

# PHOTOVOLTAIC SYSTEM

## CODES:

THIS PROJECT COMPLIES WITH THE FOLLOWING:  
 2018 INTERNATIONAL BUILDING CODE (IBC)  
 2018 INTERNATIONAL RESIDENTIAL CODE (IRC)  
 2018 INTERNATIONAL MECHANICAL CODE (IMC)  
 2018 INTERNATIONAL PLUMBING CODE (IPC)  
 2018 INTERNATIONAL FUEL GAS CODE (IFGC)  
 2018 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)  
 2018 INTERNATIONAL EXISTING BUILDING CODE (IEBC)  
 2018 INTERNATIONAL SWIMMING POOL AND SPA CODE (ISPSA)  
 2020 NATIONAL ELECTRICAL CODE (NEC)  
 AS ADOPTED BY HARNETT COUNTY (NC)

## CONSTRUCTION NOTES:

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

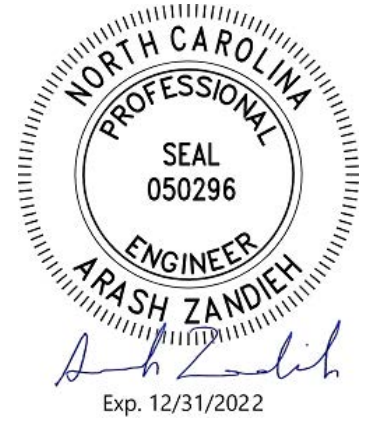
PHOTOVOLTAIC SYSTEM GROUND WILL BE TIED INTO EXISTING GROUND AT MAIN SERVICE FROM DC DISCONNECT/INVERTER AS PER 2020 NEC SEC 250.166(A).

SOLAR PHOTOVOLTAIC SYSTEM EQUIPMENT WILL BE INSTALLED IN ACCORDANCE WITH REQUIREMENTS OF ART. 690 OF THE 2020 NEC

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

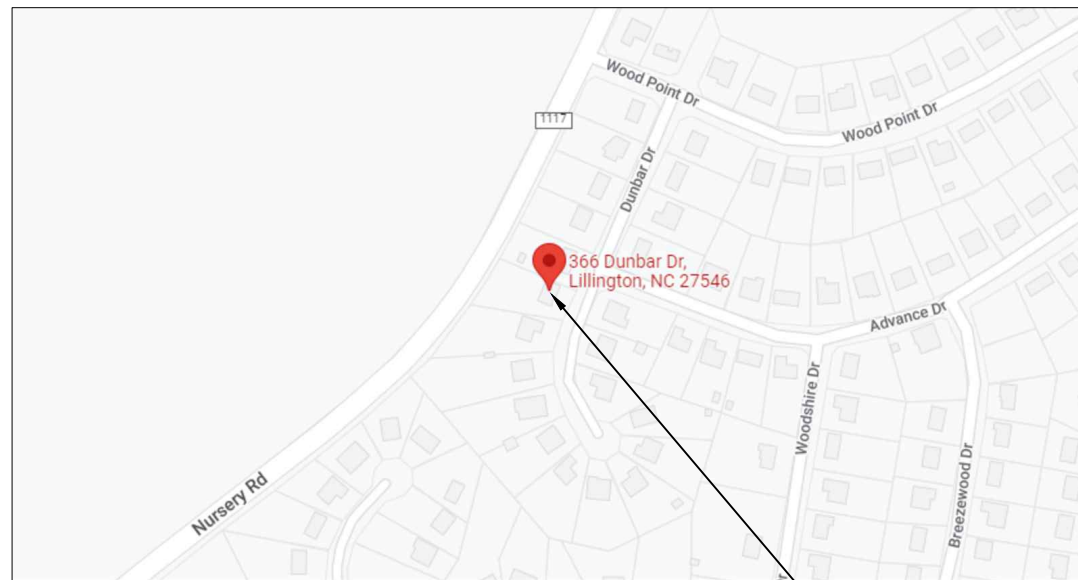
UTILITY COMPANY WILL BE NOTIFIED PRIOR TO ACTIVATION OF THE SOLAR PV SYSTEM

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



6/14/2022

## VICINITY MAP:



SITE LOCATION



**CLIENT:**  
 ANDREW REINHEIMER  
 366 DUNBAR DR, LILLINGTON, NC 27546  
 AHJ: HARNETT COUNTY (NC)  
 UTILITY: SOUTH RIVER EMC  
 PHONE: 8082840969

**SYSTEM:**  
 SYSTEM SIZE (DC): 32 X 400 = 12.800 kW  
 SYSTEM SIZE (AC): 9.280 kW @ 240V  
 MODULES: 32 X HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 400, 400W  
 MICROINVERTERS: 32 X ENPHASE IQ7PLUS-72-2-US [240V]

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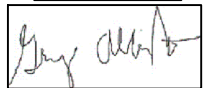
PV-1	SITE LOCATION
PV-2	SITE PLAN
PV-2A	ROOF PLAN WITH MODULES LAYOUT
PV-2B	STRUCTURAL CALCULATIONS
PV-3	MOUNTING DETAILS
PV-4	THREE LINE DIAGRAM
PV-5	CONDUCTOR CALCULATIONS
PV-6	EQUIPMENT & SERVICE LIST
PV-7	LABELS
PV-7A	SITE PLACARD
PV-8	MICROINVERTER CHART
PV-9	SAFETY PLAN
PV-10	SAFETY PLAN
APPENDIX	MANUFACTURER SPECIFICATION SHEETS

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: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-1
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**LEGEND:**

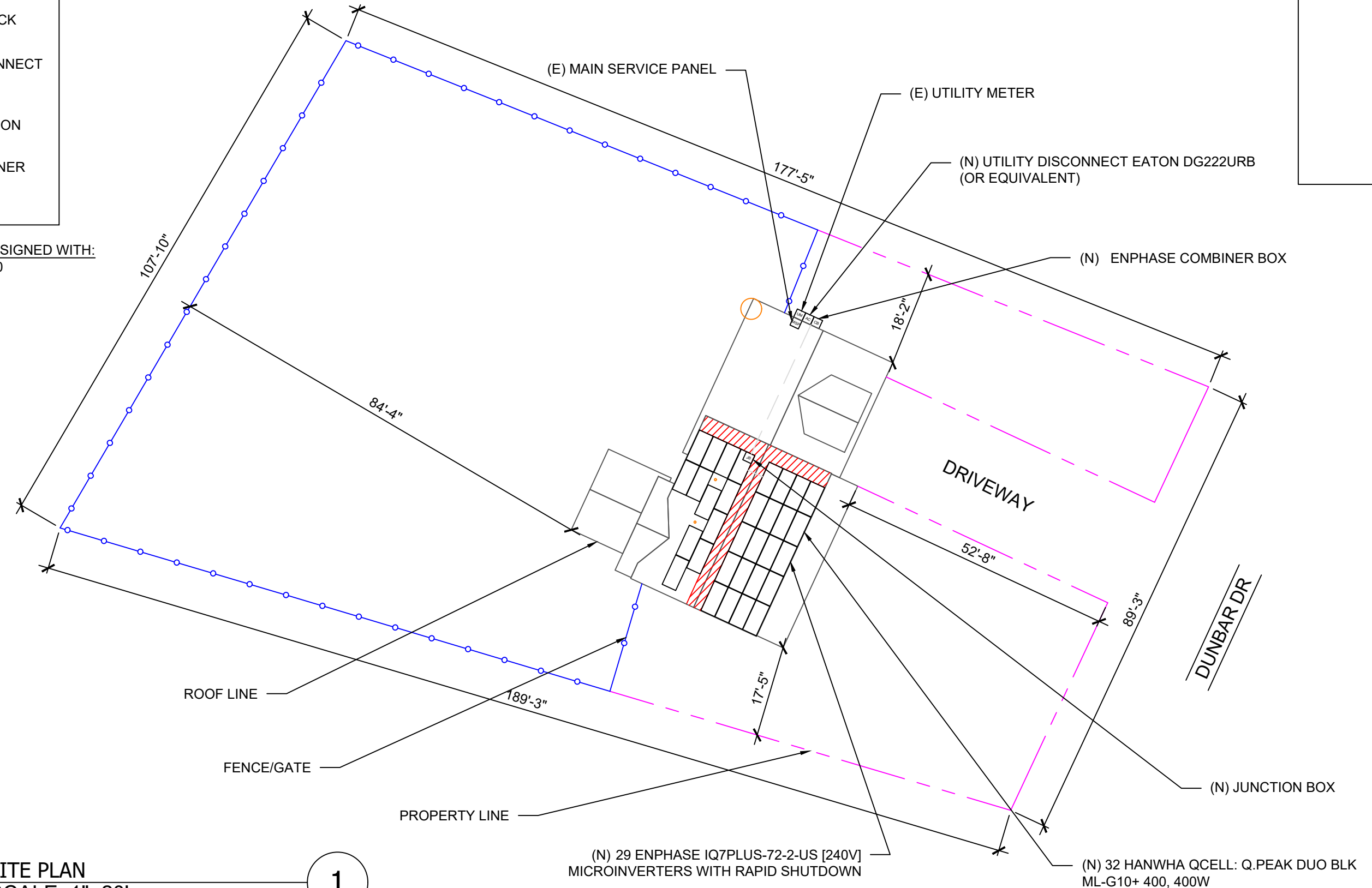
-  OBSTRUCTION
-  PIPE VENT
-  MODULES
-  CONDUIT
-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  COMBINER BOX

LOCKABLE DISCONNECT, WITHIN 5' OF THE METER, MUST BE PROVIDED THAT IS READILY ACCESSIBLE AT ALL TIMES TO THE ASSOCIATION'S PERSONNEL.



6/14/2022

THIS SYSTEM DESIGNED WITH:  
WIND SPEED: 130  
SNOW LOAD: 15



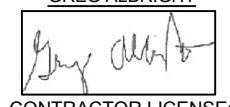
ROOF AREA: 2530 SQ FT

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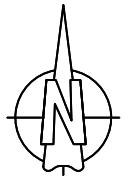
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DUO BLK ML-G10+ 400, 400W  
MICROINVERTERS: 32 X ENPHASE  
IQ7PLUS-72-2-US [240V]

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


SITE PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	PV-2



**SITE PLAN**  
SCALE: 1"=20'

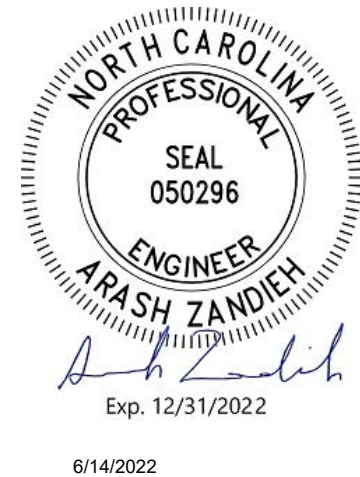
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**LEGEND:**

-  OBSTRUCTION
-  PIPE VENT
-  MODULES
-  CONDUIT
-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  COMBINER BOX

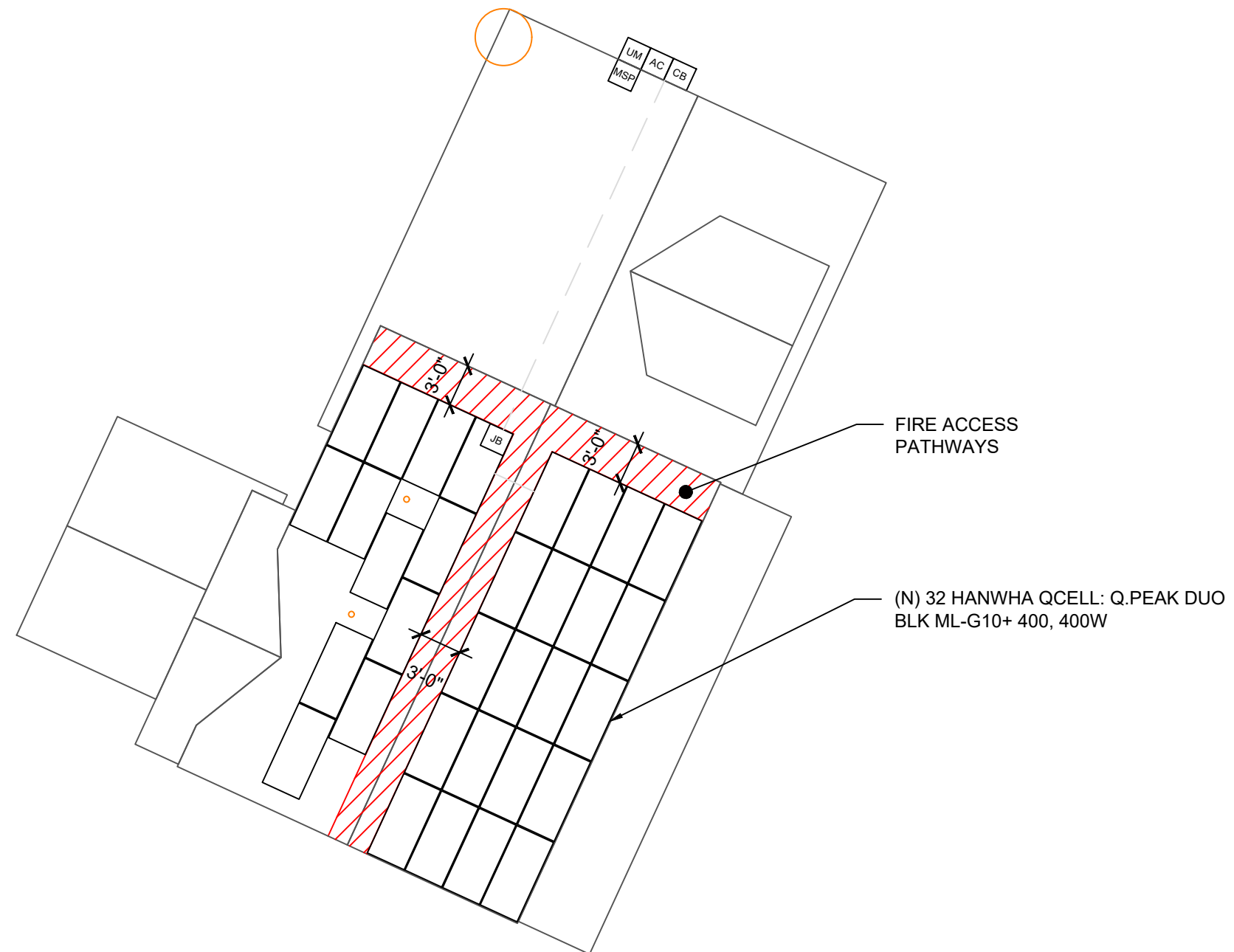
**MODIFIED SETBACKS PROPOSED AT RIDGE:**  
 TOTAL ARRAY AREA = 676.48 SF  
 TOTAL ROOF AREA = 2530 SF  
 TOTAL ARRAY AREA AS A % TO ROOF AREA = 26.74%  
 26.74% < 33%

LOCKABLE DISCONNECT, WITHIN 5' OF THE METER, MUST BE PROVIDED THAT IS READILY ACCESSIBLE AT ALL TIMES TO THE ASSOCIATION'S PERSONNEL.



6/14/2022

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ROOF AREA: 2530 SQ FT

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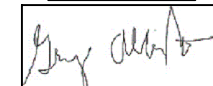
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 MICROINVERTERS: 32 X ENPHASE IQ7PLUS-72-2-US [240V]

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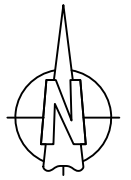


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**ROOF PLAN**  
 SCALE: 1"=10'

1

**NOTES:**

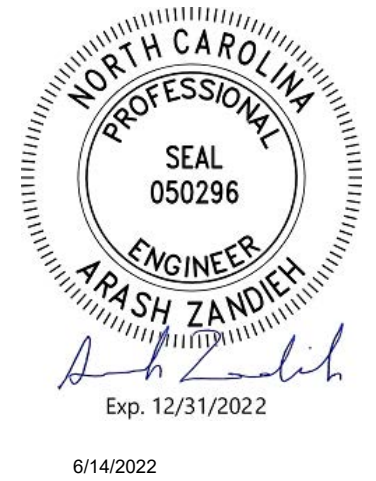
1. EMT CONDUIT ATTACHED TO THE ROOF USING CONDUIT MOUNTS
2. ATTACHED CLAMPS AT 25% FROM THE EDGE AND 50% FROM THE CENTER OF THE MODULES
3. JUNCTION BOX IS MOUNTED TO THE RAIL.

ROOF PLAN WITH MODULES LAYOUT

JOB NO: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-2A
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## ROOF DETAILS:

TOTAL ROOF AREA: 2530 SQ FT  
 ARRAY COVERAGE: 26.74%  
 SYSTEM DISTRIBUTED WEIGHT: 2.29 LBS  
 SFM INFINITY \ ROCKIT MICRORAIL POINT-LOAD: 12.94 LBS



ROOF AREA STATEMENT						
ROOF	MODULE QUANTITY	ROOF PITCH	ARRAY PITCH	AZIMUTH	ROOF AREA	ARRAY AREA
1	12	34°	34°	295°	515 SQ FT	253.68 SQ FT
2	20	34°	34°	115°	544 SQ FT	422.8 SQ FT

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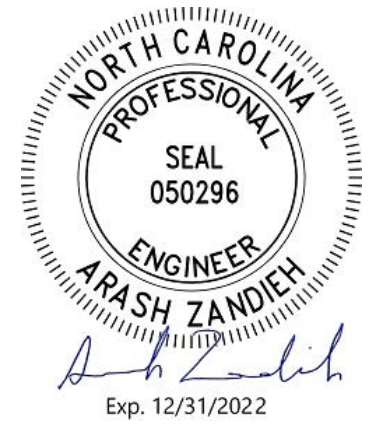
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ROOF DETAILS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	PV-2B

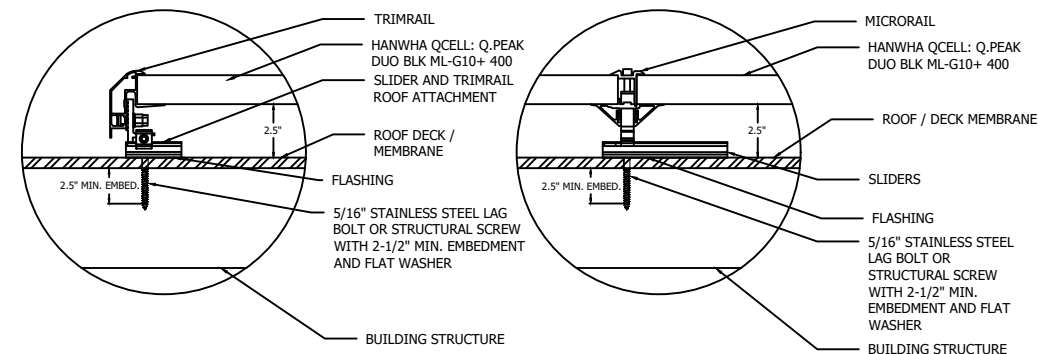
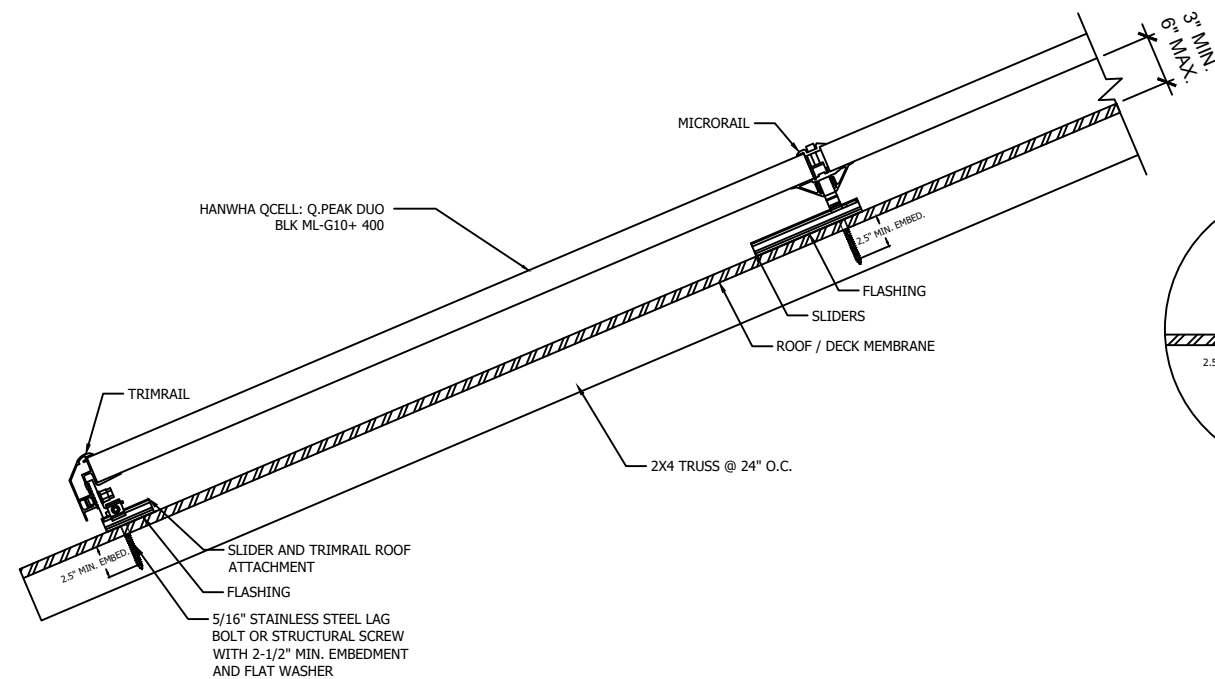
MAX ATTACHMENT SPAN - 4' FULLY STAGGERED



6/14/2022

PARTIAL ROOF FRAMING PLAN

Scale: NTS



SOLAR PV ARRAY SECTION VIEW

Scale: NTS

ATTACHMENT DETAIL

Scale: NTS

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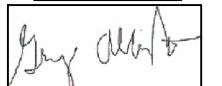
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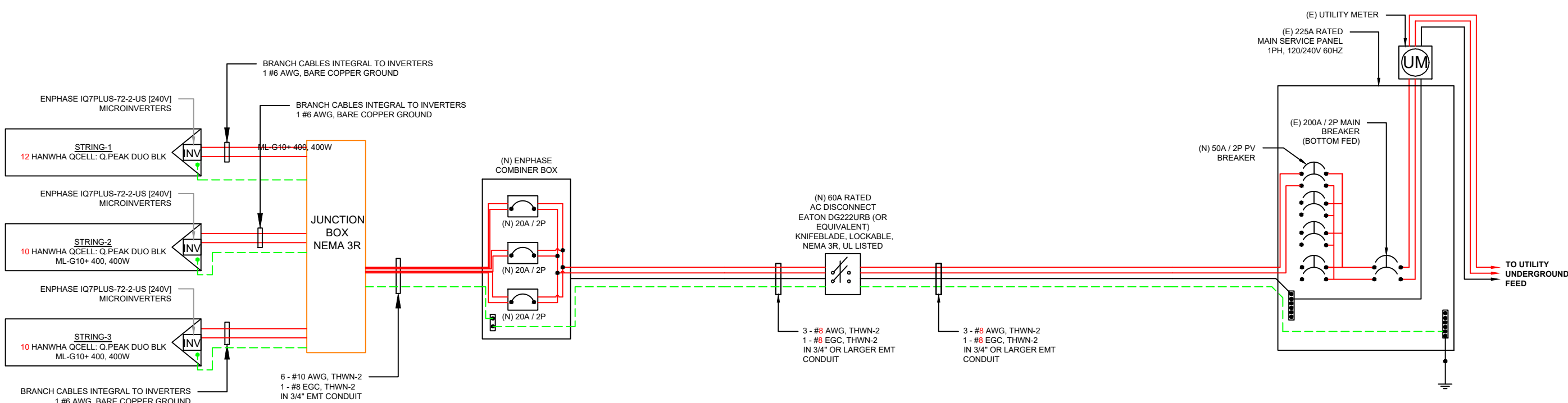
GREG ALBRIGHT



CONTRACTOR LICENSE:  
ELECTRICAL CONTRACTOR U.34043

MOUNTING DETAILS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	PV-3

**BACKFEED BREAKER SIZING**  
 MAX. CONTINUOUS OUTPUT 38.72A @ 240V  
 38.72 X 1.25 = 48.40AMPS 50A BREAKER - OK  
 SEE 705.12 OF 2020 NEC  
 225 X 1.20 = 270  
 270 - 200 = 70A ALLOWABLE BACKFEED



CONNECT TO EXISTING UFER

NOTE:  
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**freedom**  
FOREVER

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GREG ALBRIGHT

*Greg Albright*

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THREE LINE DIAGRAM

JOB NO: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-4
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WIRE SCHEDULE													
RACEWAY #	EQUIPMENT			WIRE LOCATION	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	ROOF / FREE-AIR	2	10	40	13.93	1	40.00	17.41	
2	AC	MICROINVERTER	TO	JUNCTION BOX	ROOF / FREE-AIR	2	10	40	14.52	1	40.00	18.15	
3	AC	JUNCTION BOX	TO	ENPHASE COMBINER BOX	EXTERIOR WALL	6	10	40	14.52	1	32.00	18.15	
4	AC	ENPHASE COMBINER BOX	TO	AC DISCONNECT	EXTERIOR WALL	3	8	55	38.72	1	55.00	48.40	
5	AC	AC DISCONNECT	TO	POI	EXTERIOR WALL	3	8	55	38.72	1	55.00	48.40	

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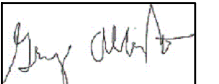
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CONDUCTOR AMPACITY CALCULATIONS IN ACCORDANCE WITH NEC 690.8.

CONDUCTOR CALCULATIONS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	PV-5

### BREAKER SIZES:

50A PV BREAKER
20A PV BREAKER
20A PV BREAKER
20A PV BREAKER

### SERVICE LIST:

NONE

### MATERIAL LIST:

QTY.	PART	PART #	DESCRIPTION
32	MODULES	PV-111-400W-2	HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 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)
32	MICROINVERTER(S)	120-011	ENPHASE IQ7PLUS-72-2-US [240V] UL 62109-1 LISTED MICROINVERTER W/ PV RAPID SHUT DOWN EQUIPMENT
1	ENVOY	160-100	"ENPHASE AC COMBINER W/ ENVOY PCB, 80A"
37	Q CABLE	160-106	"ENPHASE, Q CABLE PORTRAIT FOR 60/72 CELL"
37	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)"
256	CLIP	160-108	ENPHASE TIE WRAPS / CABLE CLIPS
8	SEAL	160-107	ENPHASE SEALING CAPS FOR Q CABLE
4	TERMINATOR	160-109	ENPHASE TERMINATOR
1	DISCONNECT	261-526	ENPHASE DISCONNECT TOOL
1	AC DISCONNECT	321-060	60A RATED 240VAC NEMA 3R UL LISTED
120	ROOF ATTACHMENT 1	261 -602	SFM INFINITY \ ROCKIT MICRORAIL
23	SFM TRIM 1	241-253	FLASHKIT SFM / ROCK-IT TRIM COMP DARK
61	SFM SLIDER 1	261-603	FLASHKIT SFM / ROCK-IT SLIDER COMP DARK
18	BONDING CLAMP 1	221-100	N/S BONDING CLAMP
7	BONDING CLAMP 1	241-404	TRIM BONDING CLAMP
34	MOUNT ASSEMBLY 1	241-405	MLPE MOUNT ASSY
19	SFM SPLICE 1	261-604	SFM / ROCK-IT SPLICE
5	SFM ATTACHED SPLICE 1	211-101	ATTACHED SPLICE 8 INCH
27	TRIMRAIL 1	261-606	TRIMRAIL UNIV CLIP W/ HDW
8	TRIM SPLICE 1	261-605	TRIM SPLICE DRK
14	TRIMRAIL 1	211-115	TRIMRAIL UNIV DRK
32	GROUND LUG 1	260-585	ILSCO GROUND LUG
32	TRIM END CAPS 1	221-200	UNIRAC SFM / ROCK-IT TRIM END CAPS

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### EQUIPMENT & SERVICE LIST

JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	PV-6



**MAIN PHOTOVOLTAIC SYSTEM DISCONNECT**  
690.13(B)

**DO NOT DISCONNECT UNDER LOAD**  
NEC 690.15 (B) & NEC 690.33(D)(2)

**WARNING**  
SINGLE 120-VOLT SUPPLY  
DO NOT CONNECT  
MULTIWIRE BRANCH CIRCUITS  
NEC 710.15(C) & 692.9 (C)

**WARNING DUAL POWER SOURCE**  
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM  
NEC 705.12(D) & NEC 690.59

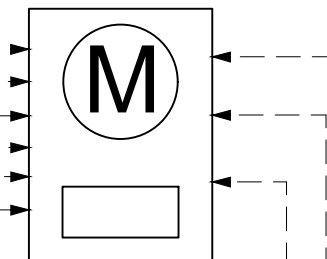
**WARNING**  
TURN OFF PHOTOVOLTAIC  
AC DISCONNECT PRIOR TO  
WORKING INSIDE PANEL  
NEC 110.27(C) & OSHA 1910.145(F)(7)

**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION  
706.15(C)(4) & 690.13(B)

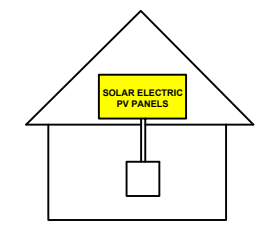
**WARNING**  
THIS EQUIPMENT FED BY  
MULTIPLE SOURCES:  
TOTAL RATING OF ALL OVERCURRENT  
DEVICES EXCLUDING MAIN POWER  
SUPPLY SHALL NOT EXCEED  
AMPACITY OF BUSBAR  
NEC 705.12(B)(3)(3)

**WARNING**  
THE DISCONNECTION OF THE  
GROUNDED CONDUCTOR(S)  
MAY RESULT IN OVERVOLTAGE  
ON THE EQUIPMENT  
NEC 690.31(E)

**RAPID SHUTDOWN SWITCH FOR  
SOLAR PV SYSTEM**  
690.56(C)(3)



**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  
IFC 605.11.3.1(1) & 690.56(C)



**CAUTION**  
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED  
NEC 705.12(D) & NEC 690.59

**WARNING**  
POWER SOURCE OUTPUT  
CONNECTION. DO NOT  
RELOCATE THIS  
OVERCURRENT DEVICE.  
NEC 705.12(C) & NEC 690.59

**WARNING**  
ARC FLASH AND SHOCK HAZARD  
APPROPRIATE PPE REQUIRED  
24 INCH FLASH HAZARD BOUNDARY  
3 CALCMF2 FLASH HAZARD AT 18 INCHES  
480 VAC SHOCK HAZARD WHEN COVER IS REMOVED  
42 INCH LIMITED APPROACH  
12 INCH RESTRICTED APPROACH - 500 V CLASS 00 GLOVES  
1 INCH PROHIBITED APPROACH - 500 V CLASS 00 GLOVES  
LOCATION: 360 DUNBAR DR, LILLINGTON, NC 27546

**PHOTOVOLTAIC  
AC DISCONNECT**  
NEC 690.13(B)

**PHOTOVOLTAIC AC DISCONNECT**  
RATED AC OUTPUT CURRENT: **38.72A**  
NOMINAL OPERATING AC VOLTAGE: **240V**  
NEC 690.54

**WARNING DUAL POWER SOURCE**  
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM  
NEC 705.12(D) & NEC 690.59

**SOLAR PV DC CIRCUIT**  
EVERY 10' ON CONDUIT AND ENCLOSURES  
NEC 690.31(O)(2)

**PHOTOVOLTAIC POWER SOURCE**  
EVERY 10' ON CONDUIT AND ENCLOSURES  
NEC 690.31(D)(2)

MAXIMUM VOLTAGE **60** V  
MAXIMUM CIRCUIT CURRENT **15** A  
MAX DC-DC CONVERTER  
OUTPUT CURRENT **N/A** A

**NOTES:**

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

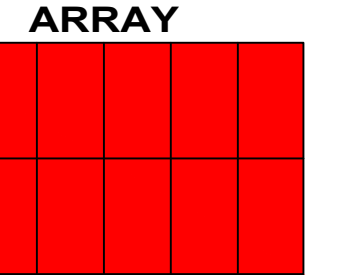
**PHOTOVOLTAIC  
DC DISCONNECT**  
NEC 690.13(B)

**MAXIMUM DC VOLTAGE  
OF PV SYSTEM**  
NEC 690.53

**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION  
DC VOLTAGE IS ALWAYS PRESENT  
WHEN SOLAR MODULES  
ARE EXPOSED TO SUNLIGHT  
706.15(C)(4) & 690.13(B)

**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION  
706.15(C)(4) & 690.13(B)

**WARNING**  
TURN OFF PHOTOVOLTAIC  
AC DISCONNECT PRIOR TO  
WORKING INSIDE PANEL  
NEC 110.27(C) & OSHA 1910.145(F)(7)



NEC 690.31(G)(3) & (4)

CLIENT:  
ANDREW REINHEIMER  
366 DUNBAR DR, LILLINGTON, NC 27546  
AHJ: HARNETT COUNTY (NC)  
UTILITY: SOUTH RIVER EMC  
PHONE: 8082840969

SYSTEM:  
SYSTEM SIZE (DC): 32 X 400 = 12,800 kW  
SYSTEM SIZE (AC): 9,280 kW @ 240V  
MODULES: 32 X HANWHA QCELL: Q.PEAK  
DUO BLK ML-G10+ 400, 400W  
MICROINVERTERS: 32 X ENPHASE  
IQ7PLUS-72-2-US [240V]

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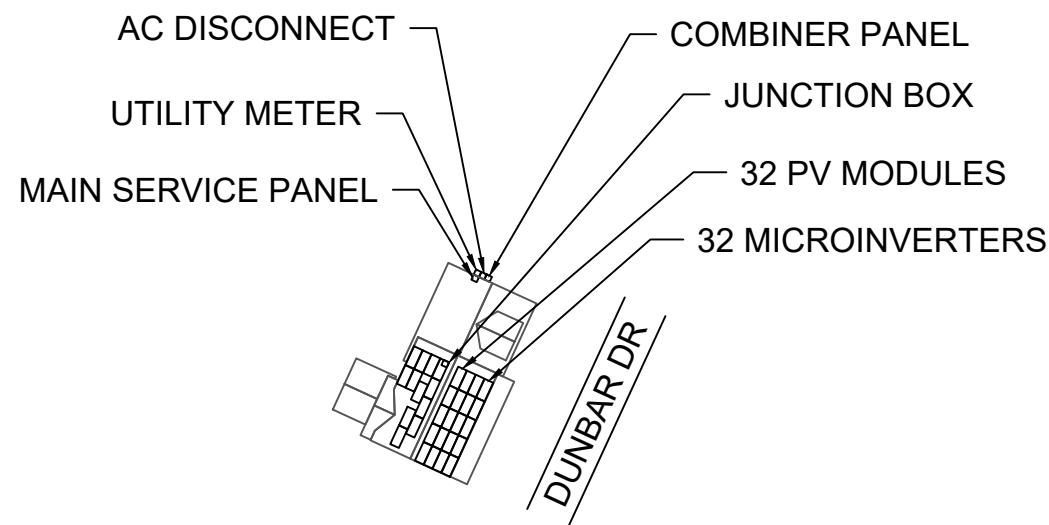
**freedom**  
FOREVER  
FREEDOM FOREVER LLC  
415 INDUSTRIAL CT., GREER, SC 29651  
Tel: (800) 385-1075

GREG ALBRIGHT  
  
CONTRACTOR LICENSE:  
ELECTRICAL CONTRACTOR U.34043

LABELS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	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



**CLIENT:**  
 ANDREW REINHEIMER  
 366 DUNBAR DR, LILLINGTON, NC 27546  
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 MICROINVERTERS: 32 X ENPHASE IQ7PLUS-72-2-US [240V]

REVISIONS		
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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 PLACARD**

JOB NO: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-7A
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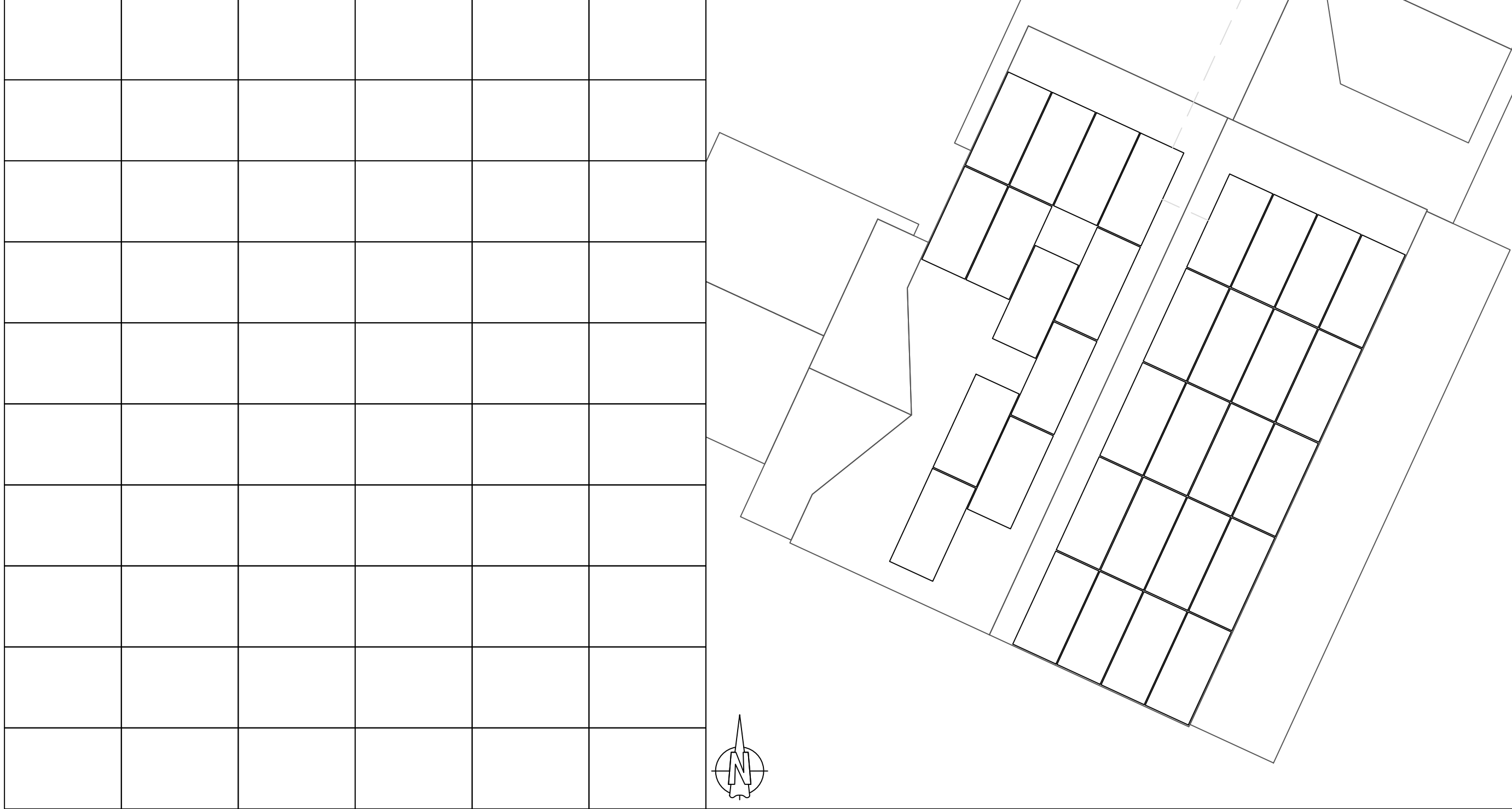
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  - C. AERIAL FONT.
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4. SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS.

# 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:**  
 ANDREW REINHEIMER  
 366 DUNBAR DR, LILLINGTON, NC 27546  
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 IQ7PLUS-72-2-US [240V]

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**GREG ALBRIGHT**

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

**MICROINVERTER CHART**

JOB NO: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-8
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# SAFETY PLAN

## 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

## IN CASE OF EMERGENCY

NEAREST HOSPITAL OR OCCUPATIONAL/INDUSTRIAL CLINIC

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

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

### SAFETY COACH CONTACT INFORMATION

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

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

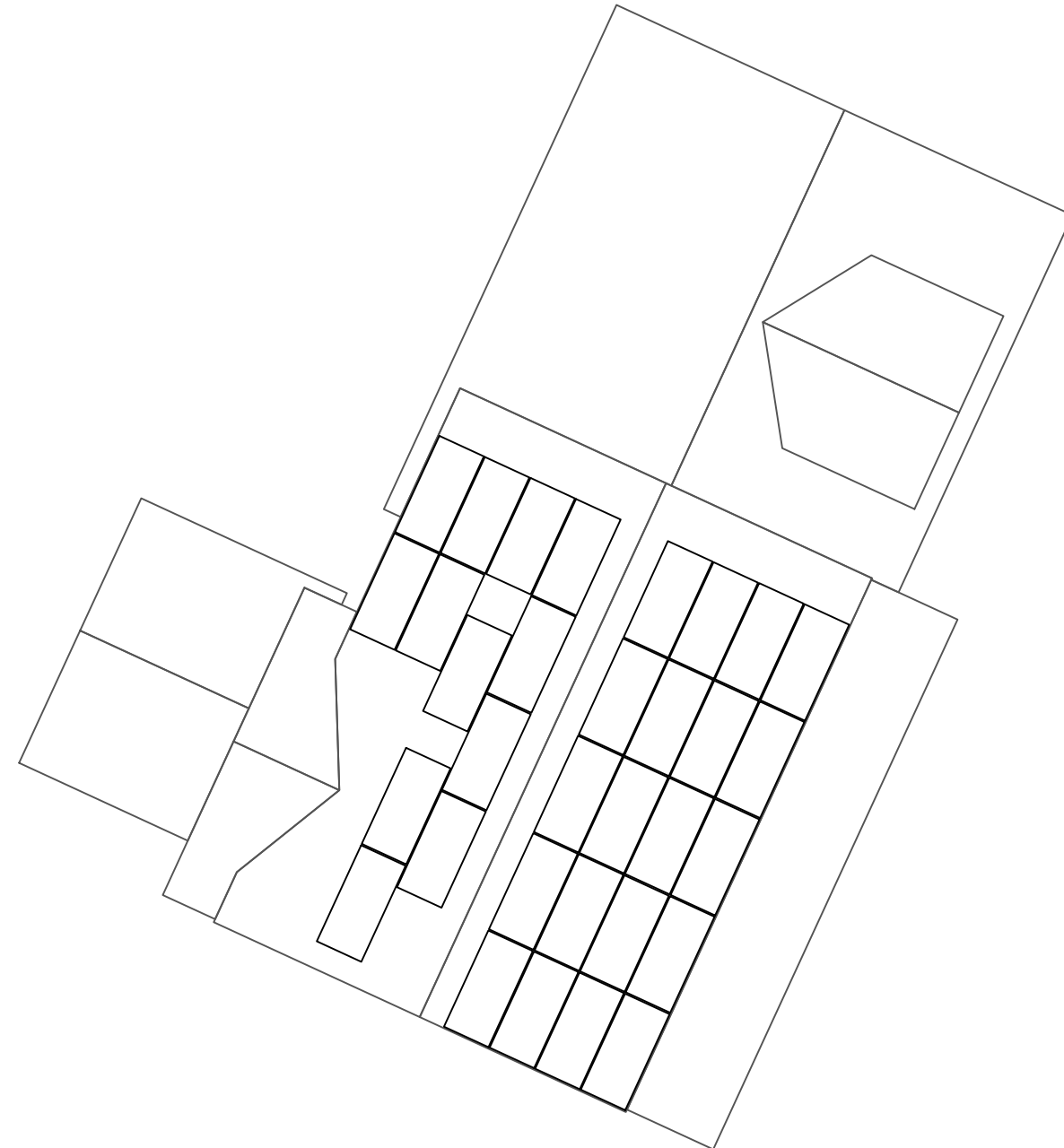
ALL EMPLOYEES ON SITE SHALL BE MADE AWARE OF THE SAFETY PLAN AND SIGN INDICATING THAT THEY ARE AWARE OF THE HAZARDS ON-SITE AND THE PLAN FOR WORKING SAFELY.

NAME

SIGNATURE

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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



# MARK UP KEY

- 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 SHUT OFF
- WATER SHUT OFF
- 7 SERVICE DROP
- Z POWER LINES

CLIENT:  
ANDREW REINHEIMER  
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GREG ALBRIGHT

CONTRACTOR LICENSE:  
ELECTRICAL CONTRACTOR U.34043

SAFETY PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
230693	6/7/2022	J.C.	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:  
ANDREW REINHEIMER  
366 DUNBAR DR, LILLINGTON, NC 27546  
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GREG ALBRIGHT

CONTRACTOR LICENSE:  
ELECTRICAL CONTRACTOR U.34043

SAFETY PLAN			
JOB NO: 230693	DATE: 6/7/2022	DESIGNED BY: J.C.	SHEET: PV-10

powered by

**Q.ANTUM DUO Z**

# Q.PEAK DUO BLK ML-G10+

## 385-405

ENDURING HIGH PERFORMANCE



### BREAKING THE 20% EFFICIENCY BARRIER

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



### THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY

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



### 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 Tra.Q™.



### EXTREME WEATHER RATING

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



### A RELIABLE INVESTMENT

Inclusive 25-year product warranty and 25-year linear performance warranty<sup>2</sup>.

<sup>1</sup> APT test conditions according to IEC/TS 62804-1:2015, method A (-1500 V, 96h)

<sup>2</sup> See data sheet on rear for further information.



6 BUSBAR CELL TECHNOLOGY

12 BUSBAR CELL TECHNOLOGY

### THE IDEAL SOLUTION FOR:



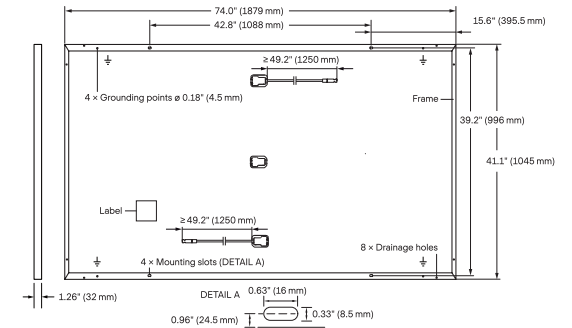
Rooftop arrays on residential buildings

Engineered in Germany



### MECHANICAL SPECIFICATION

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm <sup>2</sup> Solar cable; (+) ≥ 49.2 in (1250 mm), (-) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

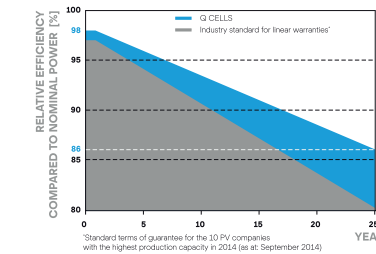


### ELECTRICAL CHARACTERISTICS

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

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

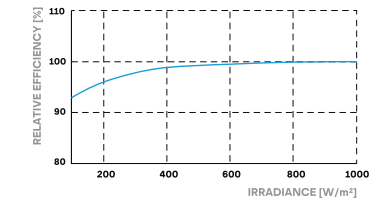
### Q CELLS PERFORMANCE WARRANTY



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

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

### PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25°C, 1000 W/m<sup>2</sup>)

### TEMPERATURE COEFFICIENTS

Temperature Coefficient of I <sub>SC</sub>	α [%/K]	+0.04	Temperature Coefficient of V <sub>OC</sub>	β [%/K]	-0.27
Temperature Coefficient of P <sub>MPP</sub>	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3 °C)

### PROPERTIES FOR SYSTEM DESIGN

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

<sup>3</sup> See Installation Manual

### QUALIFICATIONS AND CERTIFICATES

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



### PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules
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**Note:** Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.

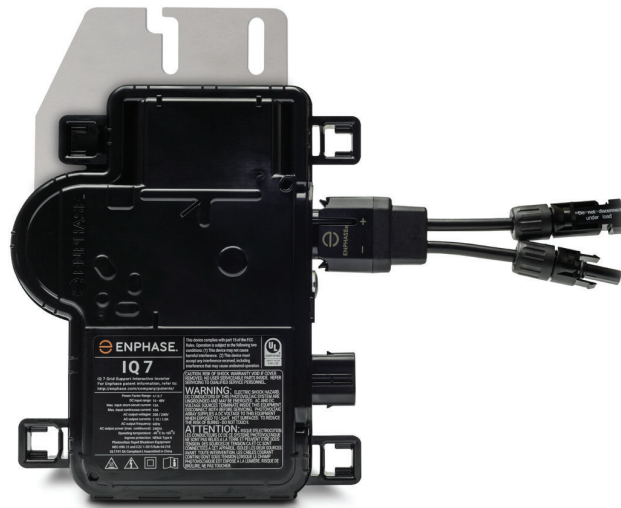
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL inquiry@us.q-cells.com | WEB www.q-cells.us

# 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

- Lightweight and simple
- Faster installation with improved, lighter two-wire cabling
- Built-in rapid shutdown compliant (NEC 2014 & 2017)

### Productive and Reliable

- Optimized for high powered 60-cell/120 half-cell and 72-cell/144 half-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 is required to support 72-cell/144 half-cell modules.

## Enphase IQ 7 and IQ 7+ Microinverters

INPUT DATA (DC)	IQ7-60-2-US		IQ7PLUS-72-2-US	
Commonly used module pairings <sup>1</sup>	235 W - 350 W +		235 W - 440 W +	
Module compatibility	60-cell/120 half-cell PV modules only		60-cell/120 half-cell and 72-cell/144 half-cell PV modules	
Maximum input DC voltage	48 V		60 V	
Peak power tracking voltage	27 V - 37 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 Isc)	15 A		15 A	
Overvoltage class DC port	II		II	
DC port backfeed current	0 A		0 A	
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)	IQ 7 Microinverter		IQ 7+ Microinverter	
Peak output power	250 VA		295 VA	
Maximum continuous output power	240 VA		290 VA	
Nominal (L-L) voltage/range <sup>2</sup>	240 V / 211-264 V	208 V / 183-229 V	240 V / 211-264 V	208 V / 183-229 V
Maximum continuous output current	1.0 A (240 V)	1.15 A (208 V)	1.21 A (240 V)	1.39 A (208 V)
Nominal frequency	60 Hz		60 Hz	
Extended frequency range	47 - 68 Hz		47 - 68 Hz	
AC short circuit fault current over 3 cycles	5.8 Arms		5.8 Arms	
Maximum units per 20 A (L-L) branch circuit <sup>3</sup>	16 (240 VAC)	13 (208 VAC)	13 (240 VAC)	11 (208 VAC)
Overvoltage class AC port	III		III	
AC port backfeed current	18 mA		18 mA	
Power factor setting	1.0		1.0	
Power factor (adjustable)	0.85 leading ... 0.85 lagging		0.85 leading ... 0.85 lagging	
EFFICIENCY	@240 V	@208 V	@240 V	@208 V
Peak efficiency	97.6 %	97.6 %	97.5 %	97.3 %
CEC weighted efficiency	97.0 %	97.0 %	97.0 %	97.0 %
MECHANICAL DATA				
Ambient temperature range	-40°C to +65°C			
Relative humidity range	4% to 100% (condensing)			
Connector type	MC4 (or Amphenol H4 UTX with additional Q-DCC-5 adapter)			
Dimensions (HxWxD)	212 mm x 175 mm x 30.2 mm (without bracket)			
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			
Environmental category / UV exposure rating	NEMA Type 6 / outdoor			
FEATURES				
Communication	Power Line Communication (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 690.			
Compliance	CA Rule 21 (UL 1741-SA) UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according manufacturer's instructions.			

1. No enforced DC/AC ratio. See the compatibility calculator at <https://enphase.com/en-us/support/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.



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



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[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.

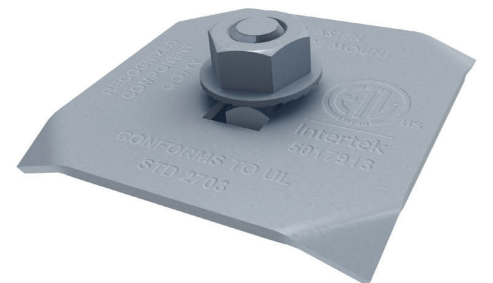


### ROCKIT SLIDE

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

### FRAME MLPE MOUNT

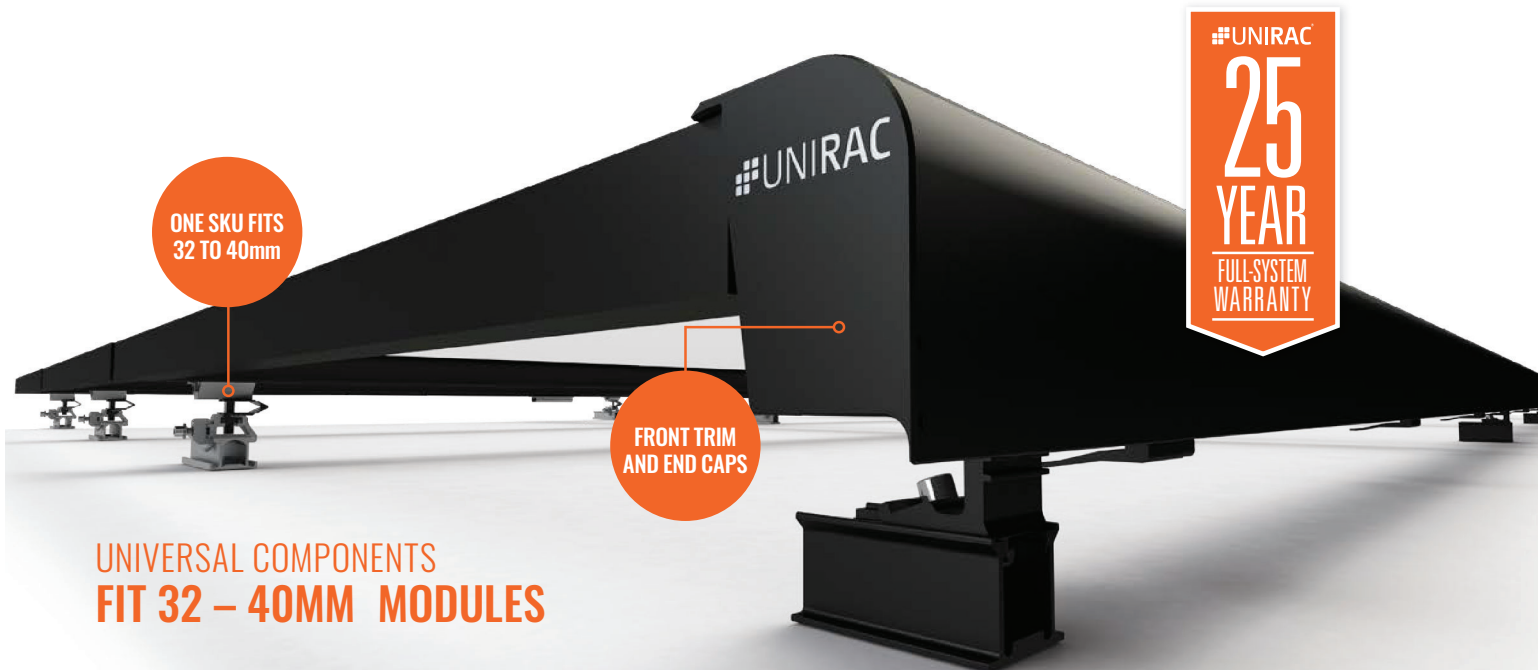
Attaches and fully bonds MLPE's (Module Level Power Electronics) to the module frame with a single bolt clip.



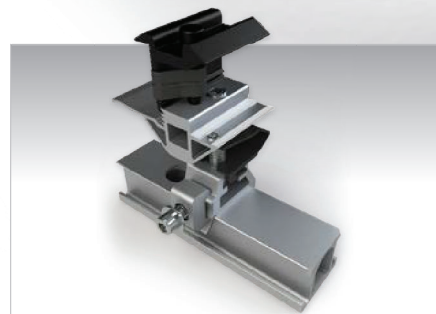
# SFM INFINITY



Take your business to the next level with **SFM INFINITY**, UNIRAC's rail-less PV mounting system for flush mount installations on comp shingle and tile roofs. An advanced 3rd generation product platform in use by top solar contractors nationwide, **SFM INFINITY** optimizes your operations on and off the roof, with approximately 40% less labor, 30% logistics savings, and 20% fewer roof attachments than traditional solar racking. Plus, 87% of homeowners prefer **SFM INFINITY's** aesthetics.



UNIVERSAL COMPONENTS  
FIT 32 – 40MM MODULES



### SUPERIOR PERFORMANCE

Enhance your business with two installs per day and 30% less cost.



### EASY INSTALLATION

Pre-assembled components, 20% fewer roof attachments, and level array in seconds with post height adjustment.



### HOMEOWNER PREFERRED

More than 4 out of 5 homeowners prefer **SFM INFINITY'S** aesthetics over a leading rail brand.

## REVOLUTIONIZING ROOFTOP SOLAR

FOR QUESTIONS OR CUSTOMER SERVICE VISIT [UNIRAC.COM](http://UNIRAC.COM) OR CALL (505) 248-2702

# SFM INFINITY

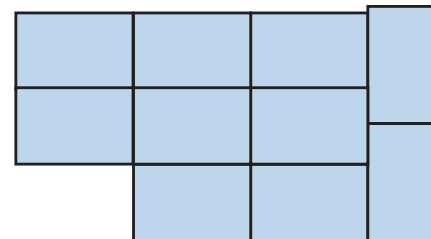
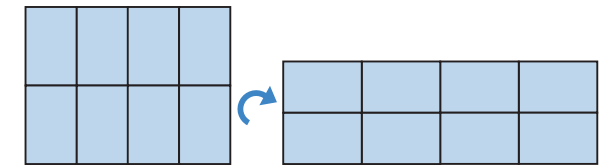
## DESIGN GUIDELINES



While you will see advantages simply from switching to **SFM INFINITY**, the following guidelines will help you to maximize its benefits.

### DEFAULT TO LANDSCAPE

When possible, design in landscape orientation in order to fit more modules on the roof and minimize roof attachments.



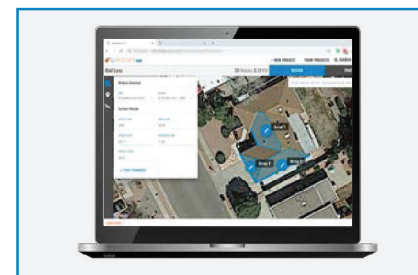
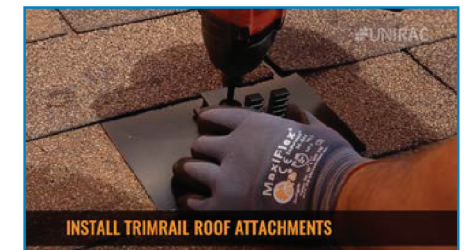
### MIX MODULE ORIENTATIONS

**SFM INFINITY** is easily configured in mixed array shapes and module orientations to maximize array density and to avoid vent pipes and other obstacles. Because mounting locations are not constrained by rails, **SFM INFINITY** has unmatched flexibility to enhance your projects.

### CONSULT THE QUICK TIPS VIDEOS

Visit UNIRAC's mobile-friendly library of short, topic-specific videos which answer common questions and demonstrate how simple it is to install **SFM INFINITY**.

Quick Tips Videos: <https://unirac.com/SFM-Infinity/>



### DESIGN IN U-BUILDER

Layout your arrays in **U-Builder**, UNIRAC's free solar design software, to optimize **SFM INFINITY'S** capabilities, including mixing module orientations and minimizing roof attachments. Quickly create layouts on Google or Bing Maps and generate project documents.

U-Builder: <https://design.unirac.com/>

## REVOLUTIONIZING ROOFTOP SOLAR

FOR QUESTIONS OR CUSTOMER SERVICE VISIT [UNIRAC.COM](http://UNIRAC.COM) OR CALL (505) 248-2702

2.0 Product Description	
Product	Photovoltaic Mounting System, Sun Frame Microrail - Installed Using Unirac Installation Guide, Rev PUB2019MAR01 with Annex North Row Extension Installation Guide Rev PUB2019FEB20
Brand name	Unirac
Description	<p>The product covered by this report is the Sun Frame Micro Rail roof mounted Photovoltaic Rack Mounting System. This system is designed to provide bonding and grounding to photovoltaic modules. The mounting system employs anodized or mill finish aluminum brackets that are roof mounted using the slider, outlined in section 4 of this report. There are no rails within this product, whereas the 3" Micro Rail, Floating Splice, and 9" Attached Splice electrically bond the modules together forming the path to ground.</p> <p>The Micro Rails are installed onto the module frame by using a stainless steel bolt anodized with black oxide with a stainless type 300 bonding pin, torqued to 20 ft-lbs, retaining the modules to the bracket. The bonding pin of the Micro Rail when bolted and torqued, penetrate the anodized coating of the photovoltaic module frame to contact the metal, creating a bonded connection from module to module.</p> <p>The grounding of the entire system is intended to be in accordance with the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems. Any local electrical codes must be adhered in addition to the national electrical codes. The Grounding Lug is secured to the photovoltaic module, torqued in accordance with the installation manual provided in this document.</p> <p>Other optional grounding includes the use of the Enphase UL2703 certified grounding system, which requires a minimum of 2 micro-inverters mounted to the same rail, and using the same engage cable.</p>
Models	Unirac SFM

2.0 Product Description	
Model Similarity	NA
Ratings	<p><b>Fuse Rating:</b> 30A</p> <p><b>Module Orientation:</b> Portrait or Landscape  <b>Maximum Module Size:</b> 17.98 ft<sup>2</sup>  <b>UL2703 Design Load Rating:</b> 33 PSF Downward, 33 PSF Upward, 10 PSF Down-Slope                      Tested Loads - 50 psf/2400Pa Downward, 50psf/2400Pa Uplift, 15psf/720Pa Down Slope                      Trina TSM-255PD05.08 and Sunpower SPR-E20-327 used for Mechanical Loading</p> <p>Increased size ML test:  <b>Maximum Module Size:</b> 22.3 ft<sup>2</sup>  <b>UL2703 Design Load Rating:</b> 113 PSF Downward, 50 PSF Upward, 30 PSF Down-Slope                      LG355S2W-A5 used for Mechanical Loading test.  <b>Mounting configuration:</b> Four mountings on each long side of panel with the longest span of 24"</p> <p><b>UL2703 Design Load Rating:</b> 46.9 PSF Downward, 40 PSF Upward, 10 PSF Down-Slope                      LG395N2W-A5, LG360S2W-A5 and LG355S2W-A5 used for used for Mechanical Loading test.  <b>Mounting configuration:</b> Six mountings for two modules used with the maximum span of 74.5"</p> <p>Fire Class Resistance Rating:                      - Class A for Steep Slope Applications when using Type 1 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail.                      - Class A for Steep Slope Applications when using Type 2 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail.                      - Class A Fire Rated for Low Slope applications with Type 1 or 2 listed photovoltaic modules. This system was evaluated with a 5" gap between the bottom of the module and the roof's surface</p> <p><i>See section 7.0 illustration # 1 and 1a for a complete list of PV modules evaluated with these racking systems</i></p>
Other Ratings	NA

**AUTHORIZATION TO MARK**

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

<b>Applicant:</b> Unirac, Inc	<b>Manufacturer:</b> Cixi Emeka Aluminum Co. Ltd
<b>Address:</b> 1411 Broadway Blvd NE Albuquerque, NM 87102	<b>Address:</b> No. 688 ChaoSheng Road Cixi City Zhejiang Province 315311
<b>Country:</b> USA	<b>Country:</b> China
<b>Contact:</b> Klaus Nicolaedis Tom Young	<b>Contact:</b> Jia Liu Robin Luo
<b>Phone:</b> 505-462-2190 505-843-1418	<b>Phone:</b> +86-15267030962 +86-13621785753
<b>FAX:</b> NA klaus.nicolaedis@unirac.com	<b>FAX:</b> NA
<b>Email:</b> toddg@unirac.com	<b>Email:</b> jia.liu@cxymj.com buwan.luo@cxymj.com

**Party Authorized To Apply Mark:** Same as Manufacturer  
**Report Issuing Office:** Lake Forest, CA U.S.A.

**Control Number:** 5003705

**Authorized by:** *Natalie Johnson*  
for Dean Davidson, Certification Manager



This document supersedes all previous Authorizations to Mark for the noted Report Number.

This Authorization to Mark 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 Authorization to Mark. Only the Client is authorized to permit copying or distribution of this Authorization to Mark 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 Authorization to Mark. 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 Fax 312-283-1672

<b>Standard(s):</b>	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels [UL 2703: 2015 Ed.1]
<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail - Installed Using Unirac Installation Guide, Rev PUB2019MAR01 with Annex North Row Extension Installation Guide Rev PUB2019FEB20
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM



May 20, 2021

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 # 2015-05584HG.07.01 – EcoFasten - Rock-It 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 - Rock-It System, as presented in PZSE Report # 2015-05584HG.07.01, "Engineering Certification for the EcoFasten - ClickFit 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 7-16, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers
  2. 2018 International Building Code, by International Code Council, Inc.
  3. 2018 International Residential Code, by International Code Council, Inc.
  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, by The Aluminum Association, Inc.
  6. ANSI/AWC NDS-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 - Rock-It 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

