



Freedom Forever  
Planset Revision Letter

5/25/2023  
REV #1

Attn. Harnett County (NC):

The changes outlined in Revision Details have been applied to the plans corresponding to the following customer:

JOHNNY F ALLEN  
214 TWIN OAK DR, ANGIER, NC 27501

**Revision Details:**  
LAYOUT CHANGE

All corresponding changes are notated on the plans by revision clouds.

Thank you for your time in reviewing these plans. Please reach out if you have any additional questions or concerns.

Construction Engineering  
Freedom Forever  
[engineering@freedomforever.com](mailto:engineering@freedomforever.com)

# ROOF MOUNT PHOTOVOLTAIC SYSTEM

## CODES:

## CONSTRUCTION NOTES:

THIS PROJECT COMPLIES WITH THE FOLLOWING:  
 2018 NORTH CAROLINA BUILDING CODE  
 2018 NORTH CAROLINA RESIDENTIAL CODE  
 2018 NORTH CAROLINA PLUMBING CODE  
 2018 NORTH CAROLINA MECHANICAL CODE  
 2018 NORTH CAROLINA FUEL GAS CODE  
 2017 NATIONAL ELECTRICAL CODE  
 AS ADOPTED BY HARNETT COUNTY (NC)

CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.

ALL SOLAR ENERGY SYSTEM EQUIPMENT SHALL BE SCREENED TO THE MAXIMUM EXTENT POSSIBLE AND SHALL BE PAINTED A COLOR SIMILAR TO THE SURFACE UPON WHICH THEY ARE MOUNTED.

MODULES SHALL BE TESTED , LISTED AND IDENTIFIED WITH FIRE CLASSIFICATION IN ACCORDANCE WITH UL 2703. SMOKE AND CARBON MONOXIDE ALARMS ARE REQUIRED PER SECTION R314 AND 315 TO BE VERIFIED AND INSPECTED BY INSPECTOR IN THE FIELD.

DIG ALERT (811) TO BE CONTACTED AND COMPLIANCE WITH EXCAVATION SAFETY PRIOR TO ANY EXCAVATION TAKING PLACE

PHOTOVOLTAIC SYSTEM GROUND WILL BE TIED INTO EXISTING GROUND AT MAIN SERVICE FROM DC DISCONNECT/INVERTER AS PER 2017 AC SEC 250.166(A).

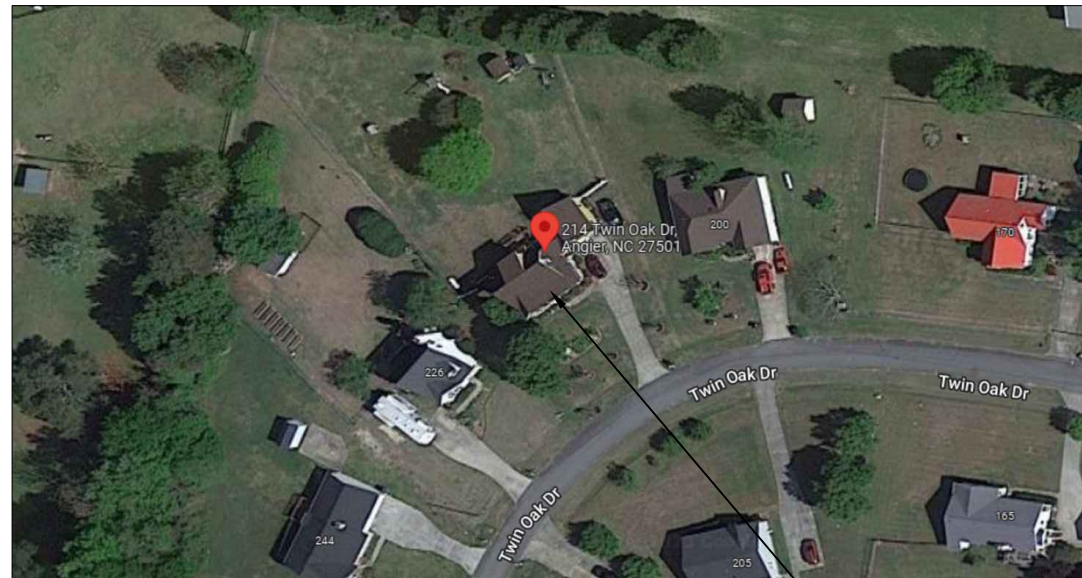
SOLAR PHOTOVOLTAIC SYSTEM EQUIPMENT WILL BE INSTALLED IN ACCORDANCE WITH REQUIREMENTS OF ART. 690 OF THE 2017 AC

THE MAIN SERVICE PANEL WILL BE EQUIPPED WITH A GROUND ROD OR UFER

UTILITY COMPANY WILL BE NOTIFIED PRIOR TO ACTIVATION OF THE SOLAR PV SYSTEM

INSTALL CREW TO VERIFY ROOF STRUCTURE PRIOR TO COMMENCING WORK. EMT CONDUIT ATTACHED TO THE ROOF USING CONDUIT MOUNT.

## VICINITY MAP:



SITE LOCATION

**CLIENT:**  
 JOHNNY F ALLEN  
 214 TWIN OAK DR, ANGIER, NC 27501  
 AHJ: HARNETT COUNTY (NC)  
 UTILITY: DUKE ENERGY (NC)  
 PHONE: (919) 696-7759  
 EMAIL: ALLENJF1967@GMAIL.COM  
 FINANCE: OTHER

**SYSTEM:**  
 SYSTEM SIZE (DC): 20 X 400 = 8.000 kW  
 SYSTEM SIZE (AC): 5.800 kW @ 240V  
 MODULES: 20 X FREEDOM FOREVER:  
 FF-MP-BBB-400  
 MICROINVERTERS: 20 X ENPHASE  
 IQ8PLUS-72-2-US

REVISIONS		
NO.	REVISED BY	DATE
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**FREEDOM FOREVER LLC**  
 415 INDUSTRIAL CT., GREER, SC 29651  
 Tel: (800) 385-1075














**GREG ALBRIGHT**

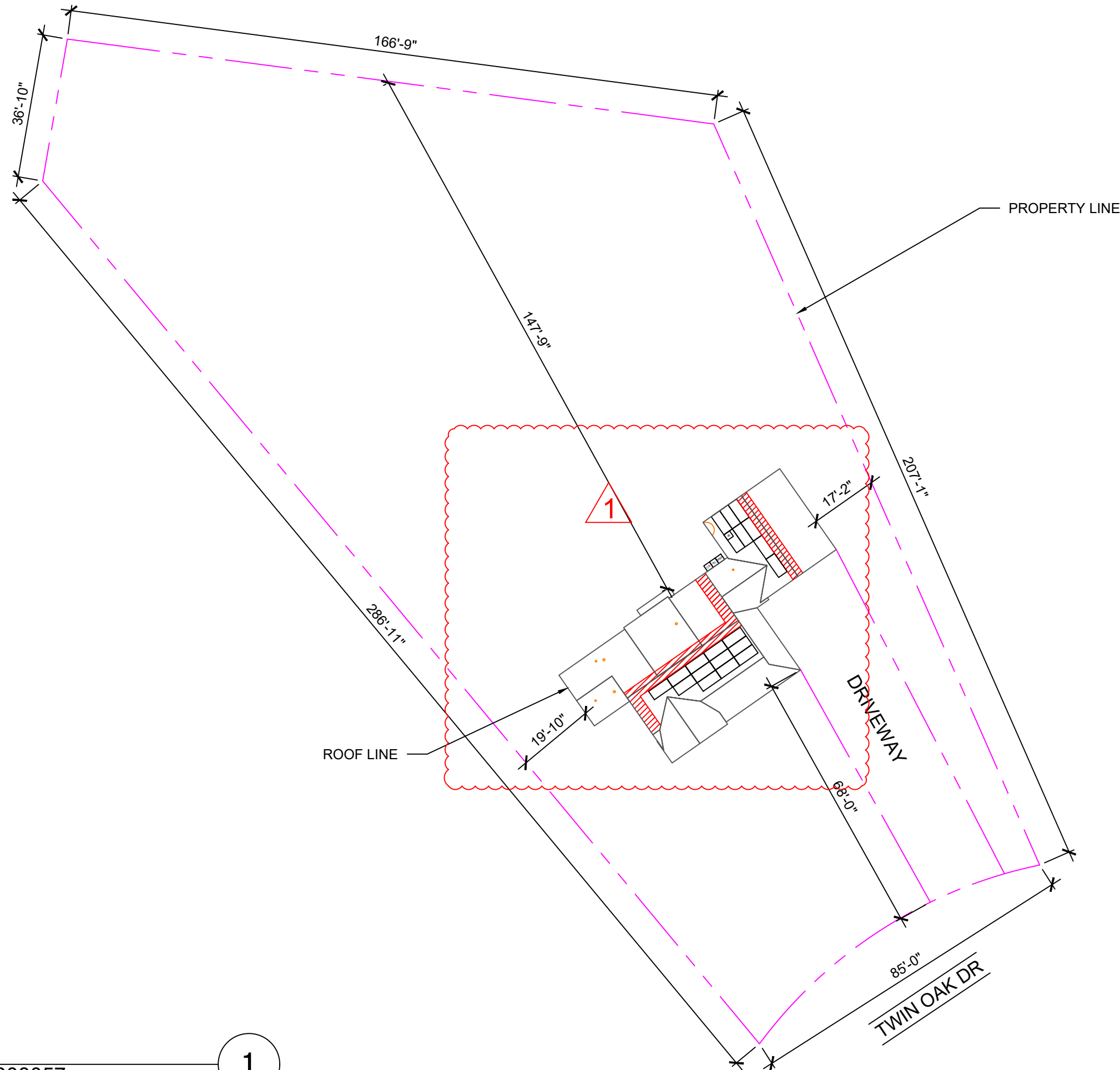
**CONTRACTOR LICENSE:**  
 ELECTRICAL CONTRACTOR U.34043

## SITE LOCATION

JOB NO: 295090	DATE: 5/25/2023	DESIGNED BY: O.E.	SHEET: PV-1
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**LEGEND:**

-  CHIMNEY
-  PIPE VENT
-  ATTACHMENTS
-  MODULES
-  RAFTERS
-  RAIL
-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  PRODUCTION METER
-  MICRO INVERTER
-  COMBINER BOX



ROOF AREA: 2949 SQ FT

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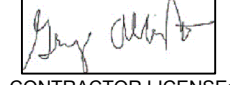
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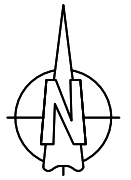


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







**SITE PLAN**  
 SCALE: 0.003057

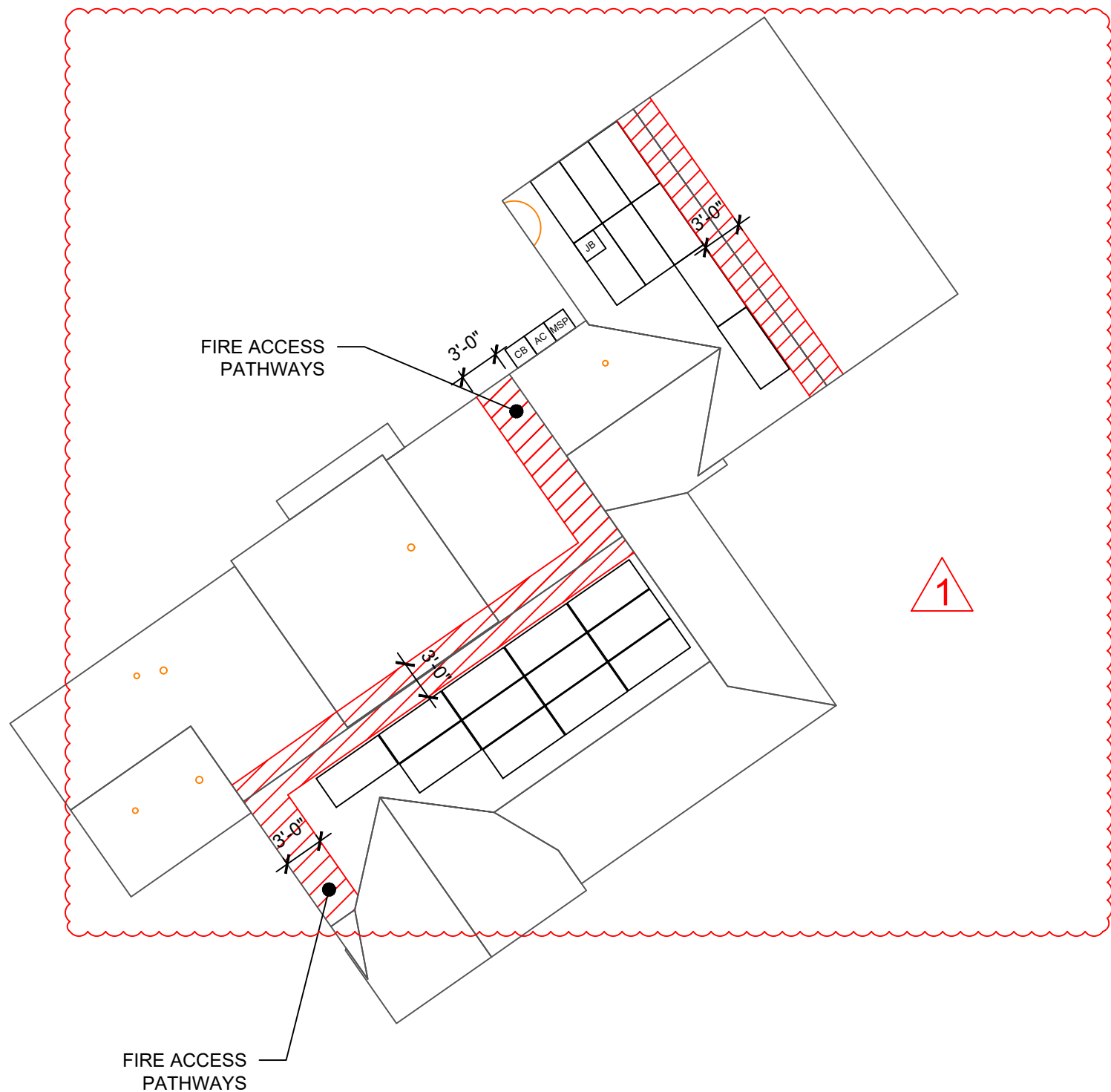
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SITE PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-2

LEGEND:

-  CHIMNEY
-  PIPE VENT
-  ATTACHMENTS
-  MODULES
-  RAFTERS
-  RAIL
-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  PRODUCTION METER
-  MICRO INVERTER
-  COMBINER BOX

TOTAL ROOF AREA: 2949 SQ FT  
 TOTAL ARRAY AREA: 420.39 SQ FT  
 ARRAY COVERAGE: 14.26%  
 SYSTEM DISTRIBUTED WEIGHT: 2.32 LBS  
 ROCKIT MICRORAIL POINT-LOAD: 21.18 LBS



ROOF AREA: 2949 SQ FT

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ROOF PLAN WITH MODULES LAYOUT

JOB NO: 295090	DATE: 5/25/2023	DESIGNED BY: O.E.	SHEET: PV-2A
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**ROOF PLAN**  
 SCALE: 3/32" = 1'-0"

1

**NOTES:**

1. EMT CONDUIT ATTACHED TO THE ROOF USING CONDUIT MOUNTS
2. ATTACHED CLAMPS AT 25% FROM THE EDGE AND 50% FROM THE CENTER OF THE MODULES
3. JUNCTION BOX IS MOUNTED TO THE RAIL.

# ROOF DETAILS:

TOTAL ROOF AREA: 2949 SQ FT  
 TOTAL ARRAY AREA: 420.39 SQFT  
 ARRAY COVERAGE: 14.26%  
 SYSTEM DISTRIBUTED WEIGHT: 2.32 LBS  
 ROCKIT MICRORAIL POINT-LOAD: 21.18 LBS

ROOF AREA STATEMENT						
ROOF	MODULE QUANTITY	ROOF PITCH	ARRAY PITCH	AZIMUTH	ROOF AREA	ARRAY AREA
ROOF 1	12	45	45	145	506 SQ FT	252.23 SQ FT
ROOF 2	8	45	45	235	357 SQ FT	168.16 SQ FT
----	----	----	----	----	SQ FT	SQ FT
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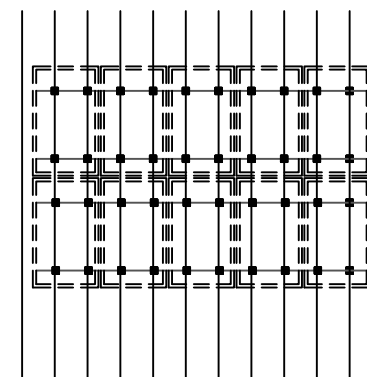
**ROOF DETAILS**

JOB NO: 295090	DATE: 5/25/2023	DESIGNED BY: O.E.	SHEET: PV-2B
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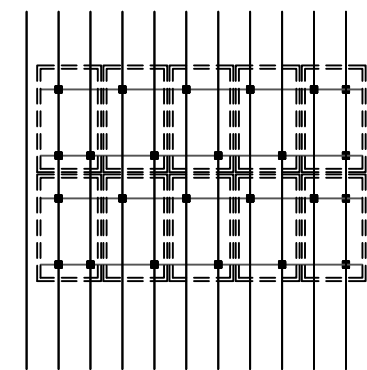
**TABLE 1 - ARRAY INSTALLATION**

	ROOF PITCH	ROOFING TYPE	ATTACHMENT TYPE	FRAMING TYPE <sup>1</sup>	MAX UNBRACED LENGTH(FT.) <sup>1</sup>	RAFTER/TRUSS SISTERING	PENETRATION PATTERN <sup>2</sup>	MAX ATTACHMENT SPACING (IN.) <sup>2</sup>	MAX RAIL OVERHANG(I N.) <sup>3</sup>
ROOF 1	45	COMP SHINGLE	ECOFASTEN ROCKIT SLIDE	2X6 RAFTER @ 16" OC	7.00'	NOT REQ'D	STAGGERED	48" OC	16"
ROOF 2	45	COMP SHINGLE	ECOFASTEN ROCKIT SLIDE	2X6 RAFTER @ 16" OC	7.00'	NOT REQ'D	STAGGERED	48" OC	16"

1. CONTRACTOR TO VERIFY FRAMING TYPE AND MAX UNBRACED LENGTH PRIOR TO INSTALLATION. IF THE ABOVE INFORMATION DOES NOT MATCH FIELD CONDITIONS, NOTIFY ENGINEER OF RECORD IMMEDIATELY.
2. WHERE COLLAR TIES OR RAFTER SUPPORTS EXIST, CONTRACTOR SHALL USE RAFTERS WITH COLLAR TIES AS ATTACHMENT POINTS.
3. WHERE APPLICABLE FOR RAILED ATTACHMENT INSTALLATIONS.



**STACKED DETAIL**  
For Illustration purposes only

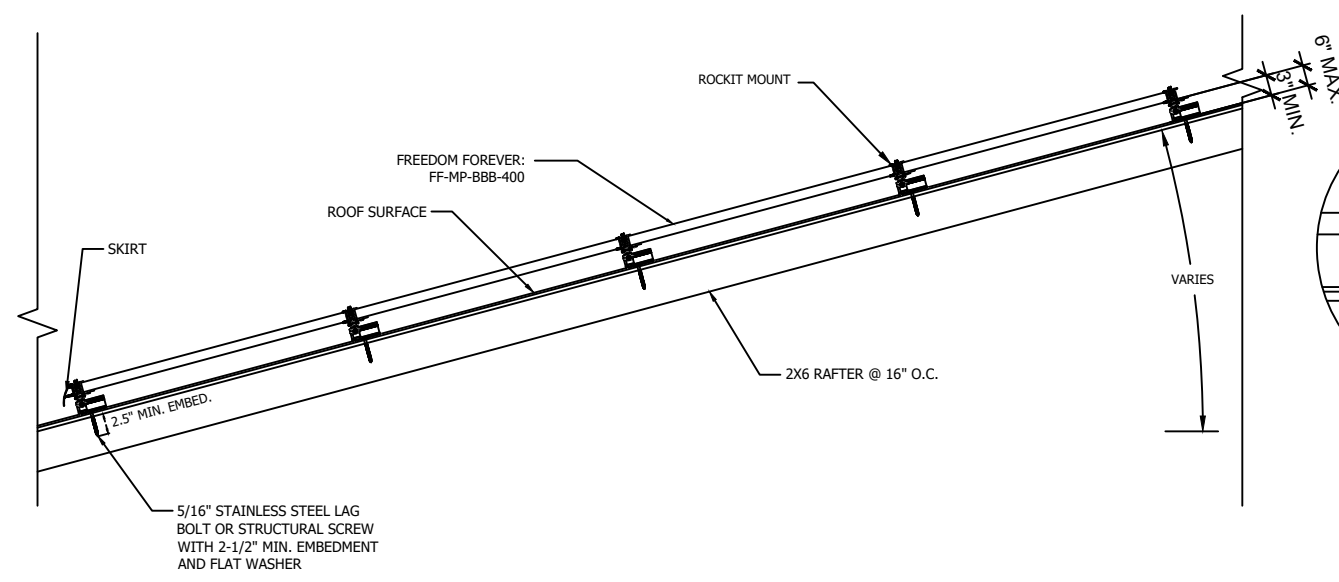


**STAGGERED DETAIL**  
For Illustration purposes only

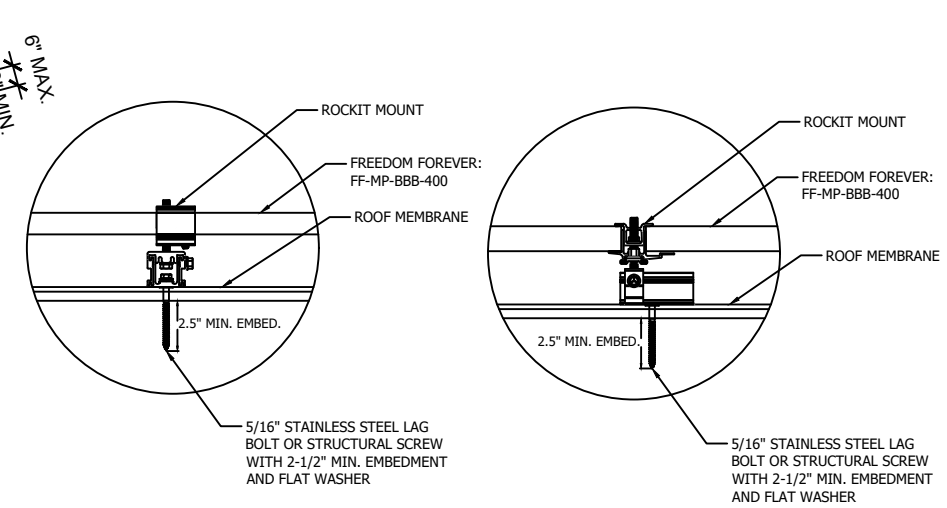
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**SOLAR PV ARRAY SECTION VIEW**  
Scale: NTS



**ATTACHMENT DETAIL**  
Scale: NTS

**freedom FOREVER**

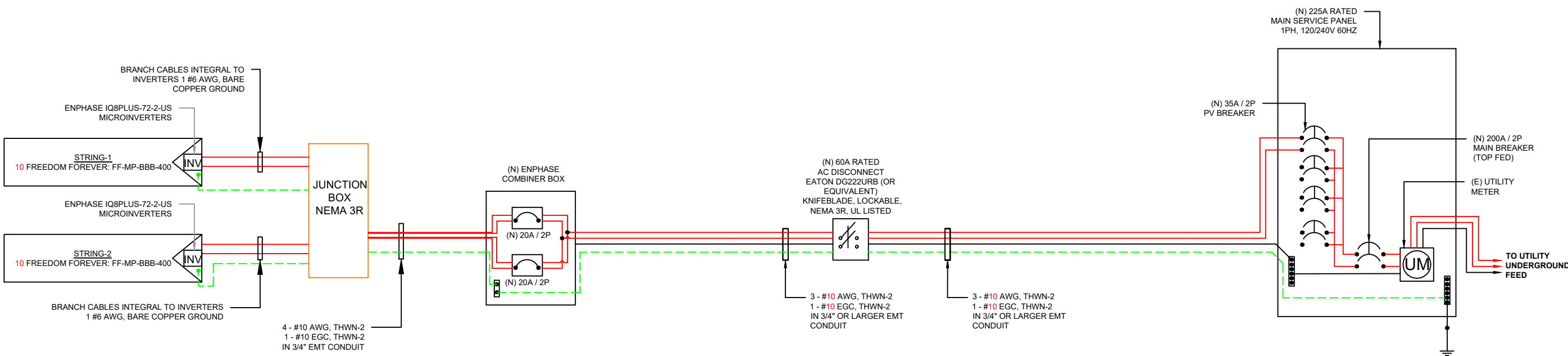
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 ELECTRICAL CONTRACTOR U.34043

MOUNTING DETAILS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-3

**BACKFEED BREAKER SIZING**  
 MAX. CONTINUOUS OUTPUT 24.20A @ 240V  
 24.20 X 1.25 = 30.25AMPS 35A BREAKER - OK  
 SEE 705.12 OF 2017 AC  
 225 X 1.20 = 270  
 270 - 200 = 70A ALLOWABLE BACKFEED



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THREE LINE DIAGRAM

JOB NO: 295090	DATE: 5/25/2023	DESIGNED BY: O.E.	SHEET: PV-4
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WIRE SCHEDULE												
RACEWAY #	EQUIPMENT				CONDUCTOR QTY.	AWG WIRE SIZE	STARTING ALLOWABLE AMPACITY @ 90°C 310.15(B)(16)	STARTING CURRENT APPLIED TO CONDUCTORS IN RACEWAY	TEMPERATURE CORRECTION FACTOR 310.15(B)(2)(a)	ADJUSTMENT FACTOR FOR MORE THAN 3 CONDUCTORS 310.15(B)(3)(a)	ADJUSTED CONDUCTOR AMPACITY @ 90°C	MAXIMUM CURRENT APPLIED TO CONDUCTORS IN RACEWAY
1	DC	MODULE	TO	MICROINVERTER	2	10	40	17.24	0.91	1	36.40	21.55
2	AC	MICROINVERTER	TO	JUNCTION BOX	2	10	40	12.10	0.91	1	36.40	15.13
3	AC	JUNCTION BOX	TO	ENPHASE COMBINER BOX	4	10	40	24.20	0.91	0.8	29.12	30.25
4	AC	ENPHASE COMBINER BOX	TO	AC DISCONNECT	3	10	40	24.20	0.91	1	36.40	30.25
5	AC	AC DISCONNECT	TO	POI	3	10	40	24.20	0.91	1	36.40	30.25
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CONDUCTOR AMPACITY CALCULATIONS IN ACCORDANCE WITH AC 690.8.

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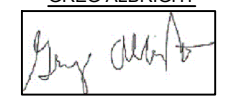
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CONDUCTOR CALCULATIONS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-5



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**ELECTRICAL CALCULATIONS**

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**OCPD SIZES:**

20A BREAKER
20A BREAKER
35A BREAKER

**SERVICE LIST:**

MAIN PANEL UPGRADE

**MATERIAL LIST:**

QTY.	PART	PART #	DESCRIPTION
20	MODULES	PV-110-400	FREEDOM FOREVER: FF-MP-BBB-400
1	JUNCTION BOX	480-276	600VDC NEMA 3R UL LISTED JUNCTION BOX
4	CONNECTORS	240-300	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (FEMALE)
4	CONNECTORS	240-301	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (MALE)
20	MICROINVERTER(S)	INV-120-015	ENPHASE IQ8PLUS-72-2-US
1	ENVOY	160-100	"ENPHASE AC COMBINER W/ ENVOY PCB, 80A"
23	Q CABLE	160-106	"ENPHASE, Q CABLE PORTRAIT FOR 60/72 CELL"
23	Q CABLE	160-105	"ENPHASE, Q CABLE LANDSCAPE 60 CELL"
1	COMBINER BOX	160-100	ENPHASE COMBINER BOX NEMA 3R RATED
1	CABLE	310-300	"ENPHASE, RAW TRUCK CABLE (300 FT. ROLL)"
160	CLIP	160-108	ENPHASE TIE WRAPS / CABLE CLIPS
5	SEAL	160-107	ENPHASE SEALING CAPS FOR Q CABLE
2	TERMINATOR	160-109	ENPHASE TERMINATOR
1	DISCONNECT	261-526	ENPHASE DISCONNECT TOOL
1	AC DISCONNECT	321-060	60A RATED 240VAC NEMA 3R UL LISTED
46	ROOF ATTACHMENT 1	261-602	ROCKIT MICRORAIL
15	TRIM 1	241-253	ROCK-IT TRIM COMP DARK
38	SLIDER 1	261-603	ROCK-IT SLIDER COMP DARK
11	BONDING CLAMP 1	221-100	N/S BONDING CLAMP
5	BONDING CLAMP 1	241-404	TRIM BONDING CLAMP
21	MOUNT ASSEMBLY 1	241-405	MLPE MOUNT ASSY
12	SPLICE 1	261-604	ROCK-IT SPLICE
3	ATTACHED SPLICE 1	211-101	ATTACHED SPLICE 8 INCH
17	TRIMRAIL 1	261-606	TRIMRAIL UNIV CLIP W/ HDW
5	TRIM SPLICE 1	261-605	TRIM SPLICE DRK
9	TRIMRAIL 1	211-115	TRIMRAIL UNIV DRK
20	GROUND LUG 1	260-585	ILSCO GROUND LUG
20	TRIM END CAPS 1	221-200	ROCK-IT TRIM END CAPS

**CLIENT:**  
 JOHNNY F ALLEN  
 214 TWIN OAK DR, ANGIER, NC 27501  
 AHJ: HARNETT COUNTY (NC)  
 UTILITY: DUKE ENERGY (NC)  
 PHONE: (919) 696-7759  
 EMAIL: ALLENJF1967@GMAIL.COM  
 FINANCE: OTHER

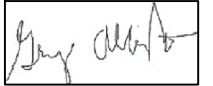
**SYSTEM:**  
 SYSTEM SIZE (DC): 20 X 400 = 8.000 kW  
 SYSTEM SIZE (AC): 5.800 kW @ 240V  
 MODULES: 20 X FREEDOM FOREVER:  
 FF-MP-BBB-400  
 MICROINVERTERS: 20 X ENPHASE  
 IQ8PLUS-72-2-US

REVISIONS		
NO.	REVISED BY	DATE
1	O.E.	5/25/2023
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**FREEDOM FOREVER LLC**  
 415 INDUSTRIAL CT., GREER, SC 29651  
 Tel: (800) 385-1075

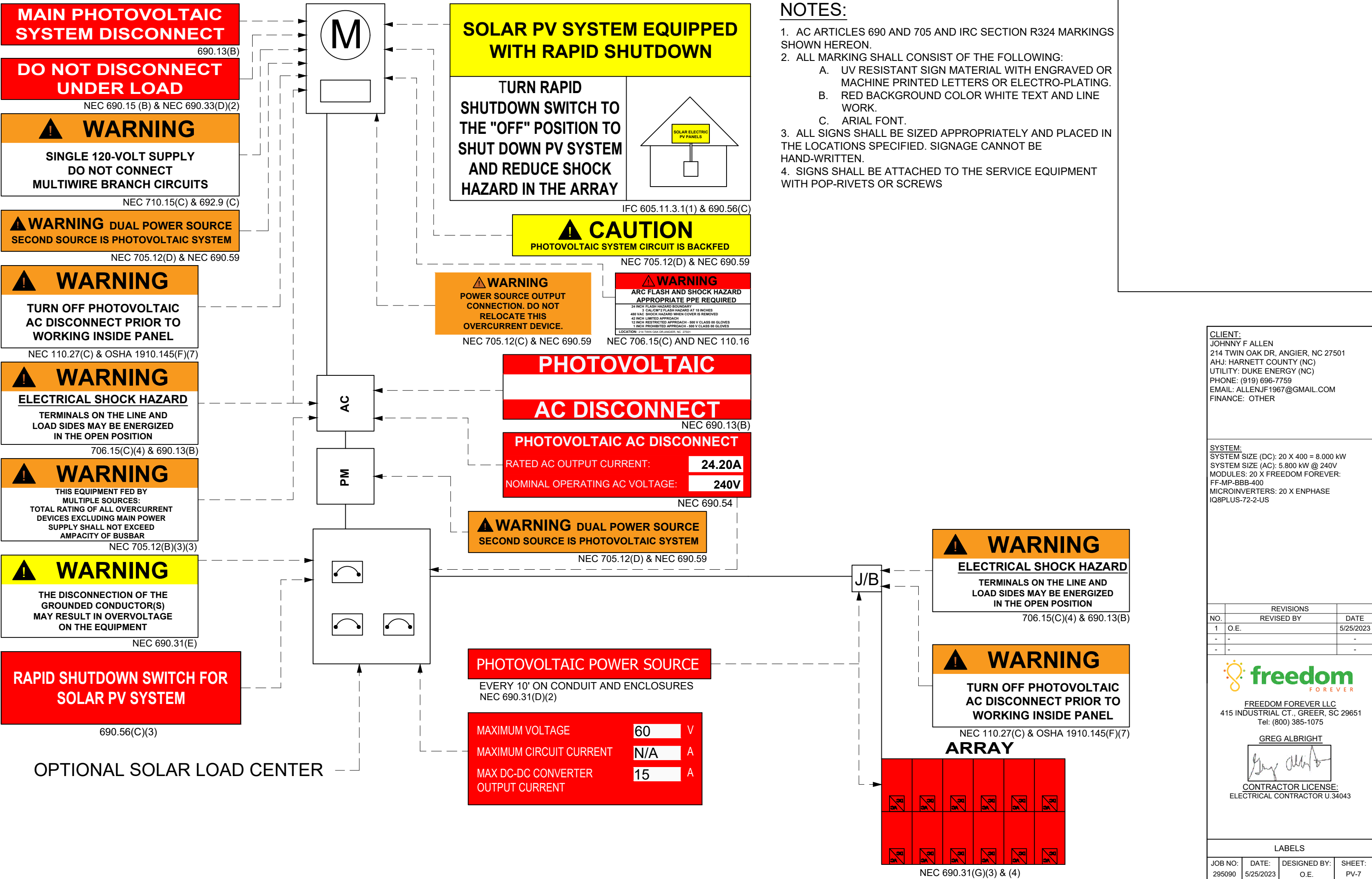
**GREG ALBRIGHT**



**CONTRACTOR LICENSE:**  
 ELECTRICAL CONTRACTOR U.34043

**EQUIPMENT & SERVICE LIST**

JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-6



- NOTES:**
- AC ARTICLES 690 AND 705 AND IRC SECTION R324 MARKINGS SHOWN HEREON.
  - ALL MARKING SHALL CONSIST OF THE FOLLOWING:
    - UV RESISTANT SIGN MATERIAL WITH ENGRAVED OR MACHINE PRINTED LETTERS OR ELECTRO-PLATING.
    - RED BACKGROUND COLOR WHITE TEXT AND LINE WORK.
    - ARIAL FONT.
  - ALL SIGNS SHALL BE SIZED APPROPRIATELY AND PLACED IN THE LOCATIONS SPECIFIED. SIGNAGE CANNOT BE HAND-WRITTEN.
  - SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS

**CLIENT:**  
 JOHNNY F ALLEN  
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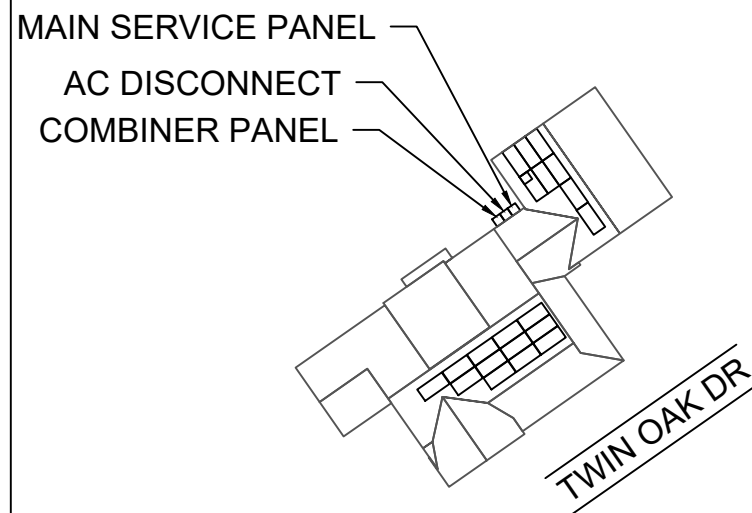
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 415 INDUSTRIAL CT., GREER, SC 29651  
 Tel: (800) 385-1075

GREG ALBRIGHT  
  
 CONTRACTOR LICENSE:  
 ELECTRICAL CONTRACTOR U.34043

LABELS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-7

# CAUTION:

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



## WARNING

TURN OFF PHOTOVOLTAIC AC DISCONNECT  
PRIOR TO WORKING INSIDE PANEL



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### SITE PLACARD

JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-7A

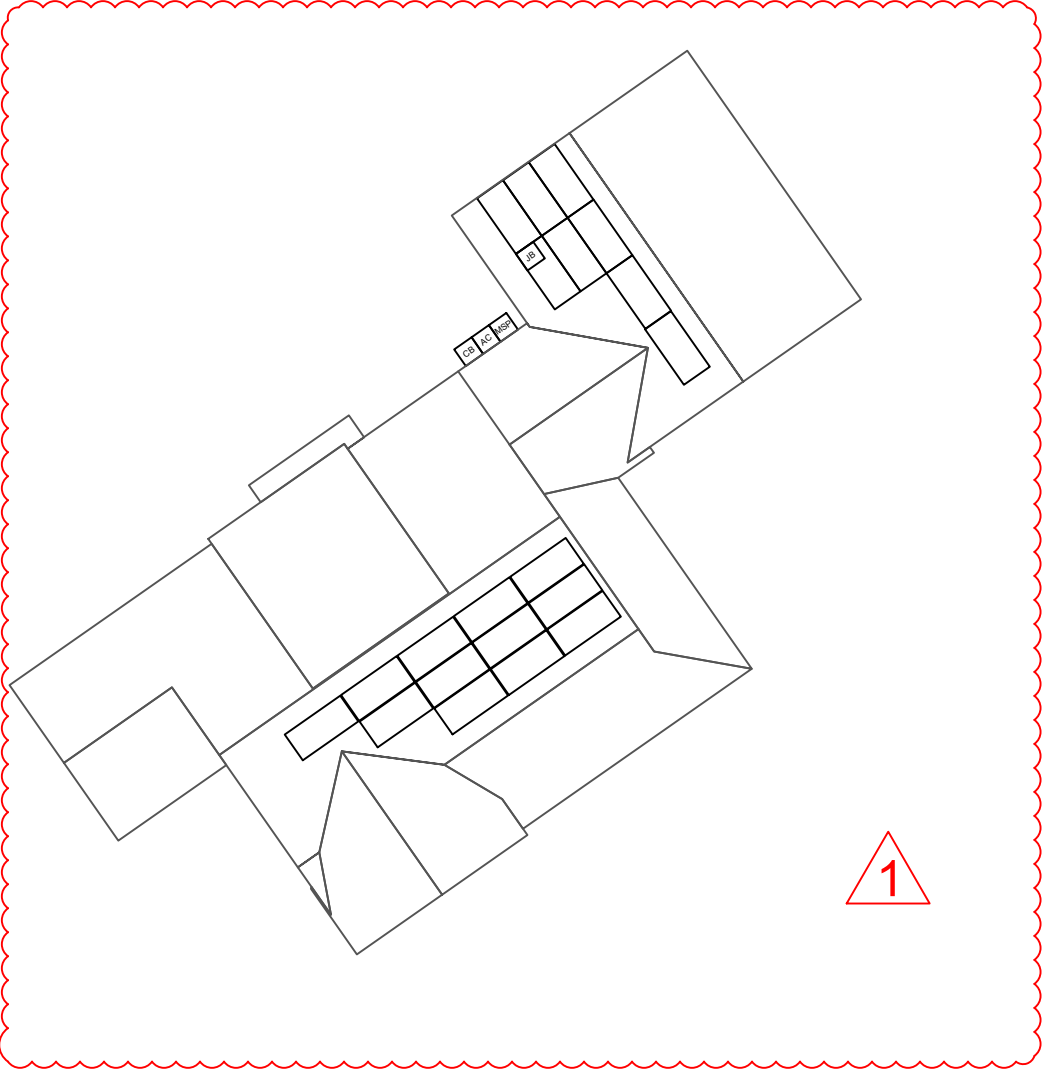
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  - AERIAL FONT.
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- SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS.

# ENPHASE MICROINVERTER CHART

1-10    11-20    21-30    31-40    41-50    51-60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10

**CLIENT:**  
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MICROINVERTER CHART			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-8

# SAFETY PLAN

# MARK UP KEY

### INSTRUCTIONS:

1. USE SYMBOLS IN KEY TO MARK UP THIS SHEET.
2. SAFETY PLAN MUST BE MARKED BEFORE JOB STARTS AS PART OF THE PRE-PLAN
3. DOCUMENT ALL ADDITIONAL HAZARDS ON THIS PAGE & MAKE NOTES ON THE JHA SHEET

### INCIDENT REPORTING:

INJURIES - CALL INJURY HOTLINE

**(855) 400-7233**

*\*If injury is life threatening, call 911 first THEN the Injury Hotline*

NON-INJURIES - USE MOBILE INCIDENT REPORTING

(Auto, Property Damage, Near Miss)



### NEAREST OCCUPATIONAL/INDUSTRIAL CLINIC:

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

### NEAREST HOSPITAL:

NAME: \_\_\_\_\_

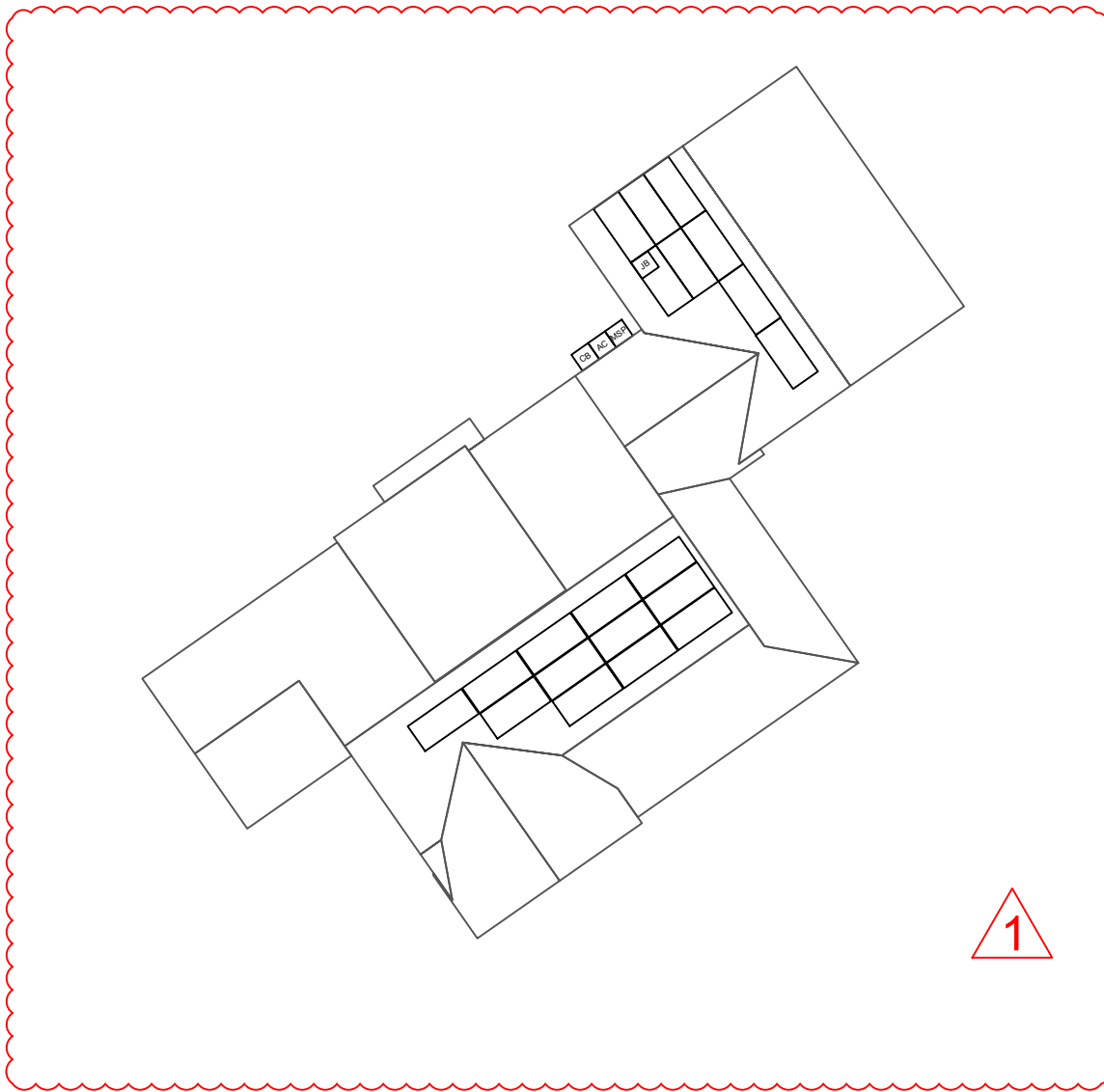
ADDRESS: \_\_\_\_\_

### SAFETY COACH CONTACT INFORMATION:

NAME: \_\_\_\_\_

PHONE NUMBER: \_\_\_\_\_

ALL EMPLOYEES ON SITE SHALL BE MADE AWARE OF THE SAFETY PLAN AND SIGN INDICATING THAT THEY ARE AWARE OF THE HAZARDS ON-SITE AND THE PLAN FOR WORKING SAFELY.



- P PERMANENT ANCHOR
- T TEMPORARY ANCHOR
- IL INSTALLER LADDER
- B JUNCTION / COMBINER BOX
- S STUB-OUT
- ☒ SKYLIGHT
- NO LADDER ACCESS (STEEP GRADE OR GROUND LEVEL OBSTRUCTIONS)
- RESTRICTED ACCESS
- CONDUIT
- GAS GAS SHUT OFF
- H<sub>2</sub>O WATER SHUT OFF
- 7 SERVICE DROP
- Z POWER LINES

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 IQ8PLUS-72-2-US

REVISIONS		
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1	O.E.	5/25/2023
-	-	-
-	-	-

## BREAK AND WATER LOG

THIS LOG IS TO BE FILLED OUT ANY TIME THE TEMP EXCEEDS **90** DEGREES. THE CREW LEAD AND ROOF LEAD ARE RESPONSIBLE FOR ENSURING THIS IS COMPLETED AND UPLOADED AT THE END OF EVERYDAY WHEN TEMPS EXCEED **90** DEGREES

NAME	0800HRS	0900HRS	1000HRS	1100HRS	1200HRS	1300HRS	1400HRS	1500HRS	1600HRS

NAME	SIGNATURE

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

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 415 INDUSTRIAL CT., GREER, SC 29651  
 Tel: (800) 385-1075

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 ELECTRICAL CONTRACTOR U.34043

SAFETY PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-9

# JOB HAZARD ANALYSIS

Crew leader to fill out all sections below, hold a pre-job safety meeting with all personnel, and upload this completed document and the Safety Plan to Site Capture

## Ladder Access

- Ladders must be inspected before each use.
- Extension ladders must be set up on a firm and level surface at a 4-to-1 rise to run angle (or 75 degrees) and the top must be secured to the structure. Extension style ladders placed on uneven, loose or slippery surfaces must additionally have the base firmly anchored or lashed so the base will not slip out.
- Extension ladders must be used with walk-through devices or the ladder must extend 36" above the stepping off point.
- A-frame ladders must only be climbed with the ladder spreader bars locked in the open position; A-frame ladders shall not be climbed while in the closed position (ex, closed and used while leaned against a structure).

Additional notes:

## Mobile Equipment

- Only Qualified operators will operate equipment; operators must maintain a certification on their person for the equipment being operated.
- Type(s) of mobile equipment (Type/Make/Model):
- Qualified operator(s):

## Material Handling and Storage

- Materials will be staged/stored in a way that does not present a hazard to client, personnel or public. Materials stored on the roof will be physically protect from failing or sliding off.

## Fall Protection

- A site-specific plan for fall prevention and protection is required prior to starting work and must remain onsite at all times until work is complete; a fall rescue plan must be outlined and discussed among the crew prior to work start.
- First-person-Up (FPU) must install their anchor and connect before any other task, including installing other anchors. The Last-Person-Down (LPD) must be the only person on a roof uninstalling fall protection.

FPCP (name and title):

FPU and LPD (name and title):

## Electrical Safety

- The Electrical Qualified Person (EQP) is required onsite to perform electrical work.
- All electrical work will be performed with equipment in an electrically safe condition (de-energized) unless approval has been granted prior to work.
- Service drops and overhead electrical hazards will be identified and protected from contact, as neccessary.

EQP (name and tile):

## Public Protection

- The safety of the Client and Public must be maintained at all times.
- The Client and the Public shall be prevented from entering the work zone through the use of barriers and/or signage, as required.
- Company, Client and Public property shall be protected from falling objects.
- Pets (including dogs) shall be secured by their owners prior to work start.
- The Client should not leave pets, family members, or others in charge or care of Employees, Contractors, or Temporary Workers.

Crew leader responsible for communication with the client:

Client and public is excluded from work area by barricades (N/A, Yes, No):

## Training and Pre-Job Safety Briefing

- All employees onsite shall be made aware of the specific hazards of this project and review this HJA during a pre-job briefing, and their signature indicates awareness of site conditions and the plan to eliminate any hazards identified prior to and during the project.

Crew leader (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

## Airborne Contaminants:

- Asbestos-containing (Transite) piping (ACP) - Do not disturb (move, drill, cut fracture, etc.)
- Asbestos-containing thermal insulation (ACI) and Asbestos-containing duct wrapping (ACW) - do not disturb, no attic or crawlspace access is allowed if work to be performed could cause exposure to personnel, client or public.

If yes, list specific tasks and protection in place:

## Weather and Environment

- The site supervisor shall forecast the weather conditions at the job site, prior to crew arrival, in order to mitigate any hazards associated with inclement weather (heat, cold, wind, rain, etc.)
- The site supervisor will utilized a portable wind meter (anemometer) to verify actual onsite wind conditions, by checking at the ground and on any elevated work surface (ex, rooftop) prior to work start, at midday and prior to solar panel staging on a roof.
- Elevated work involving the moving or maneuvering of solar panels shall cease at 25mph (sustained wind) until wind subsides.

Forecasted weather maximum temp (degrees f):

## Heat Related Illness Prevention

- Employees shall have access to potable drinking water that is fresh, pure, and suitably cool. The water shall be located as close as practicable to the areas where employees are working. Water shall be supplied in sufficient quantity at the beginning of the work shift to provide at least one quart per employee per hour for drinking for the entire shift. Employees may begin the shift with smaller quantities of water if they identify the location and have effective means for replenishment during the shift to allow employees to drink on quart or more per hour. The frequent drinking of water shall be encouraged.
- Shade shall be present when temperature exceeds 80 degrees Fahrenheit. When the outdoor temperature in the work exceeds 80 degrees Fahrenheit, employees shall have and maintain one or more areas with shade at all times.
- New employees must be acclimatized. New employees will be monitored by their Crew Leader (site supervisor) for the first two (2) weeks of employment or longer when necessary.
- Employees will be allowed and encouraged to implement scheduled breaks during each shift. Employees must take cool-down breaks in the shade any time they feel the need to do so to protect them from overheating. Supervisors are REQUIRED to allow employees any break period they need during high heat conditions.
- Cool Vests are encouraged for all employees at all times during periods of high heat.
- Identify the location of the closet Occupational/Industrial Clinic or Hospital in case a crew member becomes ill.

What is the specific plan to provide and replenish sufficient water for all employees on site?

If offsite replenish is necessary, where will you go to replenish water (location/address):

Who will replenish the drinking water (name):

## Restroom facilities

- Employees shall have access to restroom facilities with hand-washing stations. Use of onsite restroom is at the client's discretion (location is annotated below). If client does not give permission, location of suitable restroom facilities with hand-washing stations offsite will be provided. The onsite supervisor will identify location and make arrangements to ensure all employees have access at any point.

Restroom facilities will be (circle one): Onsite - Offsite

If Offsite, add location name and address:

## Incident Reporting Procedure

Contact your Site Supervisor

Name:

Phone:

Contact your Manager

Name:

Phone:

Contact your Site Supervisor

Name:

Phone:

With: Your full name, phone number, office location, brief description of what happen and when.

## NOTE ADDITIONAL HAZARDS NOT ADDRESSED ABOVE

(add as many as necessary by using additional sheets)

Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:

**CLIENT:**  
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 IQ8PLUS-72-2-US

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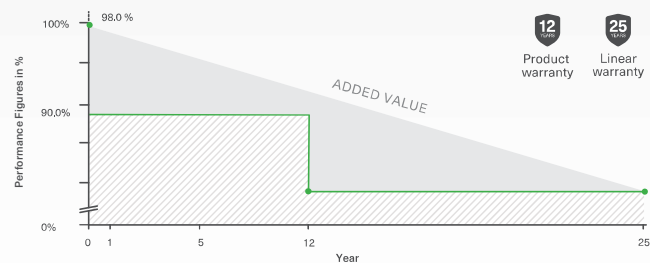
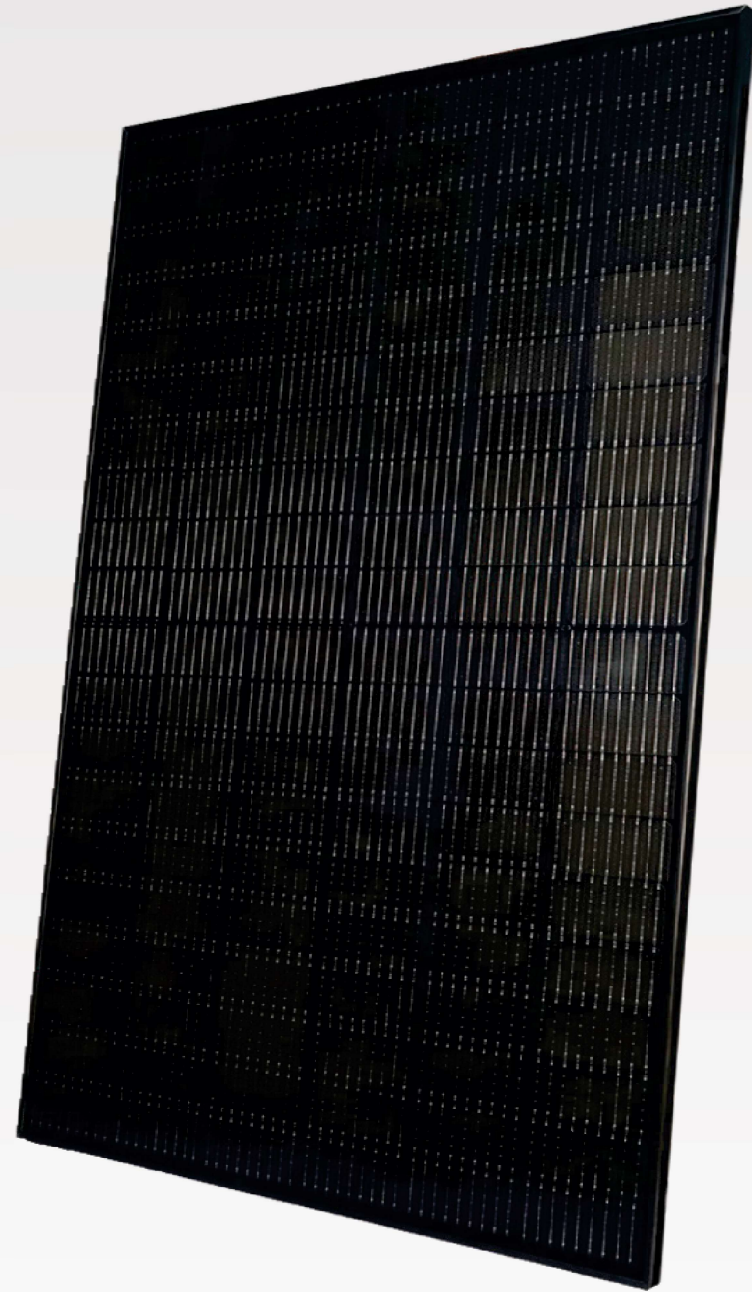
**GREG ALBRIGHT**



**CONTRACTOR LICENSE:**  
 ELECTRICAL CONTRACTOR U.34043

## SAFETY PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
295090	5/25/2023	O.E.	PV-10



## MODULE SPECIFICATIONS

### ELECTRICAL CHARACTERISTICS

Characteristics	FF-MP-BBB-400
Maximum Power (Pmax)	400W
Maximum Power Voltage (Vmp)	31.01V
Maximum Power Current (Imp)[A]	12.90A
Open Circuit Voltage (Voc)[V]	37.04V
Short Circuit Current (Isc)[A]	13.79A
Module Efficiency	20.48%
Power Tolerance	0/+5W
STC	Irradiance of 1000W/m <sup>2</sup> , AM1.5, Cell Temperature 25°C

### MECHANICAL CHARACTERISTICS

Cell Type	Mono perc, 182 mm-half cells, 108 (6x9+6x9)
Weight	22.1 kgs (48.7 lbs)
Dimension	1722 x 1134 x 35 mm (67.80 x 44.65 x 1.38 in)
Front Glass	3.2 mm (.13 in)
Junction Box	IP68 (3 Bypass Diodes)
Output Cables	1200 mm (47.24 in)
Connector	Staubli MC4
Frame & Installation	Anodized aluminum profile

### OPERATIONS CHARACTERISTICS

Operational Temperature	-40°C~+85°
Max System Voltage	1500V
Max Series Fuse Rating	25A
Safety Class	Class II
Fire Rating	Type 1

### MECHANICAL LOADING

Snow Load	5,400Pa (113lb/ft <sup>2</sup> )
Rear Side Design Load	2,400Pa (50lb/ft <sup>2</sup> )

### PACKAGING INFORMATION

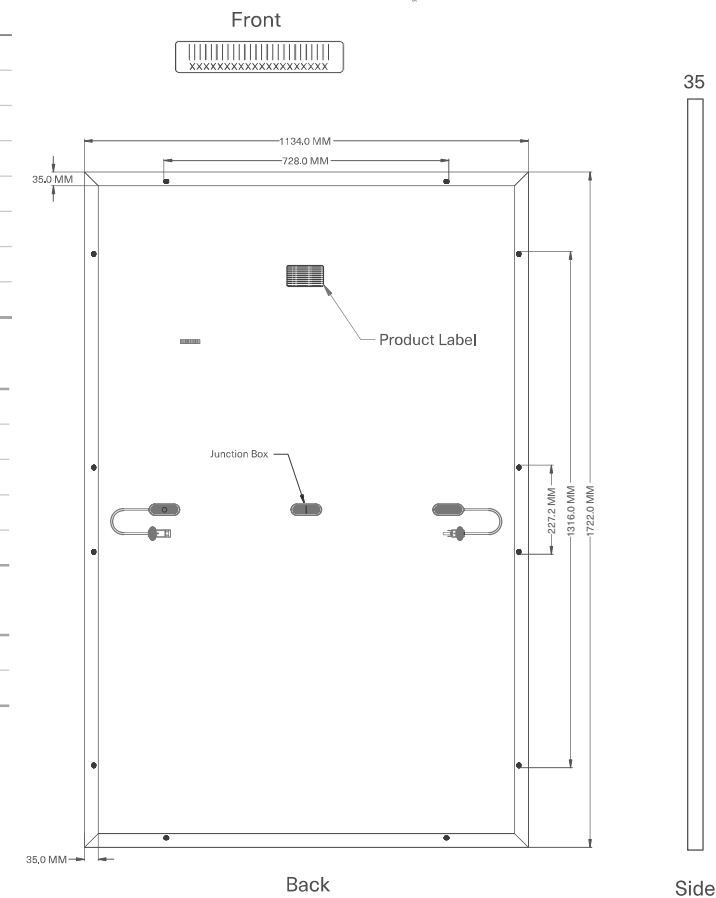
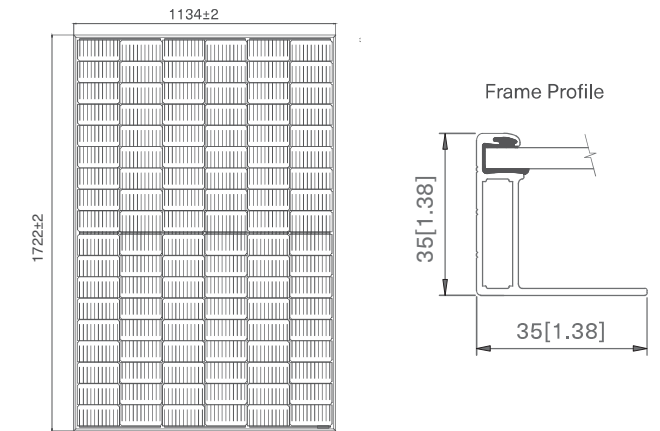
	20' GP	40' HC
Pallets per Container	6	26
Panels per Container	186	806
Panels per Pallet	31	31
Packaging Bon Weight	679 kg (1497 lbs)	
Panels per Pallet	1785 x 1130 x 1180 mm (70.28 x 44.49 x 46.46 in)	

### TEMPERATURE RATINGS

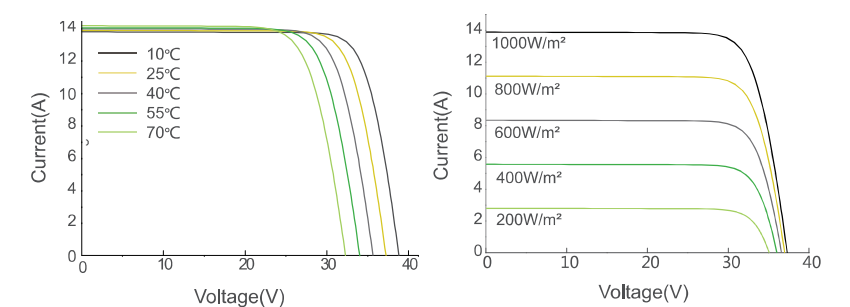
Temperature Coefficient of P <sub>max</sub>	-0.350%/°C
Temperature Coefficient of V <sub>oc</sub>	-0.275%/°C
Temperature Coefficient of I <sub>sc</sub>	+0.045%/°C
Nominal Operating cell Temperature (NOCT)	42°C±2°C



UL 61730 | UL 61215 | ISO 9001 | ISO 14001



### CURRENT-VOLTAGE CURVE





# CERTIFICATE OF COMPLIANCE

This certificate confirms the model(s) for the product listed are in compliance and authorized to bear the Certification Mark(s) shown below when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This document is for use with the Design Light Consortium or California Energy Commission application only.

<b>Basic Listee:</b>	PT IDN SOLAR TECH	<b>Multiple Listee:</b>	Freedom Forever Procurement LLC
<b>Address:</b>	KOMPLEK KABIL INDONUSA ESTATE, BLOK A NOMOR 19B, BATU BESAR, Batam	<b>Address:</b>	43445 Business Park Drive, Suite 110, Temecula, CA 92590
<b>Country:</b>	Indonesia	<b>Country:</b>	USA

**Party Authorized to Apply Label:** PT IDN SOLAR TECH  
**Report Issuing Office:** Intertek Testing Services Shanghai Limited

**Control Number:** 5019087      **Authorized by:** *Jordan Hobbert*  
for L. Matthew Snyder, Certification Manager

VALID LISTING MARKS



This Certificate of Compliance is for the exclusive use of Intertek's Client and is provided pursuant to the Certification Agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the Agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the Agreement, for any loss, expense or damage occasioned by the use of this Certificate. Only the Client is authorized to permit copying or distribution of this Certificate and then only in its entirety. Use of Intertek's Certification mark is restricted to the conditions laid out in the Agreement and in this Certificate. Any further use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. Initial Factory Assessments and Follow up Services are for the purpose of assuring appropriate usage of the Certification mark in accordance with the Agreement, they are not for the purposes of production quality control and do not relieve the Client of their obligations in this respect.

Intertek Testing Services NA Inc.  
545 East Algonquin Road, Arlington Heights, IL 60005  
Telephone 800-345-3851 or 847-439-5667

<b>Standard(s):</b>	Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [UL 61730-1:2017 Ed.1+R:30Apr2020]  Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [CSA C22.2#61730-1:2019 Ed.2]  Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [UL 61730-2:2017 Ed.1+R:30Apr2020]
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# CERTIFICATE OF COMPLIANCE

	Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [CSA C22.2#61730-2:2019 Ed.2]  Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 1: Test Requirements [UL 61215-1:2017 Ed.1]  Terrestrial Photovoltaic (PV) Modules - Design Qualification And Type Approval - Part 1-1: Special Requirements For Testing of Crystalline Silicon Photovoltaic (PV) Modules [UL 61215-1-1:2017 Ed.1]  Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 2: Test Procedures[UL 61215-2:2017 Ed.1]	
<b>Product:</b>	Crystalline Silicon Photovoltaic (PV) Modules	
<b>Brand Name:</b>	Freedom Forever	
<b>Models:</b>	<b>MULTIPLE LISTEE 12 MODELS</b>	<b>BASIC LISTEE MODELS</b>
	FF-MP-BBB- followed by 365, 370, 375 or 380.  FF-MP-BBB- followed by 395, 400, 405 or 410.	NUSA120H- followed by 365, 370, 375 or 380; followed by MB.  NUSA108H- followed by 395, 400, 405 or 410; followed by MB.



## 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.

### 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 3<sup>rd</sup> Ed.)

### Note:

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

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

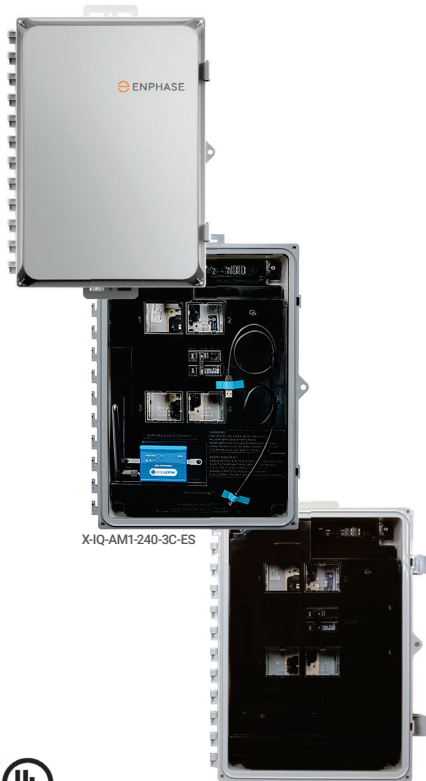
## IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-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
Overtoltage 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)		IQ8-60-2-US	IQ8PLUS-72-2-US
Peak output power	VA	245	300
Max. continuous output power	VA	240	290
Nominal (L-L) voltage / range <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%
Overtoltage class AC port			III
AC port backfeed current	mA		30
Power factor setting			1.0
Grid-tied power factor (adjustable)			0.85 leading – 0.85 lagging
Peak efficiency	%		97.7
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 3 <sup>rd</sup> Ed.), FCC Part 15 Class B, ICES-0003 Class B, CAN / CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid 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.

## Enphase IQ Combiner 3-ES/3C-ES

X-IQ-AM1-240-3-ES  
X-IQ-AM1-240-3C-ES



X-IQ-AM1-240-3C-ES

X-IQ-AM1-240-3-ES

The **Enphase IQ Combiner 3-ES/3C-ES** with Enphase IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 3C-ES) 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 Gateway for communication and control
- Includes LTE-M1 cell modem (included only with IQ Combiner 3C-ES)
- Includes solar shield to match Ensemble esthetics and deflect heat
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

### Simple

- Reduced size from IQ Combiner+ (X-IQ-AM1-240-2)
- Centered mounting brackets support single stud mounting
- Supports back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80 A total PV or storage branch circuits

### Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the Combiner SKU's
- UL listed

## Enphase IQ Combiner 3-ES / 3C-ES

### MODEL NUMBER

IQ Combiner 3-ES (X-IQ-AM1-240-3-ES)	IQ Combiner 3-ES with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.
IQ Combiner 3C-ES (X-IQ-AM1-240-3C-ES)	IQ Combiner 3C-ES with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect LTE-M1 (CELLMODEM-M1), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.

### MICROINVERTERS, ACCESSORIES AND REPLACEMENT PARTS (not included, order separately)

Supported Microinverters	IQ6, IQ7, IQ8. Do not mix IQ6/7 Micro-inverters with IQ8
Ensemble Communications Kit (COMMS-CELLMODEM-M1)	Includes COMMS-KIT-01 and CELLMODEM-M1 with 5-year data plan for Ensemble sites
Circuit Breakers BRK-10A-2-240 BRK-15A-2-240 BRK-20A-2P-240	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220
EPLC-01	Power line carrier (communication bridge pair), quantity - one pair
XA-SOLARSHIELD-ES	Replacement solar shield for Combiner 3-ES / 3C-ES
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 3-ES / 3C-ES (required for EPLC-01)
XA-ENV-PCBA-3	Replacement IQ Gateway printed circuit board (PCB) for Combiner 3-ES / 3C-ES

### ELECTRICAL SPECIFICATIONS

Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating	65 A
Max. continuous current rating (input from PV/storage)	64 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation / 95A with IQ Gateway breaker included
Gateway breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-SPLIT)	A pair of 200 A split core current transformers

### MECHANICAL DATA

Dimensions (WxHxD)	37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"). Height is 21.06" (53.5 cm) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	<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 1/0 AWG copper conductors</li> <li>• Main lug combined output: 10 to 2/0 AWG copper conductors</li> <li>• Neutral and ground: 14 to 1/0 copper conductors</li> </ul> Always follow local code requirements for conductor sizing.
Altitude	Up to 3000 meters (9,842 feet)

### INTERNET CONNECTION OPTIONS

Integrated Wi-Fi	802.11b/g/n
Cellular	CELLMODEM-M1-06 4G based LTE-M1 cellular modem (included only with IQ Combiner 3C-ES). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)

### COMPLIANCE

Compliance, Combiner	UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

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

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



[pe.eaton.com](http://pe.eaton.com)

## Eaton general duty non-fusible safety switch

**DG222URB**

**UPC:**782113144238

### Dimensions:

- **Height:** 14.38 IN
- **Length:** 7.38 IN
- **Width:** 8.69 IN

**Weight:**9 LB

**Notes:**WARNING! Switch is not approved for service entrance unless a neutral kit is installed.

### Warranties:

- Eaton Selling Policy 25-000, one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

### Specifications:

- **Type:** Non-fusible, single-throw
- **Amperage Rating:** 60A
- **Enclosure:** NEMA 3R, Rainproof
- **Enclosure Material:** Painted galvanized steel
- **Fuse Configuration:** Non-fusible
- **Number Of Poles:** Two-pole
- **Number Of Wires:** Two-wire
- **Product Category:** General duty safety switch
- **Voltage Rating:** 240V

### Supporting documents:

- [Eatons Volume 2-Commercial Distribution](#)
- [Eaton Specification Sheet - DG222URB](#)

### Certifications:

- UL Listed

**Product compliance:** No Data





## ROCKIT

### COMPLETE RAIL-LESS RACKING SYSTEM

The RockIt system is the industry's premier rail-less PV racking system for composition shingle, tile, and metal roofs. Designed in conjunction with the needs of installers, RockIt quickly & easily installs with a single tool. Featuring an easy-to-position alignment slide and a top-down leveling system, RockIt is logistically intelligent with no need to ship or transport long rails. Components are available in a black finish that complements both commercial and residential applications. Conforms to UL 2703.

### FEATURES & BENEFITS

- Patented watertight technology
- Fully integrated bonding
- Top-down leveling system
- North-South adjustability
- Single tool install

### STREAMLINED INSTALLATION WITH MINIMAL ROOF PENETRATIONS



## ROCKIT

### COUPLING

The fast installing RockIt Coupling easily attaches to the module frame to bridge the gaps between modules.

### SKIRT

The sleek black Skirt installs first and acts as an alignment guide for the entire array. The Skirt End Cap does double duty as a skirt coupling device and an aesthetically-pleasing finishing touch.

### ROCKIT MOUNT

Featuring integrated bonding pins, the RockIt Mount connects to the Slide and can easily be positioned for fast installation. Features top-down leveling.

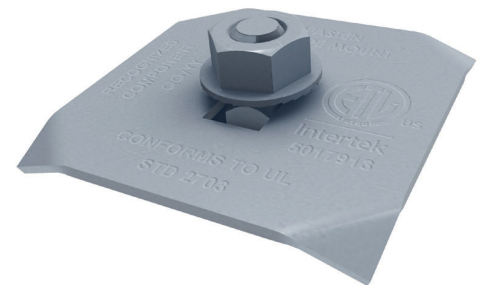


### ROCKIT SLIDE

Available in three variations, the RockIt Slide allows installation on composition shingle, tile, and metal roofs.

### FRAME MLPE MOUNT

Attaches and fully bonds MLPE's (Module Level Power Electronics) to the module frame with a single bolt clip.



## COMPATIBLE MODULES

The Rockit System has been tested and evaluated to UL 2703 for bonding, grounding, mechanical loading and fire classification, and may be used to ground and/or mount PV modules listed to UL 1703 or UL 61730. A list of approved modules is included below.

Unless otherwise noted, “xxx” refers to the module power rating and both black and silver frames are included in the certification.

\*Class A System fire rating with Type 1, 2, and 29 PV modules with no skirt required.

**NOTE:** Modules with flange widths shorter than 22mm cannot be installed in portrait.

### TYPE 1, 2 & 29 MODULES

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Adani</b>	Adani modules with 35 and 40mm frames ASX-Y-ZZ-xxx Where “X” can be B, M or P, “Y” can be 6 or 7, and “ZZ” can be blank, PERC, B-PERC, or AB-PERC
<b>AIONRISE</b>	Aionrise modules with 35 and 40mm frames AIONyyG1-xxx Where “yy” can be 60 or 72
<b>Aptos Solar</b>	Aptos modules with 35 and 40 mm frames DNA-yy-zzaa-xxx Where “yy” can be 108, 120 or 144; “zz” can be MF or BF; and “aa” can be 10, 23 or 26
<b>Astronergy Solar</b>	Astronergy modules with 35 and 40 mm frames CHSMbbyC/zz-xxx Where “bb” can be 60, 66, or 72; “yy” can be blank, 10 or 12; “C” can be M, M(BL), M-HC, P, P(BL) or P-HC ; and “zz” can be blank or HV
<b>Auxin</b>	Auxin modules with 40 mm frames AXN6M6YYMxxxZ Where “YY” can be 10 or 12; “Z” can be blank, A, B or C
<b>Axitec</b>	Axitec Modules with 30 and 35 mm frames AC-xxxY/aaZZ “Y” can be M, P, MH or MBT; and “aa” can be blank, 125 or 156; and “ZZ” can be 60S, 108V, 108VB, 120S, 120V or 120VB

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Bluesun Solar</b>	Bluesun modules with 30 and 35mm frames BSMxxxM-AAA Where “AAA” can be 60HPH or 72HBD
<b>Boviet</b>	Boviet modules with 35 and 40mm frames BVM66aaYY-xxxBcc Where “aa” can be 9, 10 or 12; “YY” is M, or P; and “B” can be blank, L or S; and “cc” can be blank, H, H-BF, H-HC or HC-BF
<b>Canadian Solar</b>	Canadian Solar modules with 35 and 40 mm frames CSbY-xxxZ Where “b” can be 1, 3 or 6; “Y” can be H, K, L, N, P, R, V or Y; and “Z” can be M, MS, M-SD, MS-HL, MS-SD, P, PX, or P-SD
<b>CertainTeed</b>	CertainTeed modules with 35 and 40mm frames CTxxxYZZ-AA Where “Y” can be M, HC; “ZZ” can be 00, 10, 11; and “AA” can be 04 or 06
<b>CSUN</b>	CSUN modules with 35 and 40 mm frames CSUNxxx-zzAbb Where “zz” is 60 or 72; and “A” is M or MM; “bb” is blank or 5BB
<b>Dehui</b>	Dehui modules with 35 and 40mm frames DH-MYYYY-xxx Where “YYY” can be 760, 772, 860, 872; and “Z” can be B or W
<b>ET Solar</b>	ET Solar modules with 35 and 40mm frames ET-YZZxxxAA Where “Y” can be P, L, or M; “ZZZ” can be 660, 660BH, 672, 672BH, or 754BH; and “AA” can be TB, TW, WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
<b>Freedom Forever</b>	Freedom Forever modules with 35mm frames FF-MPa-BBB-xxx Where “a” can be blank or 1
<b>Freevolt</b>	Freevolt modules with 35mm frames ECP-PVGRAF-144HC-xxx

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Hanwha Q CELLS</b>	Hanwha Q CELLS Modules with 32, 35 and 40mm frames aaYY-ZZ-xxx where "aa" can be Q, or B.; "YY" can be PLUS, PRO, PEAK, LINE PRO, LINE PLUS, PLUS DUO or PEAK DUO; and "ZZ" can be G3, G3.1, G4, G4.1, L-G2, L-G2.3, L-G3, L-G3.1, L-G3y, L-G4, L-G4.2, L-G4y, LG4.2/TAA, BFR-G3, BLK-G3, BFR-G3.1, BLK-G3.1, BFR-G4, BFR-G4.1, BFR G4.3, BLK-G4.1, G4/SC, G4.1/SC, G4.1/TAA, G4.1/MAX, BFR G4.1/TAA, BFR G4.1/MAX, BLK G4.1/TAA, BLK G4.1/SC, EC-G4.4, G5, G5/SC, G5/TS, BLK-G5, BLK-G5/SC, BLK-G5/TS, L-G5, L-G5.1, L-G5.2, L-G5.2/H, L-G5.3, G6, G6/SC, G6/TS, G6+, G6+/TS, BLK-G6, G7, BLK-G6+, BLK-G6+/AC, BLK-G6+/HL, BLK-G6+/SC, BLK-G6/TS, BLK-G6+/TS, BLK-G7, G7.2, G8, BLK-G8, G8+, BLK-G8+ L-G7, L-G7.1, L-G7.2, L-G7.3, BLK ML-G9, ML-G9+, BLK ML-G9+, ML-G9, BLK-G10+, BLK-G10+/AC, ML-G10, BLK ML-G10, ML-G10+, BLK ML-G10+, ML-G10.a, BLK ML-G10.a+ or BLK ML-G10.a+
<b>Heliene</b>	Heliene modules with 35 and 40 mm frames YYZZxxxA Where "YY" can be 60, 72, 108 or 120; "ZZ" can be HC, M or P; and "A" can be blank, M10-SL, M10-SL-BLK or M10-SL-Bifacial
<b>HT-SAAE</b>	HT-SAAE modules with 35 and 40 mm frames HTyy-aaaZ-xxx Where "yy" can be 60 or 72, "aaa" can be 156 or 166, "Z" can be M, M(V), M(S), M(VS), M-C, M(V)-C, P or P(V)
<b>Hyperion</b>	Hyperion modules with 35mm frames HY-DH108P8-xxx
<b>Hyundai</b>	Huyn dai modules with 32, 35 and 40 mm frames HiY-SxxxZZ Where "Y" can be A or S; "S" can be M or S; and "ZZ" can be HG, KI, MF, MG, PI, SG, RG, RG (BK), TG or YH(BK) or XG(BK)
<b>Itek</b>	Itek Modules with 40 mm frames IT-xxx-YY "YY" can be blank, HE, or SE
<b>JA Solar</b>	JA Solar modules with 30, 35 and 40mm frames JAyyzz-bbwww-xxx/aa Where "yy" can be M, P, M6 or P6; "zz" can be blank, (K), (L), (R), (V), (BK), (FA), (SE), (TG), (FA)(R), (K)(SE), (K)(TG), (L)(BK), (L)(TG), (R)(BK), (R)(TG), (V)(BK), (BK)(TG), or (L)(BK)(TG); "bb" can be 54, 60 or 72; "www" can be blank, D30, S01, S02, S03, S09, S10, S17, S30 or S31; and "aa" can be MR, SI, SC, PR, RE, 3BB, 4BB, 4BB/RE, 4BB/1500V, PR/1500V, 5BB

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Jinko</b>	Jinko modules with 35 and 40 mm frames JKMYxxxZZ-aa Where "Y" can either be blank or S; "ZZ" can be M, P, PP, or -V; and "aa" can be blank, 60, 60B, 60H, 60HB, 60L, 60BL, 60HL, 60HBL, 60-J4, 60B-J4, 60B-EP, 60(Plus), 60-V, 60-MX, 72H, 72H-V, 72HL-V, 72HBL-V, 72L-V, 6RL3, 6RL3-B or 6TL3-B
<b>LG</b>	LG modules with 40mm frames LGxxxzyz-bb "y" can be A, E, M, N, Q, or S; "a" can be A, 1, 2 or 3; "z" can be C, K or W; and "bb" can be G4, A5, A6, B6, E6, E6.AW5, L5, N5, v5, V6
<b>Longi</b>	Longi modules with 35 and 40 mm frames LRa-YYZZ-xxxM Where "a" can be 4, 5 or 6; "YY" can be 54, 60 or 66 "ZZ" can be blank, BK, PB, PE, PH, HPB, or HPH
<b>Maxeon</b>	Maxeon modules with 35, 40 and 46mm frames SPR-AAAY-xxx-zzz Where "AAA" can be MAX or X; "Y" can be 3, 5, 6, 21 or 22; and "zzz" can be R, BLK or COM
<b>Meyer Burger</b>	Meyer Burger Modules with 35mm frames Meyer Burger Glass
<b>Mission Solar</b>	Mission Solar modules with 35, 40 mm frames YYYbb-xxxZZaa Where "YYY" can be MSE or TXS; "bb" can be blank, 6 or 60A; "ZZ" can be blank, SO, SQ, SX, 120 or 144; and "aa" can be blank, BB, BW, 4J, 4S, 5K, 5R, 5T, 8T, 8K, 9R or 9Z
<b>Next Energy Alliance</b>	Next Energy Alliance modules with 35 and 40mm frames yyNEA-xxxZZ where "yy" can be blank or US; "ZZ" can be M, MB or M-60
<b>NE Solar</b>	NE Solar modules with 30, 35 and 40mm frames NESExxx-zzMH-yy Where "zz" can be 54 or 60; and "yy" can be M6 or M10
<b>Panasonic (HIT)</b>	Panasonic modules with 40 mm frames VBHNxxxYYzzA "YY" can be either SA or KA; "zz" can be either 03, 04, 17 or 18; and "A" can be blank, E or G

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Panasonic (EverVolt)</b>	Panasonic modules with 30 mm frames EVPVxxxA Where "A" can be blank or H, K or PK
<b>Philadelphia Solar</b>	Philadelphia modules with 35 and 40 mm frames PS-YzzAA-xxx Where "Y" can be M or P; "zz" can be 60, 72 or 144; and "AA" can be blank, (BF), (HC) or (HCBF)
<b>Phono Solar</b>	Phono Solar modules with 30 and 35 mm frames PSxxxY-ZZ/A Where "Y" can be M4, M4H, M5GF, M5GFH, M6, M6H, M8GF or M8GFH; "ZZ" can be 18, 20 or 24; and "A" can be TH, UHB, VH or VHB
<b>Prism Solar</b>	Prism Solar modules with 35mm frames PST-xxxW-M72Y Where "Y" can be H, HB or HBI
<b>REC</b>	REC modules with 30 and 38 mm frames RECxxxYYZZ Where "YY" can be AA, M, NP, NP2, PE, PE72, TP, TP2, TP2M, TP2SM, TP2S, TP3M or TP4; and "ZZ" can be blank, Black, BLK, BLK2, SLV, 72, Pure or Pure-R
<b>Recom</b>	Recom modules with 35 and 40 mm frames RCM-xxx-6yy Where "yy" can be MA, MB, ME or MF
<b>Renesola</b>	ReneSola 60-cell modules with 40 mm frames JCxxxY-ZZ "Y" can be F, M or S; and "ZZ" can be Ab, Ab-b, Abh, Abh-b, Abv, Abv-b, Bb, Bb-b, Bbh, Bbh-b, Bbv, Bbv-b, Db, or Db-b
<b>S-Energy</b>	S-Energy modules with 35 and 40mm frames SABB-CCYY-xxxZ Where "A" can be C, L or N; "BB" can be blank, 20, 40 or 45; "CC" can be blank, 60 or 72; "YY" can be blank, MAE, MAI, MBE, MBI, MCE or MCI; and "Z" can be V, M-10, P-10 or P-15
<b>Seraphim USA</b>	Seraphim modules with 35 and 40 mm frames SRP-xxx-YYY-ZZ Where "YYY" can be 6MA, 6MB, 6PA, 6PB, or BMD; "ZZ" is blank or HV

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>SEG Solar</b>	SEG Solar Modules with 35 and 40mm frames SEG-xxx-YYY-ZZ Where "YYY" can be BMB, BMD or 6MA; "ZZ" can be BB, BW, HV, TB, WB or WW
<b>Shinsung E&amp;G</b>	Shinsung Modules with 35mm frames SSVxxx-144MH
<b>Silfab</b>	Silfab Modules with 35 and 38 mm frames SY-Y-Z-xxxAb Where "YY" can be IL, SA, LA, SG or LG; "Z" can be blank, M, P, or X; "A" can be blank, B, H, M, N; and "b" can be A, C, C+, G, K, L, N, T, U or X
<b>Solar4America</b>	Solar4America modules with 35 and 40mm frames S4Axxx-72yy Where "yy" can be MH5 or MH5BB
<b>Solarever</b>	Solarever modules with 35mm frames SE-zzz*yy-xxxM-aaa Where "zzz" can be 166 or 182; "yy" can be 83 or 91; and "aaa" can be 108 or 144
<b>Solaria</b>	Solaria modules with 35 and 40 mm frames PowerA-xxxR-ZZ Where "A" can be XT or X; and "ZZ" can be blank, AC, BD, BX, BY, PD, PL, PX, PZ, WX or WZ
<b>SolarTech</b>	SolarTech modules with 40 mm frames AAA-xxx Where "AAA" can be PERCB-B, PERCB-W, HJTb-B or HJTb-W
<b>Sonali</b>	Sonali Modules with 35mm frames SS-M-xxx
<b>Star Solar</b>	Star Solar modules with 35mm frames Star-xxxYYY-ZZZ Where "YYY" can be M60H or M60HB; and "ZZZ" can be blank or M10
<b>Sunmac Solar</b>	Sunmac modules with 30 and 35mm frames SMxxxMaaaZZ-BB Where "aaa" can be 660 or 754; and "ZZ" can be NH or SH
<b>Sunpower</b>	Sunpower modules with 35 and 40 mm frames SPR-A-xxx-YY Where "A" can be A or M; and "YY" can be blank, COM, G-AC, BLK-G-AC, H-AC or BLK-H-AC
<b>Sunpreme</b>	Sunpreme Modules with 40mm frames GxB-xxxT



MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Sunspark</b>	Sunspark modules with 40 mm frames SYY-xxxZ-A Where "YY" can be MX or ST; and "Z" can be M, MB, M3, M3B, P or W; and "A" can be 60 or 72
<b>Suntech</b>	Suntech Modules with 35mm frames STPxxxS-zz/aa Where "zz" can be B60 or B72; and "aa" can be Vnh or Wnhb
<b>Talesun</b>	Talesun modules with 30mm frames TD6y72M-xxx Where "y" can be G or I
<b>Tesla</b>	Tesla modules with 40 mm frames TxxxY Where "Y" can be H or S
<b>Trina</b>	Trina modules with 30, 35 and 40 mm frames TSM-xxxYYZZ "YY" can be DD05, DD05A, DD06, DE05, DE09, DX05A, DE06X, PA05, PC05, PD05, PE14 or PX05; and "ZZ" can be blank or A, .05, .05(II), .08, A.05, A.08, A(II), A.05(II), A.08(II), C.05, C.07, C.05(II), C.07(II), H, H.05, H.08, H.05(II), H.08(II), M, M(II) or M.05(II)
<b>Universal</b>	Universal Solar Modules with 35mm frames UNI-xxx-yyyZZZ-aa Where "yyy" can be 108, 120 or 144; "ZZZ" can be M, MH or BMH; and "aa" can be blank, BB or DG
<b>URE</b>	URE modules with 35 mm frames DyMxxxaa Where "D" can be D or F, "y" can be A, B, 6 or 7; "M" can be K or M; and "aa" can be C8G, H3A, H4A, H8A, E7G-BB or MFG-BB
<b>Vikram</b>	Vikram solar modules with 35 and 40 mm frames XVSyy.ZZ.AAA.bb Where "X" can be blank, Paradea, Prexos or Somera; "yy" can be MDH, MDHT, MH or MHBB; "ZZ" can be 60 or 72; "AAA" is the module power rating; and "bb" can be 05
<b>VSUN</b>	VSUN modules with 30, 35 and 40 mm frames VSUNxxx-YYz-aa Where "YY" can be 108 or 120; "z" can be BMH or M; and "aa" can be blank, BB or BW
<b>Waaree</b>	Waaree modules with 40mm frames WSyy-xxx where "yy" can be blank, M or MB

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 1, 2 & 29 PV MODULES*
<b>Yingli</b>	Yingli modules with 35 and 40 mm frames YLxxxZ-yy Where "Z" can be D or P; "yy" can be 29b, 30b, 34d, 35b, 36b or 40d
<b>Yotta</b>	Yotta modules with 30mm frames YSM-Bxxx-06-72-1
<b>Zeus</b>	Zeus Solar Modules with 40mm frames ZxxxM-HB
<b>ZN Shine</b>	ZN Shine modules with 35mm frames ZXM6-AAA-xxx/M Where "AAA" can be 72, NH120 or NHDB144

**TYPE 4 & 5 MODULES**

\*\*Class A System fire rating with Type 4 and 5 modules with south edge skirt required. Class B System fire rating with Type 4 and 5 modules, no skirt required. Any roof-to-module gap is permitted. This rating is applicable with any roof attachment.

MANUFACTURER	LIST OF UL 2703 APPROVED TYPE 4, & 5 PV MODULES**
<b>Bluesun Solar</b>	Bluesun modules with 35mm frames BSMxxxM10-54HPH
<b>Meyer Burger</b>	Meyer Burger Modules with 35mm frames Meyer Burger Black or White
<b>Talesun</b>	Talesun modules with 30mm frames TP7G54M(H)xxx



May 16, 2022

EcoFasten Solar LLC  
4141 W Van Buren St, Ste 2  
Phoenix, AZ 85009  
TEL: (877) 859-3947

Attn.: Eco Fasten Solar LLC - Engineering Department

Re: Report # 2015-05884HG.07.01 – EcoFasten - RockIt System for Gable and Hip Roofs  
Subject: Engineering Certification for the State of North Carolina

PZSE, Inc. – Structural Engineers has provided engineering and span tables for the EcoFasten - RockIt System, as presented in PZSE Report # 2015-05884HG.07.01, "Engineering Certification for the EcoFasten - RockIt System for Gable and Hip Roofs". All information, data, and analysis therein are based on, and comply with, the following building codes and typical specifications:

- Building Codes:
1. ASCE/SEI 7-10, 7-16, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers
  2. 2015 & 2018 International Building Code
  3. 2015 & 2018 International Residential Code
  4. AC428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES
  5. Aluminum Design Manual 2015 & 2018, by The Aluminum Association, Inc.
  6. ANSI/AWC NDS-2015 & 2018, National Design Specification for Wood Construction, by the American Wood Council

Design Criteria:

Risk Category II  
Seismic Design Category = A - E  
Exposure Category = B, C & D  
Basic Wind Speed (ultimate) per ASCE 7-16 = 90 mph to 180 mph  
Ground Snow Load = 0 to 60 (psf)

This letter certifies that the loading criteria and design basis for the EcoFasten - RockIt System Span Tables are in compliance with the above codes.

If you have any questions on the above, do not hesitate to call.

Prepared by:  
PZSE, Inc. – Structural Engineers  
Roseville, CA

DIGITALLY SIGNED

