



Freedom Forever
Planset Revision Letter

6/29/2023
REV #2

Attn. Harnett County (NC):

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

KONG THAO
300 HORSE WHISPERER LANE, LILLINGTON, NC 27546

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

ROOF MOUNT PHOTOVOLTAIC SYSTEM

CODES:

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)

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 2017 AC SEC 250.166(A).

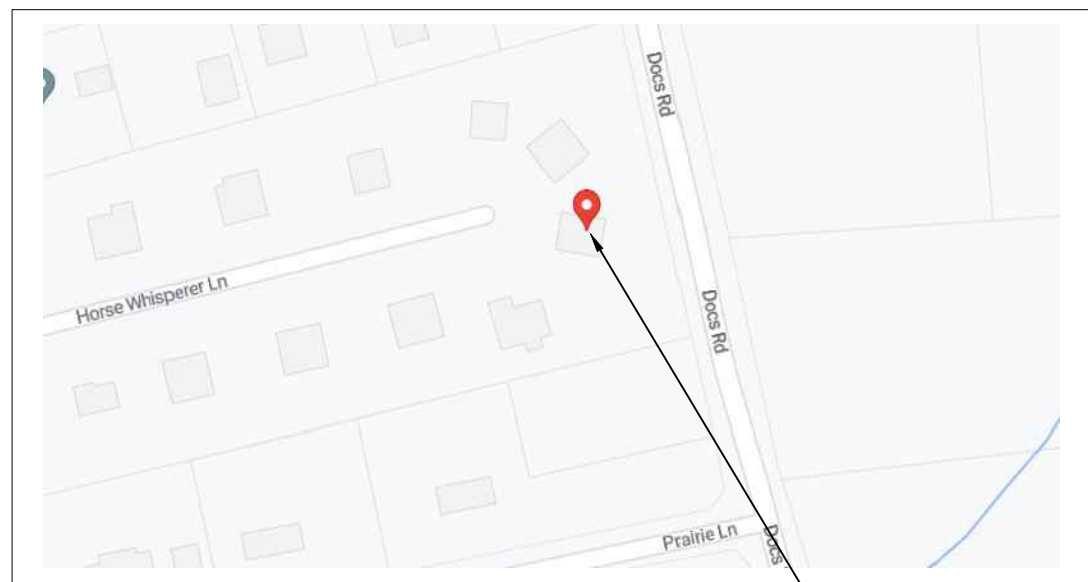
SOLAR PHOTOVOLTAIC SYSTEM EQUIPMENT WILL BE INSTALLED IN ACCORDANCE WITH REQUIREMENTS OF ART. 690 OF THE 2017 AC

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



VICINITY MAP:



SITE LOCATION

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



CLIENT:
 KONG THAO
 300 HORSE WHISPERER LANE, LILLINGTON, NC 27546
 AHJ: HARNETT COUNTY (NC)
 UTILITY: DUKE ENERGY
 PHONE: (770) 851-3166
 EMAIL: CAROLINEDTHAO@GMAIL.COM
 FINANCE: OTHER

SYSTEM:
 SYSTEM SIZE (DC): 34 X 400 = 13.600 kW
 SYSTEM SIZE (AC): 9.860 kW @ 240V
 MODULES: 34 X FREEDOM FOREVER: FF-MP-BBB-400
 MICROINVERTERS: 34 X ENPHASE IQ8PLUS-72-2-US

TABLE OF CONTENTS:

PV-1	SITE LOCATION
PV-2	SITE PLAN
PV-2A	ROOF PLAN WITH MODULES LAYOUT
PV-2B	ROOF AND STRUCTURAL TABLES
PV-3	MOUNTING DETAILS
PV-4	THREE LINE DIAGRAM
PV-5	CONDUCTOR CALCULATIONS
PV-5A	ELECTRICAL 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
1	R.K.	6/22/2023
2	R.V.	6/29/2023
-	-	-










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

GREG ALBRIGHT

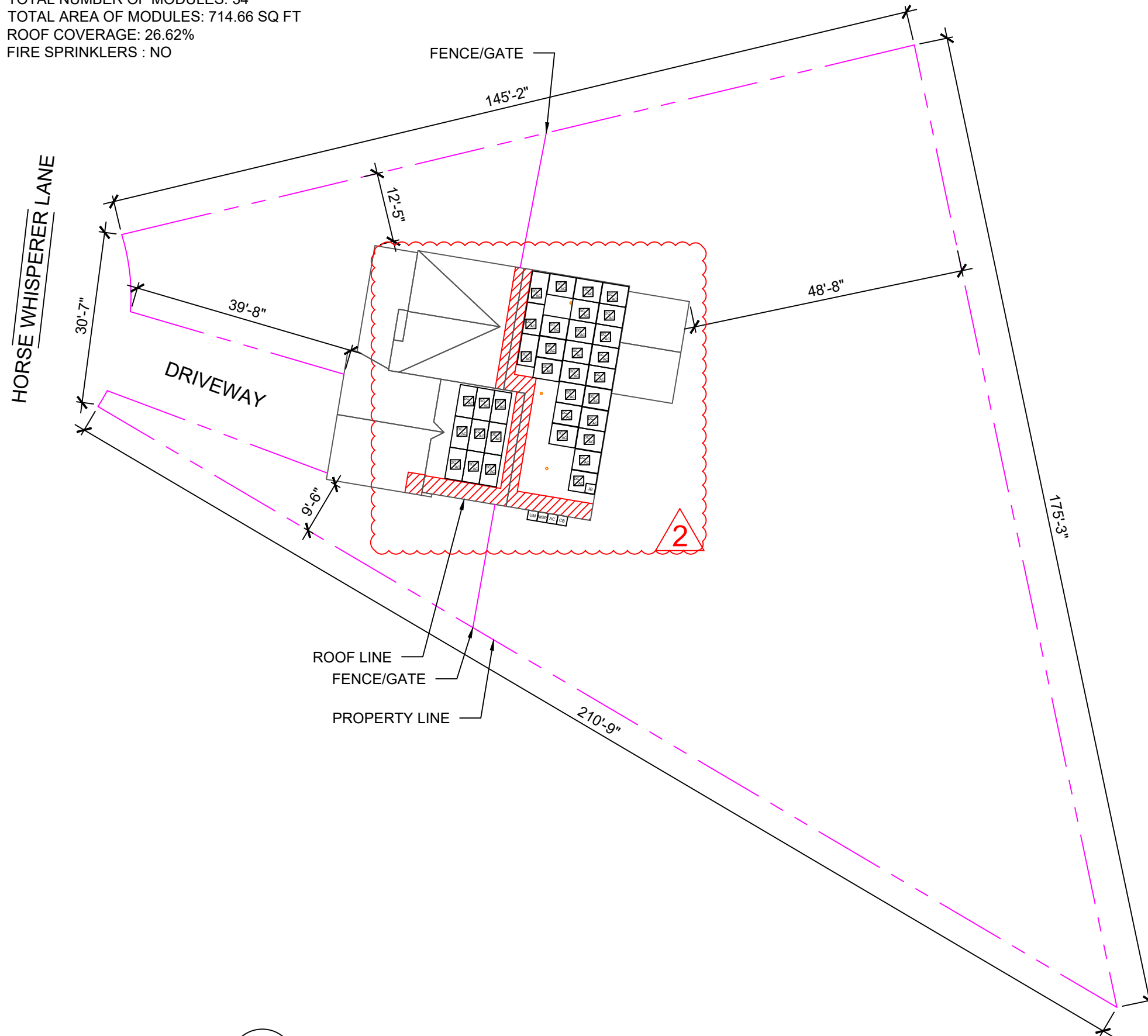
CONTRACTOR LICENSE:
 ELECTRICAL CONTRACTOR U.34043

SITE LOCATION			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-1

LEGEND:

-  CHIMNEY
-  PIPE VENT
-  MODULES
-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  MICRO INVERTER
-  COMBINER BOX

TOTAL ROOF AREA RIDGE SETBACK CALCS:
 TOTAL ROOF AREA: 2685 SQ FT
 SINGLE MODULE AREA: 21.01937947 SQ FT
 TOTAL NUMBER OF MODULES: 34
 TOTAL AREA OF MODULES: 714.66 SQ FT
 ROOF COVERAGE: 26.62%
 FIRE SPRINKLERS : NO



ROOF AREA: 2685 SQ FT

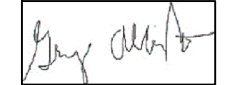
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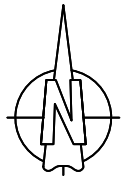
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




SITE PLAN
 SCALE: 1"=20'

1

SITE PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-2

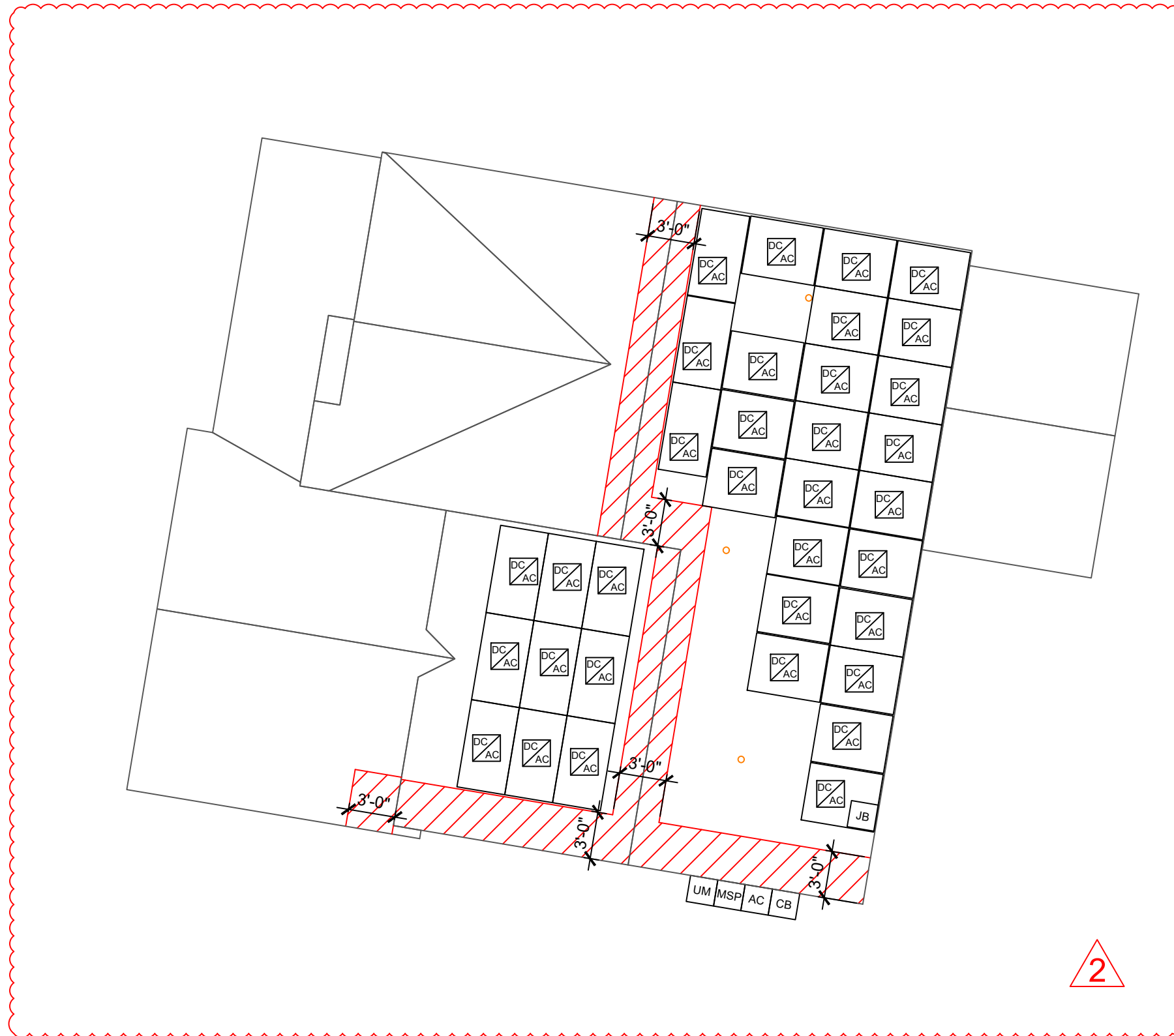
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-  SETBACK
-  AC DISCONNECT
-  MSP
-  JUNCTION BOX
-  MICRO INVERTER
-  COMBINER BOX

TOTAL ROOF AREA: 2685 SQ FT
 TOTAL ARRAY AREA: 714.66 SQ FT
 ARRAY COVERAGE: 26.62%
 SYSTEM DISTRIBUTED WEIGHT: 2.32 LBS
 ROCKIT SMART SLIDE POINT-LOAD: 28.07 LBS



STRUCTURAL ONLY



ROOF AREA: 2685 SQ FT

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ROOF PLAN WITH MODULES LAYOUT

JOB NO: 302631	DATE: 6/29/2023	DESIGNED BY: R.V.	SHEET: PV-2A
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ROOF PLAN
 SCALE: 1/8" = 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: 2685 SQ FT
 TOTAL ARRAY AREA: 714.66 SQFT
 ARRAY COVERAGE: 26.62%
 SYSTEM DISTRIBUTED WEIGHT: 2.32 LBS
 ROCKIT SMART SLIDE POINT-LOAD: 28.07 LBS



2

ROOF AREA STATEMENT

ROOF	MODULE QUANTITY	ROOF PITCH	ARRAY PITCH	AZIMUTH	ROOF AREA	ARRAY AREA
ROOF 1	9	30	30	280	370 SQ FT	189.17 SQ FT
ROOF 2	25	30	30	100	877 SQ FT	525.48 SQ FT
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT
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ROOF DETAILS

JOB NO: 302631	DATE: 6/29/2023	DESIGNED BY: R.V.	SHEET: PV-2B
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BACKFEED BREAKER SIZING

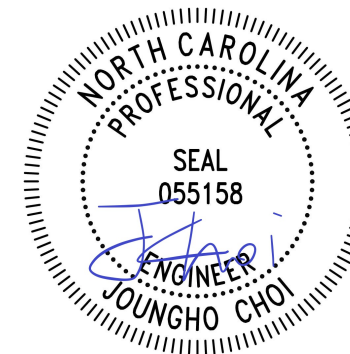
MAX. CONTINUOUS OUTPUT 41.14A @ 240V

41.14 X 1.25 = 51.43AMPS 60A BREAKER - OK

SEE 705.12 OF 2017 AC

200 X 1.20 = 240

240 - 175 = 65A ALLOWABLE BACKFEED



1

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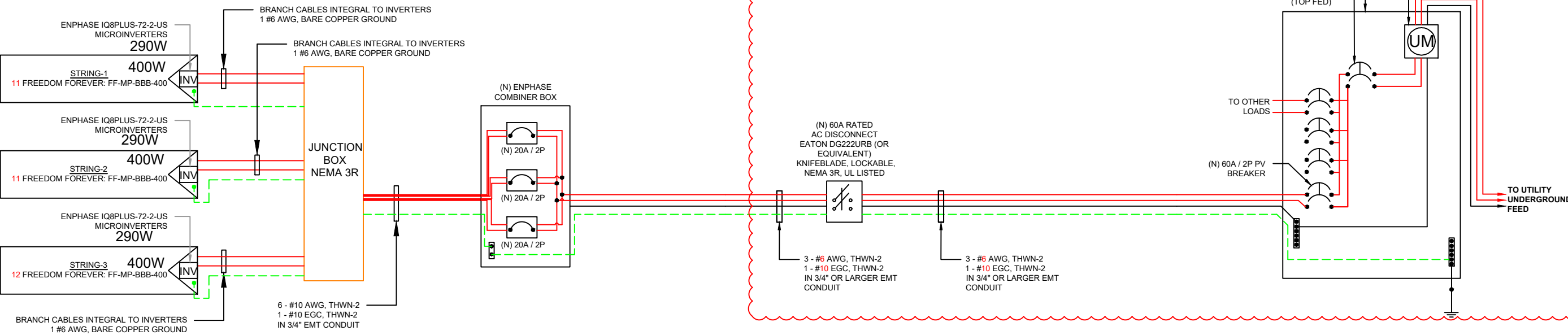
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THREE LINE DIAGRAM

JOB NO: 302631	DATE: 6/29/2023	DESIGNED BY: R.V.	SHEET: PV-4
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NOTE:
CONDUIT AND CONDUCTORS SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS

Residential Optional Calculation

9/25/1997

Freedom Forever LLC

by: John Sokolik

Version 2014

STEP 1 Article 220.82 (B) (1),(2)

sq. ft	2898	General Lighting load	8,694 VA
	2	Small Appliance	3,000 VA
	1	Laundry circuit	1,500 VA
		Gen.Lgt, Sm App.& Laun. Load	13,194 VA

Kong Thao

carolinedthao@gmail.com
300 Horse Whisperer Lane, Lillington, NC
(770) 851-3166

2/8/2023 17:18

302631

STEP 2 Article 220.82 (C)

A/C Condenser & Fixed Electric Space Heating

A/C #	VA	AHU	Select	QTY	VA
A/C #1	VA	AHU 1	Select	Qty	VA
A/C #2	VA	AHU 2	Select	Qty	VA
A/C #3	VA	AHU 3	Select	Qty	VA
A/C #4	VA	AHU 4	Select	Qty	VA
A/C #5	VA	AHU 5	Select	Qty	VA

General lighting, Sm. Appl. & Laundry 13,194 VA

Total 0 65% Demand Factor

Heating Load	VA
CU Load	VA

Electric Space Heat @ 65% <4, 40% >3, vs. A/C @ 100% VA

STEP 3 Article 220.82 (B) (3)

<input type="checkbox"/>	6,000 VA	1	Water Heater	6,000 VA
<input type="checkbox"/>	1,400 VA	1	Refrigerator	1,400 VA
<input type="checkbox"/>	800 VA	1	Freezer	800 VA
<input type="checkbox"/>	1,200 VA	1	Dishwasher	1,200 VA
<input type="checkbox"/>	1,127 VA	1	Disposal	1,127 VA
<input type="checkbox"/>	540 VA	1	Range Hood	540 VA
<input type="checkbox"/>	1,400 VA	1	Microwave	1,400 VA
<input type="checkbox"/>	1,440 VA		Central Vac	VA
<input type="checkbox"/>	288 VA		Mini Refrig	VA
<input type="checkbox"/>	400 VA		Compactor	VA
<input type="checkbox"/>	12,000 VA		Tankless heater	VA
<input type="checkbox"/>	1,500 VA		Wine Cooler	VA
<input type="checkbox"/>	select		Jacuzzi Tub	VA
<input type="checkbox"/>	select		Sprinkler	VA
<input type="checkbox"/>	select		Well Pump	VA
<input type="checkbox"/>	select		Fountain Pump	VA
<input type="checkbox"/>	select		Elevator	VA
<input type="checkbox"/>			Pool Equip. Panel	VA Apply Demand
<input type="checkbox"/>	14400		Other load	14,400 VA No Demand
<input type="checkbox"/>	12000		Other load	12,000 VA No Demand

Appliance Demand Load 38,867 VA

Dryer Demand Load 7,200 VA

Range Demand Load 9,600 VA

Service Demand 33,544 VA

Demand Load @ 240V, 1ph 140 A

Neutral Demand 92 A

Min.Service Req. 150 A

Total Appliance Load 38,867 VA

STEP 4 Article 220.82 (B) (3)

Electric Clothes Dryers **7,200 VA**

STEP 5 Article 220.82 (B) (3)

Electric Ranges **9,600 W** Col C demand **8000**

or Number of appliances

<input type="checkbox"/>	Check Box for Gas Range	Cooktop	Col B demand
<input type="checkbox"/>		Cooktop	Col B demand
<input type="checkbox"/>		Oven(s)	Col B demand
<input type="checkbox"/>		Oven(s)	Col B demand
<input type="checkbox"/>		Number of appliances	0 Dem. Factor
<input type="checkbox"/>		Cooktop & Oven Demand Load	

Use this area for your own notes



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IQ8PLUS-72-2-US

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Tel: (800) 385-1075

GREG ALBRIGHT

Greg Albright

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

ELECTRICAL CALCULATIONS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-5A

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 MULTIWIRED 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 CALORIM*2 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: 300 HORSE WHISPERER LANE, LILLINGTON, NC 27546

PHOTOVOLTAIC AC DISCONNECT
NEC 690.13(B)

PHOTOVOLTAIC AC DISCONNECT
RATED AC OUTPUT CURRENT: **41.14A**
NOMINAL OPERATING AC VOLTAGE: **240V**
NEC 690.54

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

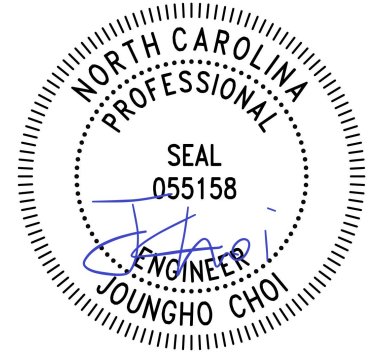
SOLAR PV DC CIRCUIT
EVERY 10' ON CONDUIT AND ENCLOSURES
NEC 690.31(O)(2)

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

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

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



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LABELS			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-7

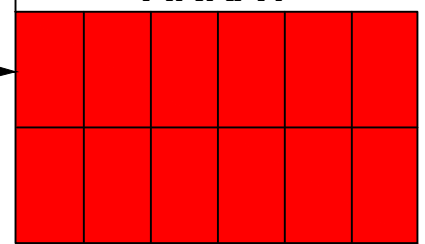
PHOTOVOLTAIC DC DISCONNECT
NEC 690.13(B)

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)

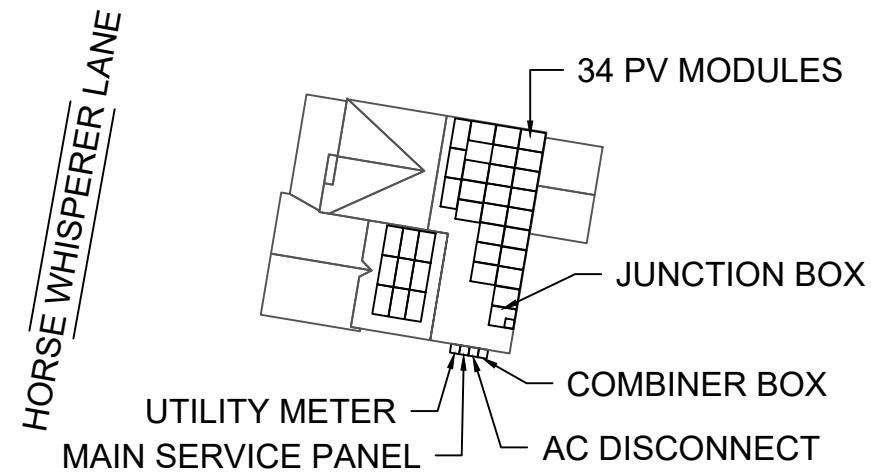


NEC 690.31(G)(3) & (4)



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:
302631	6/29/2023	R.V.	PV-7A

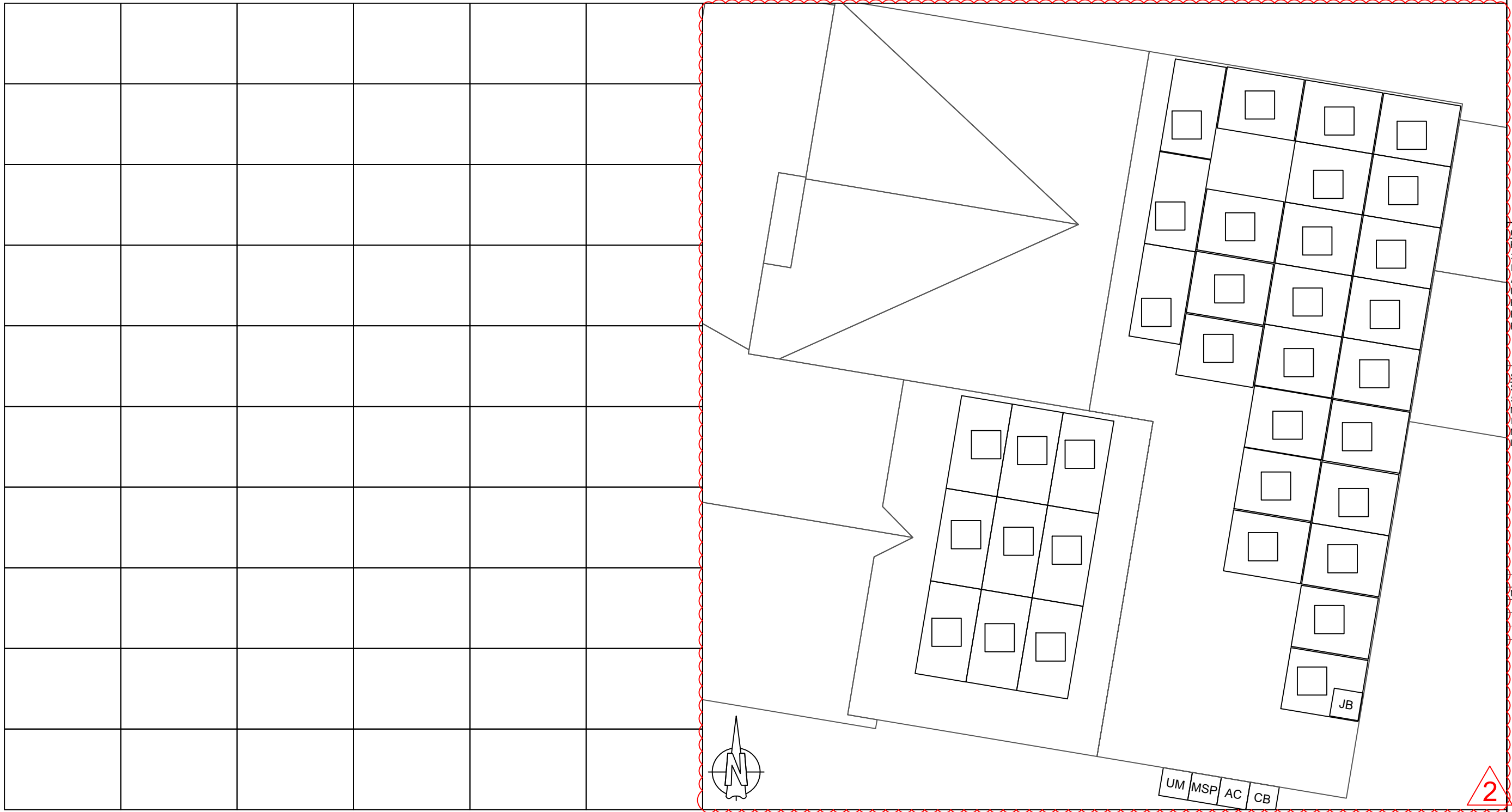
NOTES:

- 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.
 - AERIAL 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.

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:
KONG THAO
300 HORSE WHISPERER LANE, LILLINGTON,
NC 27546
AHJ: HARNETT COUNTY (NC)
UTILITY: DUKE ENERGY
PHONE: (770) 851-3166
EMAIL: CAROLINEDTHAO@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 34 X 400 = 13.600 kW
SYSTEM SIZE (AC): 9.860 kW @ 240V
MODULES: 34 X FREEDOM FOREVER:
FF-MP-BBB-400
MICROINVERTERS: 34 X ENPHASE
IQ8PLUS-72-2-US

REVISIONS		
NO.	REVISED BY	DATE
1	R.K.	6/22/2023
2	R.V.	6/29/2023
-	-	-



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

GREG ALBRIGHT

Greg Albright

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

MICROINVERTER CHART

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-8

SAFETY PLAN

MARK UP KEY

INSTRUCTIONS:

- USE SYMBOLS IN KEY TO MARK UP THIS SHEET.
- SAFETY PLAN MUST BE MARKED BEFORE JOB STARTS AS PART OF THE PRE-PLAN
- 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: _____

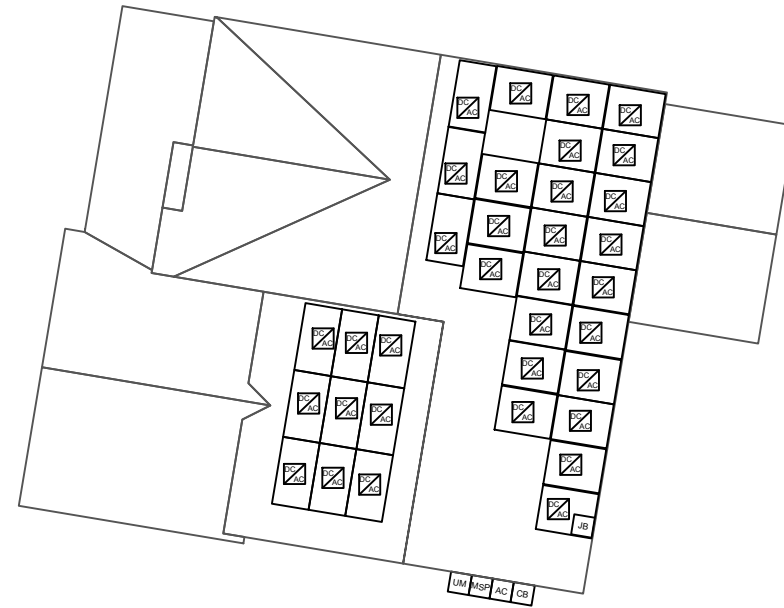
ADDRESS: _____

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
- X SKYLIGHT
- NO LADDER ACCESS (STEEP GRADE OR GROUND LEVEL OBSTRUCTIONS)
- RESTRICTED ACCESS
- CONDUIT
- GAS GAS SHUT OFF
- H₂O WATER SHUT OFF
- 7 SERVICE DROP
- Z POWER LINES

CLIENT:
KONG THAO
300 HORSE WHISPERER LANE, LILLINGTON, NC 27546
AHJ: HARNETT COUNTY (NC)
UTILITY: DUKE ENERGY
PHONE: (770) 851-3166
EMAIL: CAROLINEDTHAO@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 34 X 400 = 13.600 kW
SYSTEM SIZE (AC): 9.860 kW @ 240V
MODULES: 34 X FREEDOM FOREVER: FF-MP-BBB-400
MICROINVERTERS: 34 X ENPHASE IQ8PLUS-72-2-US

REVISIONS		
NO.	REVISED BY	DATE
1	R.K.	6/22/2023
2	R.V.	6/29/2023
-	-	-

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

GREG ALBRIGHT

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

BREAK AND WATER LOG

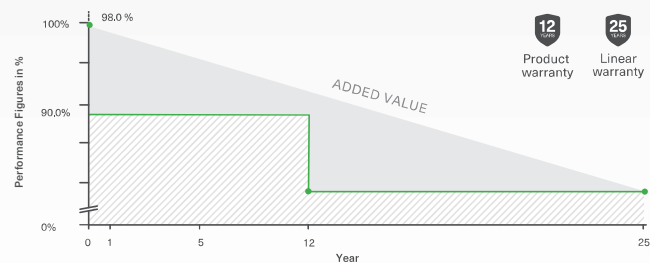
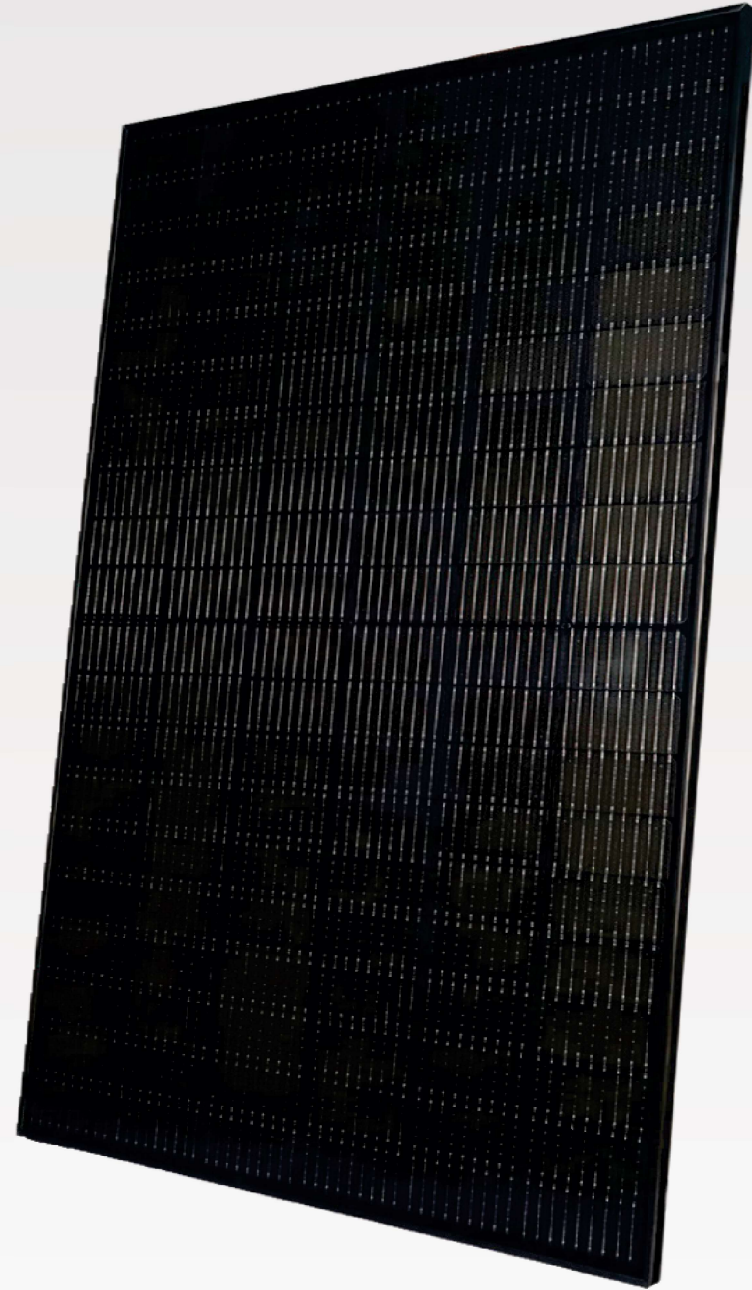
THIS LOG IS TO BE FILLED OUT ANY TIME THE TEMP EXCEEDS 90 DEGREES. THE CREW LEAD AND ROOF LEAD ARE RESPONSIBLE FOR ENSURING THIS IS COMPLETED AND UPLOADED AT THE END OF EVERYDAY WHEN TEMPS EXCEED 90 DEGREES

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

NAME	SIGNATURE
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

DATE: _____ TIME: _____

SAFETY PLAN			
JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-9



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 ² , 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 ²)
Rear Side Design Load	2,400Pa (50lb/ft ²)

PACKAGING INFORMATION

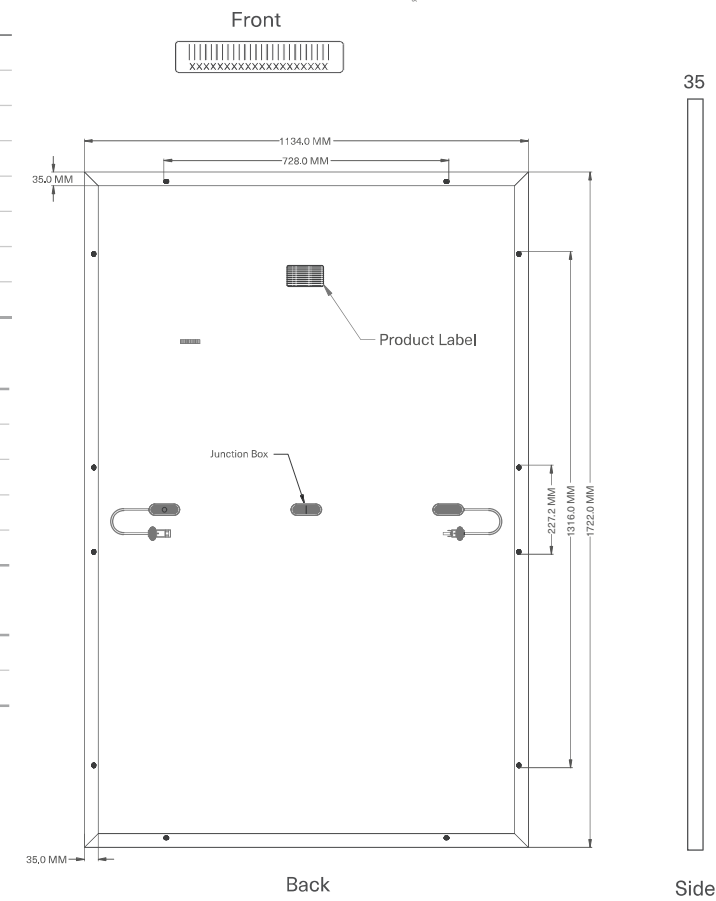
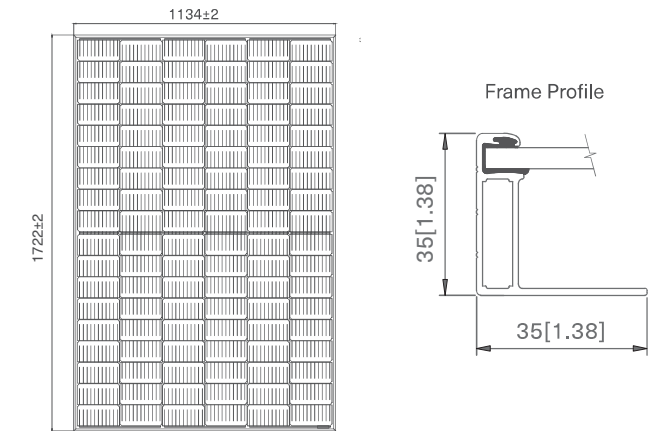
	20' GP	40' HC
Pallets per Container	6	26
Panels per Container	186	806
Panels per Pallet	31	31
Packaging Bon Weight	679 kg (1497 lbs)	
Panels per Pallet	1785 x 1130 x 1180 mm (70.28 x 44.49 x 46.46 in)	

TEMPERATURE RATINGS

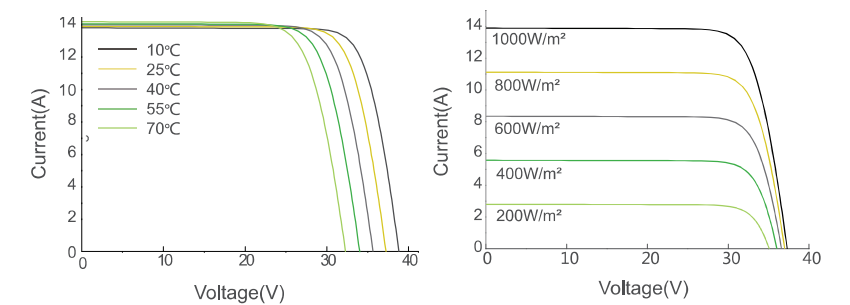
Temperature Coefficient of P _{max}	-0.350%/°C
Temperature Coefficient of V _{oc}	-0.275%/°C
Temperature Coefficient of I _{sc}	+0.045%/°C
Nominal Operating cell Temperature (NOCT)	42°C±2°C



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.

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

Standard(s):	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]

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]	
Product:	Crystalline Silicon Photovoltaic (PV) Modules	
Brand Name:	Freedom Forever	
Models:	MULTIPLE LISTEE 12 MODELS	BASIC LISTEE MODELS
	FF-MP-BBB- followed by 365, 370, 375 or 380.	NUSA120H- followed by 365, 370, 375 or 380; followed by MB.
	FF-MP-BBB- followed by 395, 400, 405 or 410.	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 3rd 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.

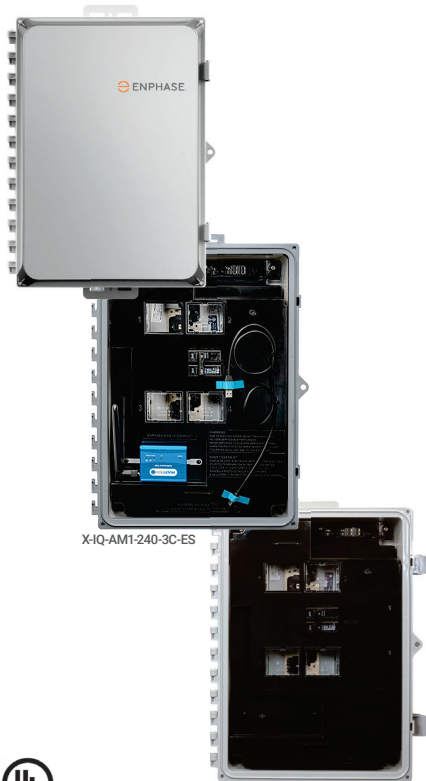
IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings ¹	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 _{sc}	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 ²	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 ³		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 rd 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



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"> • 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing.
Altitude	Up to 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

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To learn more about Enphase offerings, visit enphase.com



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:

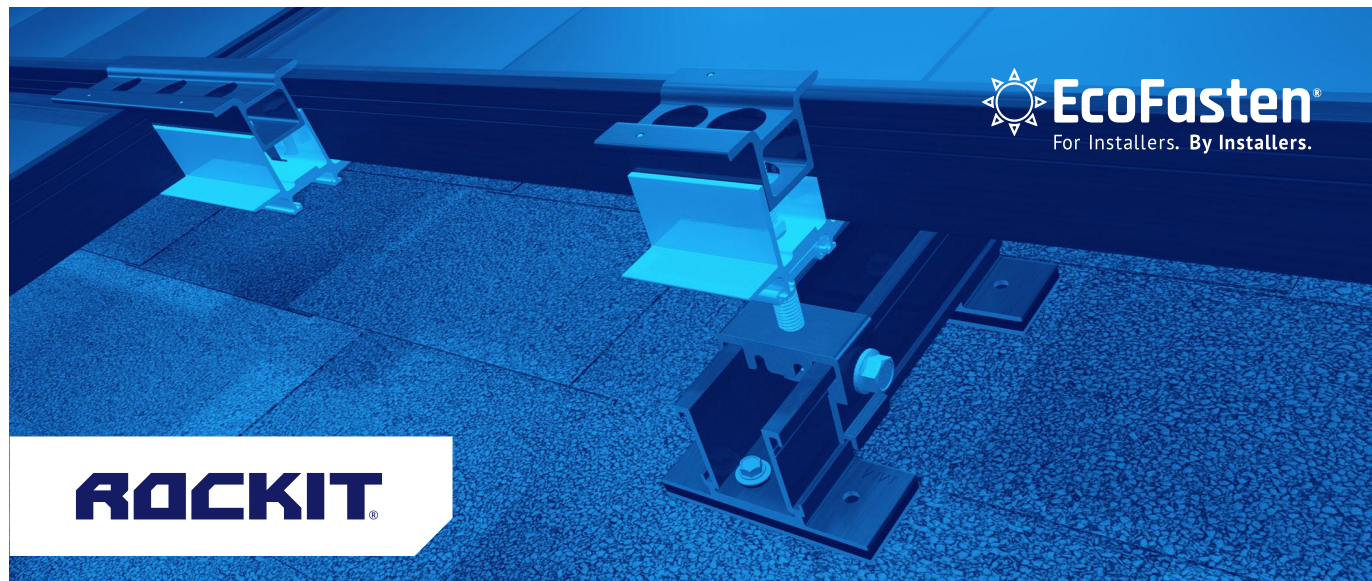
- [Eatons Volume 2-Commercial Distribution](#)
- [Eaton Specification Sheet - DG222URB](#)

Certifications:

- UL Listed

Product compliance: No Data





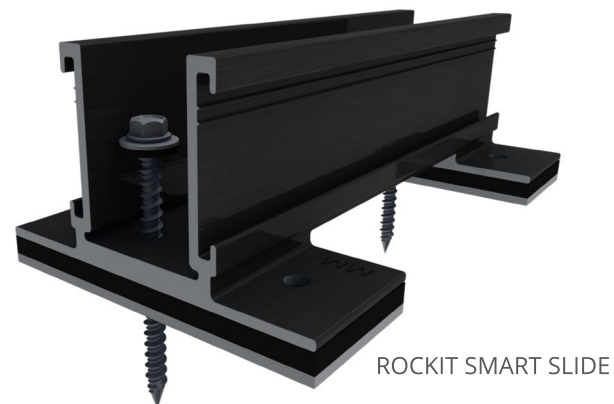
ROCKIT

INTRODUCING ROCKIT SMART SLIDE!

Introducing EcoFasten’s patent pending RockIt Smart Slide, our simple solution for quickly installing the popular RockIt rail-less racking system to composition shingle roofs.

Features & Benefits

- Eliminates the need to pry up shingle courses and install a metal flashing
- Multiple opportunities to find the rafter
- No need for additional material when architectural shingles are not level
- Longer 6.75” slide avoids overlaps in shingle courses
- Integrated flashing utilizes UltraGrip Technology™ to create a watertight seal



ROCKIT SMART SLIDE

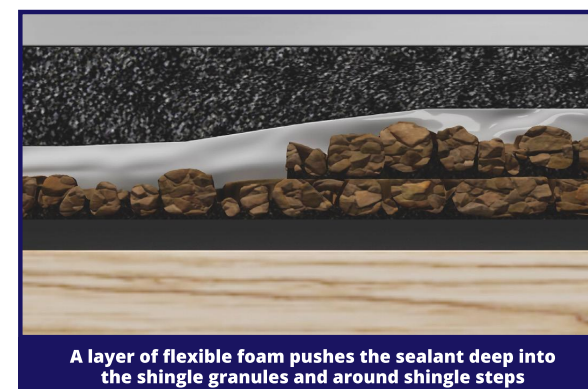
Required Components:

Part Number:	Description:
2011024	RI SMART SLIDE BLK 6.75”
2011025	RI SMART SCRW #12X3” W/BW

ROCKIT SMART SLIDE

Integrated UltraGrip Technology™

Pre-installed sealing pads are compatible with all composition shingle roofs. The compression achieved when fastened to the roof creates a super strong watertight seal. In most cases, the slide can be mounted to the deck without the need for sealant. A layer of flexible foam provides cushioning, which allows the waterproofing sealant to embed deep into the granules of the shingle as well as to flexibly conform over the steps found on architectural-style shingles.



A layer of flexible foam pushes the sealant deep into the shingle granules and around shingle steps



RockIt Smart Slide can be installed on top of architectural shingles steps

Testing & Documentation

- [UL441 Rain Report](#)
- [TAS 100 \(A\)-95 Wind and Wind Driven Rain Resistance](#)
- [Mechanical Load Test/Structural Capacity Certification](#)
- [Florida Product Approval](#)
- [RockIt Installation Manual](#)
- [RockIt CutSheets](#)



RI SMART SLIDE BLK 6.75"

PART NUMBER	DESCRIPTION
2011024	RI SMART SLIDE BLK 6.75"

ITEM NO.	DESCRIPTION
1	ROCKIT SMART SLIDE ASSEMBLY

1) ROCKIT FLASHLESS SLIDE ASSEMBLY

MATERIAL	ALUMINUM, EPDM, ADHESIVE, TREATED PAPER
FINISH	BLACK

Rev: CS-3

RI SMART SCREW #12X3" W/BW

PART NUMBER	DESCRIPTION
2011025	RI SMART SCREW #12X3" W/BW

ITEM NO.	DESCRIPTION
1	SELF TAPPING SCREW #12 WITH SEALING WASHER ASSEMBLY

MATERIAL	STAINLESS STEEL, EPDM RUBBER
FINISH	MILL, BLACK

Rev: CS-2



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

