lag bolt and locks into place with a simple twist. The Cap helps FlashFoot2 deliver superior structural strength, by aligning the rail and lag bolt in a concentric load path.



#### Single Socket Size

A custom-design lag bolt allows you to install FlashFoot2 with the same 7/16" socket size used on other Flush Mount System components.



#### Three-Tier Water Seal

FlashFoot2's seal architecture utilizes three layers of protection. An elevated platform diverts water away, while a stack of rugged components raises the seal an entire inch. The seal is then fully-encapsulated by the Cap. FlashFoot2 is the first solar attachment to pass the TAS-100 Wind-Driven Rain Test.

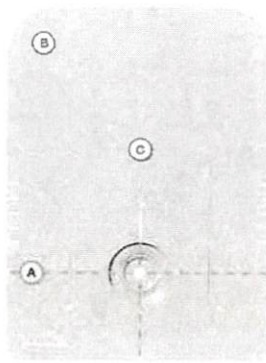


**Water-Shedding Design**  
An elevated platform diverts water away from the water seal.

Tech Brief

Tech Brief

### Installation Features



#### A Alignment Markers

Quickly align the flashing with chalk lines to find pilot holes.

#### B Rounded Corners

Makes it easier to handle and insert under the roof shingles.

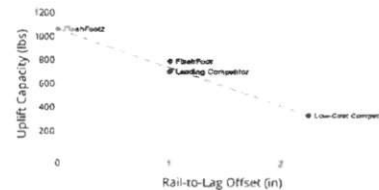
#### C Reinforcement Ribs

Help to stiffen the flashing and prevent any bending or crinkling during installation.

### Benefits of Concentric Loading

Traditional solar attachments have a horizontal offset between the rail and lag bolt, which introduces leverage on the lag bolt and decreases uplift capacity.

FlashFoot2 is the only product to align the rail and lag bolt. This concentric loading design results in a stronger attachment for the system.



### Testing & Certification

#### Structural Certification

Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7.

#### Water Seal Ratings

Water Sealing Tested to UL 441 Section 27 "Rain Test" and TAS 100-95 "Wind Driven Rain Test" by Intertek. Ratings applicable for composition shingle roofs having slopes between 2:12 and 12:12.

#### UL 2703

Conforms to UL 2703 Mechanical and Bonding Requirements. See Flush Mount Install Manual for full ratings.

## 9 ATTACHMENT DATA SHEET

Project Name:  
**Robert Grant**  
Property address:  
46 Silk Oak DR,  
Bunnlevel, NC 28323

### CONTRACTOR

#### Lighting Electric

Address: 230 Blacksnake Rd  
Stanley, NC 28164

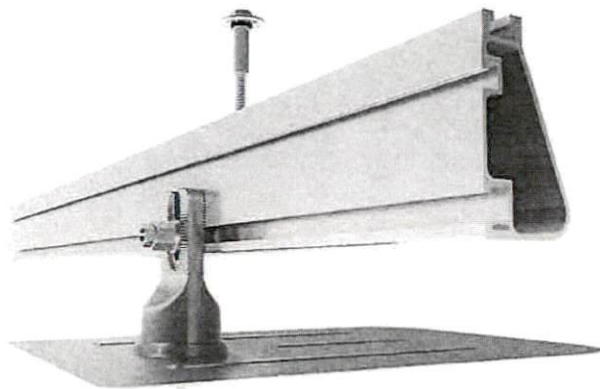
Phone: (704) 361-8011

### LIGHTING ELECTRIC

DATE: 06/27/2022



## Flush Mount System



### Built for solar's toughest roofs.

IronRidge builds the strongest mounting system for pitched roofs in solar. Every component has been tested to the limit and proven in extreme environments.

Our rigorous approach has led to unique structural features, such as curved rails and reinforced flashings, and is also why our products are fully certified, code compliant and backed by a 25-year warranty.



#### Strength Tested

All components evaluated for superior structural performance.



#### Class A Fire Rating

Certified to maintain the fire resistance rating of the existing roof.



#### UL 2703 Listed System

Entire system and components meet newest effective UL 2703 standard



#### PE Certified

Pre-stamped engineering letters available in most states.



#### Design Assistant

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



#### 25-Year Warranty

Products guaranteed to be free of impairing defects.

#### XR10 Rail



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

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

#### XR100 Rail



The ultimate residential solar mounting rail.

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

#### XR1000 Rail



A heavyweight mounting rail for commercial projects.

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

#### Bonded Splices



All rails use internal splices for seamless connections.

- Self-drilling screws
- Varying versions for rails
- Forms secure bonding

#### Clamps & Grounding

##### UFOs



Universal Fastening Objects bond modules to rails.

- Fully assembled & lubed
- Single, universal size
- Clear and black finish

##### Stopper Sleeves



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

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

##### CAMO



Bond modules to rails while staying completely hidden.

- Universal end-cam clamp
- Tool-less installation
- Fully assembled

##### Grounding Lugs



Connect arrays to equipment ground.

- Low profile
- Single tool installation
- Mounts in any direction

#### Attachments

##### FlashFoot2



Flash and mount XR Rails with superior waterproofing.

- Twist-on Cap eases install
- Wind-driven rain tested
- Mill and black finish

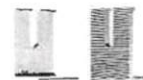
##### Conduit Mount



Flash and mount conduit, strut, or junction boxes.

- Twist-on Cap eases install
- Wind-driven rain tested
- Secures 3/4" or 1" conduit

##### Slotted L-Feet



Drop-in design for rapid rail attachment.

- Secure rail connections
- Slot for vertical adjusting
- Clear and black finish

##### Bonding Hardware



Bond and attach XR Rails to roof attachments.

- T & Square Bolt options
- Nut uses 7/16" socket
- Assembled and lubricated

#### Resources



##### Design Assistant

Go from rough layout to fully engineered system. For free. Go to [IronRidge.com/design](http://IronRidge.com/design)



##### NABCEP Certified Training

Earn free continuing education credits, while learning more about our systems. See [IronRidge.com/training](http://IronRidge.com/training)

# 10

## RACKING DATA SHEET

Project Name:  
**Robert Grant**  
Property address:  
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Bunnlevel, NC 28323

## CONTRACTOR

### Lighting Electric

Address: 230 Blacksnake Rd  
Stanley, NC 28164

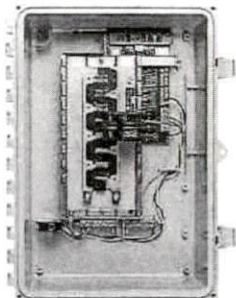
Phone: (704) 361-8011

## LIGHTING ELECTRIC

DATE: 06/27/2022

## Enphase IQ Combiner 3 (X-IQ-AM1-240-3)

The Enphase IQ Combiner 3™ with Enphase IQ Envoys™ consolidates interconnection equipment into a single enclosure and streamlines PV 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 Envoys for communication and control
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and optional consumption monitoring

### Simple

- Reduced size from three combiners
- Centered mounting brackets support simple slide mounting
- Supports back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 60 A total PV or storage branch circuits

### Reliable

- Durable NRTL certified NEMA type 3R enclosure
- Five-year limited warranty
- UL listed



To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)



## Enphase IQ Combiner 3

MODEL NUMBER	
IQ Combiner 3 X-IQ-AM1-240-3	IQ Combiner 3 with Enphase IQ Envoys™ printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional™ consumption metering (+/- 2.5%)
ACCESSORIES and REPLACEMENT PARTS (not included, order separately)	
Enphase Smart Switch™ CELLMODEM-03 (45/12-year data plan) CELLMODEM-01 (30/3-year data plan) CELLMODEM-M1 (4G based LTE-M/ NB-IoT data plan) Consumption Monitoring™ CT CT-200-3P(1)	Plug and play industrial grade cellular modem with data plan for systems up to 60 micro-inverters (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area) 50 A, 100 A, 200 A current transformers (not include, order name consumption metering +/- 2.5%)
Wireless USB adapter COMMS-KT-01	Installed at the IQ Envoys. For communications with Enphase Encharge™ storage and Enphase Enpower™ smart switch. Includes USB cable for connection to IQ Envoys or Enphase IQ Combiner™ and allows redundant wireless communications with Encharge and Enpower.
Circuit Breakers BRK 104-2-140 BRK 154-2-240 BRK 204-2P-240	Supports Eaton BR210, BR215, BR216, BR218, BR220, BR225, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breakers: 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220
EPIC 01	Power line carrier (communications bridge pair), quantity: one pair
XA-PI US-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 3 (required for EPIC 01)
XA-ENV PCB-A-3	Replacement IQ Envoys printed circuit board (PCB) for Combiner 3
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating (output to grid)	95 A
Max. fault current rating (output)	90 A
Branch circuits (plug and/or storage)	Up to four 2-pole Eaton BR series 3-structured Generation (DG) breakers (not included)
Max. continuous current rating (input from PV)	54 A
Max. total branch circuit breaker rating (output)	60 A (not distributed generation, 40 A with IQ Envoys breaker included)
Production Metering CT	200 A, solid core pre-installed and wired to IQ Envoys
MECHANICAL DATA	
Dimensions (WxHxD)	49.5 x 375 x 16.6 cm (19.5" x 14.75" x 6.6") Height is 21.05" (53.5 cm) with mounting brackets
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	40° C to +45° C   40° to 115° F
Cooling	Natural convection, passive heat sink
Enclosure environmental rating	Outdoor, NRTL certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 2/0 AL, 2/0 AL, 2/0 AWG copper conductors, 14 AWG, 18 AWG copper conductors • 60 A breaker branch circuit: 4/0, 1/0 AWG copper conductors • Main bus connected circuit: 1/0 AWG, 2/0 AWG copper conductors • Neutral and ground: 18 AWG, 18 AWG copper conductors Always follow local code requirements for conductor sizing Up to 2000 meters (6,560 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11a/g/n
Ethernet	Optional, 802.3, Cat5E (or Cat6) UTP Ethernet cable (not included)
Cellular	Optional, CELLMODEM-01 (3S) or CELLMODEM-03 (4G) or CELLMODEM-M1 (4G based LTE-M) (not included)
COMPLIANCE	
Compliance: Combiner	UL 1741, CAN/CSA C22.7 No. 107.1, 47 CFR, Part 15, Class B, ICES-003 Production metering: ANSI C12.20, accuracy class 0.5 (PV production) 1A, 5A601-1, IEC/ENSA 02.2 No. 01010-1
Compliance: IQ Envoys	

To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)

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## 11 ECB DATA SHEET

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## CONTRACTOR

### Lighting Electric

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