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)

VICINITY MAP:

TABLE OF CONTENTS:

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 INDENTIFIED WITH FIRE CLASSIFICATION IN ACCORDANCE WITH UL 2703. SMOKE AND CARBON MONOXIDE ALARMS ARE REQUIRED PER SECTION R314 AND 315 TO BE VERIFIED AND INSPECTED BY INSPECTOR IN THE FIELD.

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

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

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

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

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

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

NORTH CAROLINA PROFESSIONAL SEAL 055158 ENGINEER JOUNGHO CHOI

Joungho Choi

Digitally signed by Joungho Choi
Date: 2023.06.30 14:43:55 -04'00'

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

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

GREG ALBRIGHT

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

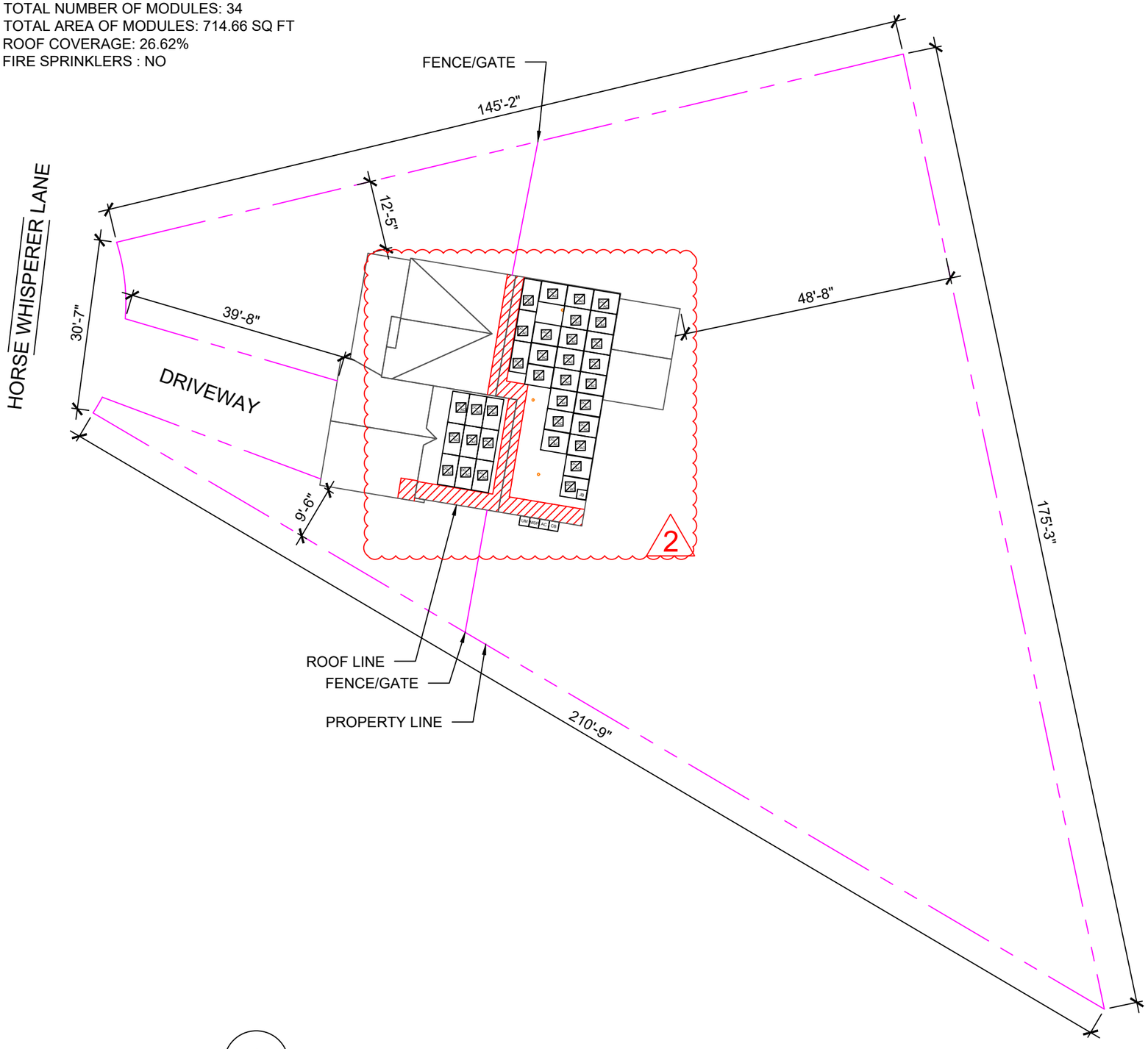
SITE LOCATION

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

LEGEND:

- CHIMNEY
- PIPE VENT
- MODULES
- SETBACK
- AC — AC DISCONNECT
- MSP — MSP
- JB — JUNCTION BOX
- DC / AC — MICRO INVERTER
- CB — 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



SITE PLAN
SCALE: 1"=20'

1

Avial Lumaguai
Digitally signed by Avial Lumaguai
Date: 2023.06.30 14:24:02 -04'00'

NORTH CAROLINA PROFESSIONAL SEAL 054960 ENGINEER AVIAL LUMAGUI

STRUCTURAL ONLY

ROOF AREA: 2685 SQ FT

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

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

GREG ALBRIGHT

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

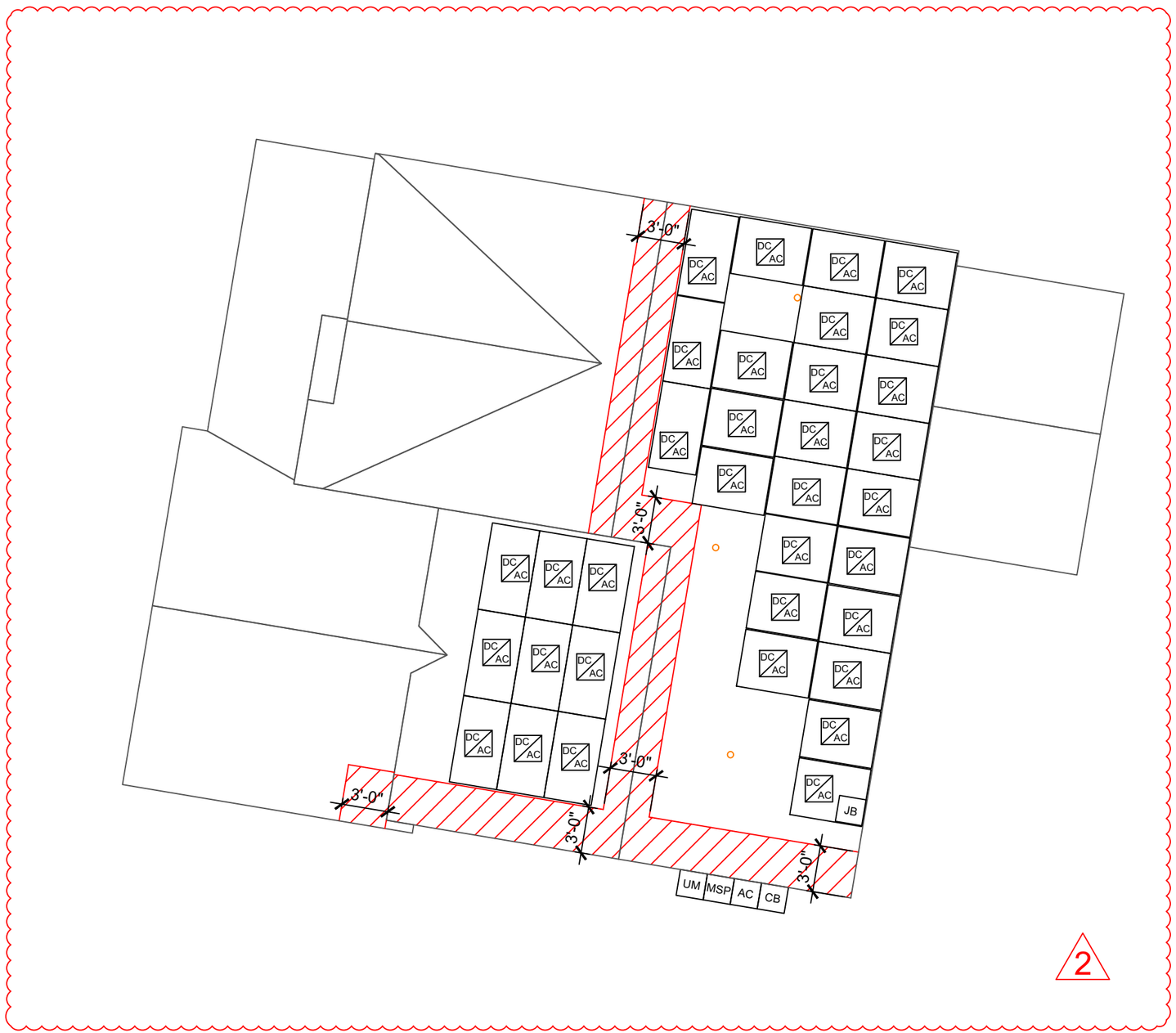
SITE PLAN

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

LEGEND:

- CHIMNEY
- PIPE VENT
- MODULES
- SETBACK
- AC — AC DISCONNECT
- MSP — MSP
- JB — JUNCTION BOX
- DC / AC — MICRO INVERTER
- CB — 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



NORTH CAROLINA PROFESSIONAL SEAL 054960 ENGINEER AVIAL LUMAGUI

STRUCTURAL ONLY

ROOF AREA: 2685 SQ FT

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

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 PLAN WITH MODULES LAYOUT

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

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
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT
----	----	----	----	----	SQ FT	SQ FT

NORTH CAROLINA PROFESSIONAL SEAL 054960 ENGINEER AVIAL LUMAGUI

STRUCTURAL ONLY

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

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

GREG ALBRIGHT

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

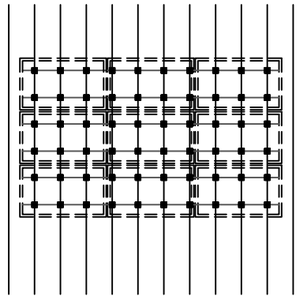
ROOF DETAILS

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

TABLE 1 - ARRAY INSTALLATION

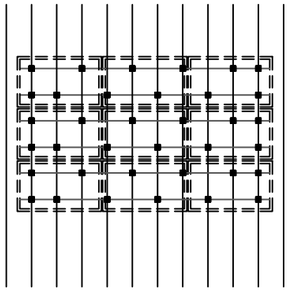
	ROOF PITCH	ROOFING TYPE	ATTACHMENT TYPE	FRAMING TYPE1	MAX UNBRACED LENGTH(FT.)1	RAFTER/TRUSS SISTERING	PENETRATION PATTERN2	MAX ATTACHMENT SPACING (IN.)2	MAX RAIL OVERHANG(IN.)3
ROOF 1	30	COMP SHINGLE	ECOFASTEN ROCKIT SMART SLIDE	2X6 RAFTER @ 24" OC	7.00'	NOT REQ'D	STAGGERED	72" OC	24"
ROOF 2	30	COMP SHINGLE	ECOFASTEN ROCKIT SMART SLIDE	2X6 RAFTER @ 24" OC	7.00'	NOT REQ'D	STAGGERED	72" OC	24"

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



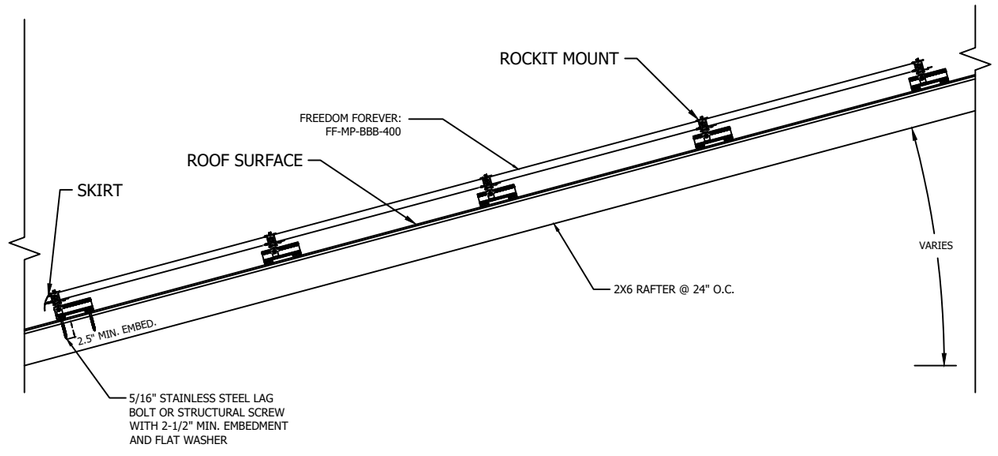
STACKED DETAIL

For Illustration purposes only



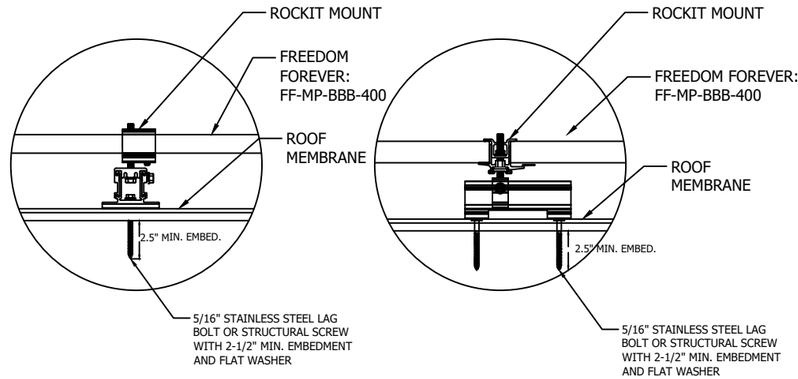
STAGGERED DETAIL

For Illustration purposes only



SOLAR PV ARRAY SECTION VIEW

Scale: NTS



ATTACHMENT DETAIL

Scale: NTS

NORTH CAROLINA PROFESSIONAL SEAL 054960 ENGINEER AVIAL LUMAGUI

STRUCTURAL ONLY

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

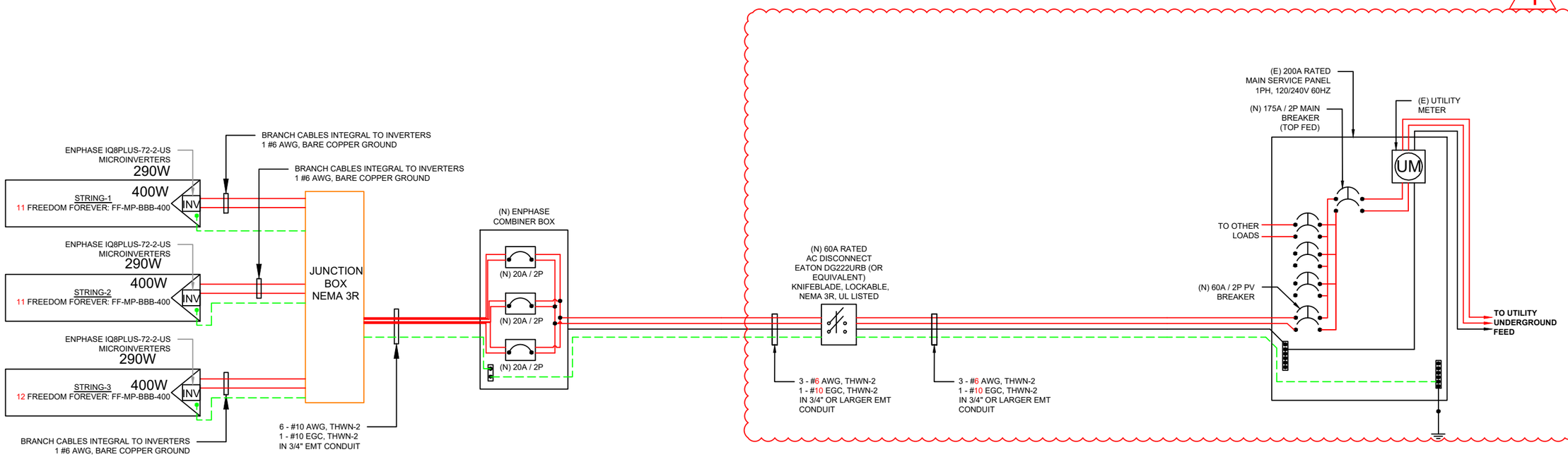
MOUNTING DETAILS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-3

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

NORTH CAROLINA PROFESSIONAL SEAL 055158 ENGINEER JOUNGHO CHOI

1



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

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

THREE LINE DIAGRAM

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-4

WIRE SCHEDULE

RACEWAY #	EQUIPMENT				CONDUCTOR QTY.	AWG WIRE SIZE	STARTING ALLOWABLE AMPACITY @ 90°C 310.15(B)(16)	STARTING CURRENT APPLIED TO CONDUCTORS IN RACEWAY	TEMPERATURE CORRECTION FACTOR 310.15(B)(2)(a)	ADJUSTMENT FACTOR FOR MORE THAN 3 CONDUCTORS 310.15(B)(3)(a)	ADJUSTED CONDUCTOR AMPACITY @ 90°C	MAXIMUM CURRENT APPLIED TO CONDUCTORS IN RACEWAY
1	DC	MODULE	TO	MICROINVERTER	2	10	40	17.24	0.91	1	36.40	21.55
2	AC	MICROINVERTER	TO	JUNCTION BOX	2	10	40	14.52	0.91	1	36.40	18.15
3	AC	JUNCTION BOX	TO	ENPHASE COMBINER BOX	6	6	75	41.14	0.91	0.8	54.60	51.43
4	AC	ENPHASE COMBINER BOX	TO	AC DISCONNECT	3	6	75	41.14	0.91	1	68.25	51.43
5	AC	AC DISCONNECT	TO	POI	3	6	75	41.14	0.91	1	68.25	51.43

CONDUCTOR AMPACITY CALCULATIONS IN ACCORDANCE WITH AC 690.8.

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

CONDUCTOR CALCULATIONS

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

Residential Optional Calculation

by: John Sokolik

Version 2014

9/25/1997

Freedom Forever LLC

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

2/8/2023 17:18

302631

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

STEP 2 Article 220.82 (C) ☑

A/C Condenser & Fixed Electric Space Heating

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

STEP 3 Article 220.82 (B) (3)

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

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

☐ Check Box for Gas Range

Cooktop Col B demand
Cooktop Col B demand
Oven(s) Col B demand
Oven(s) Col B demand

Number of appliances **0** Dem. Factor

Cooktop & Oven Demand Load

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**
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**

Use this area for your own notes

NORTH CAROLINA PROFESSIONAL SEAL 055158 ENGINEER JOUNGHO CHOI

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

ELECTRICAL CALCULATIONS

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

OCPD SIZES:

20A BREAKER
20A BREAKER
20A BREAKER
60A BREAKER

SERVICE LIST:

NONE

MATERIAL LIST:

QTY.	PART	PART #	DESCRIPTION
34	MODULES	PV-110-400	FREEDOM FOREVER: FF-MP-BBB-400
1	JUNCTION BOX	480-276	600VDC NEMA 3R UL LISTED JUNCTION BOX
4	CONNECTORS	240-300	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (FEMALE)
4	CONNECTORS	240-301	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (MALE)
34	MICROINVERTER(S)	INV-120-015	ENPHASE IQ8PLUS-72-2-US
1	ENVOY	160-100	"ENPHASE AC COMBINER W/ ENVOY PCB, 80A"
40	Q CABLE	160-106	"ENPHASE, Q CABLE PORTRAIT FOR 60/72 CELL"
40	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)"
272	CLIP	160-108	ENPHASE TIE WRAPS / CABLE CLIPS
9	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
59	ROOF ATTACHMENT 1	RAC-265-034	ROCKIT SMART SLIDE
25	TRIM 1	241-253	ROCKIT TRIM COMP DARK
64	SLIDER 1	261-603	ROCKIT SLIDER COMP DARK
19	BONDING CLAMP 1	221-100	N/S BONDING CLAMP
8	BONDING CLAMP 1	241-404	TRIM BONDING CLAMP
36	MOUNT ASSEMBLY 1	241-405	MLPE MOUNT ASSY
21	SPLICE 1	261-604	ROCKIT SPLICE
5	ATTACHED SPLICE 1	211-101	ATTACHED SPLICE 8 INCH
28	TRIMRAIL 1	261-606	TRIMRAIL UNIV CLIP W/ HDW
9	TRIM SPLICE 1	261-605	TRIM SPLICE DRK
15	TRIMRAIL 1	211-115	TRIMRAIL UNIV DRK
34	GROUND LUG 1	260-585	ILSCO GROUND LUG
34	TRIM END CAPS 1	221-200	ROCKIT TRIM END CAPS
118	SCREW	RAC-265-035	ROCKIT SCREW #12X3

NORTH CAROLINA PROFESSIONAL SEAL 055158 ENGINEER JOUNGHO CHOI

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

EQUIPMENT & SERVICE LIST

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	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)

M

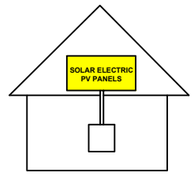
AC

PM

INVERTER

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 CAL/CM^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

NEC 706.15(C) AND NEC 110.16

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

DC

J/B

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

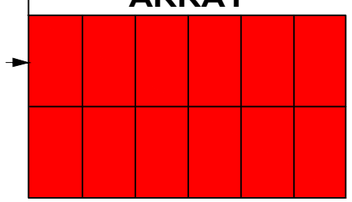
706.15(C)(4) & 690.13(B)

WARNING

TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL

NEC 110.27(C) & OSHA 1910.145(F)(7)

ARRAY



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

NOTES:

1. AC 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

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

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

GREG ALBRIGHT

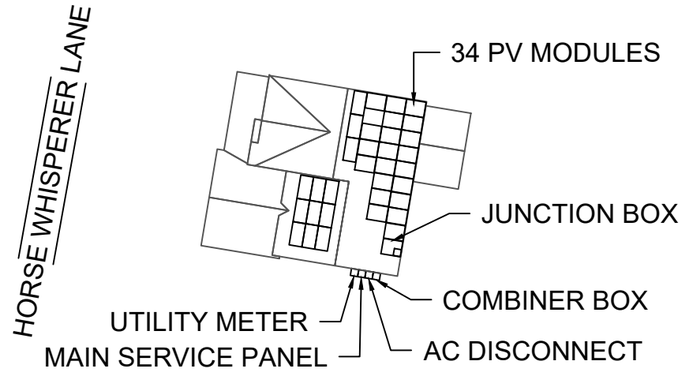
CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

LABELS

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

N

2

NOTES:

1. AC 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. AERIAL 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.

NORTH CAROLINA PROFESSIONAL SEAL 055158 ENGINEER JOUNGHO CHOI

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

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

GREG ALBRIGHT

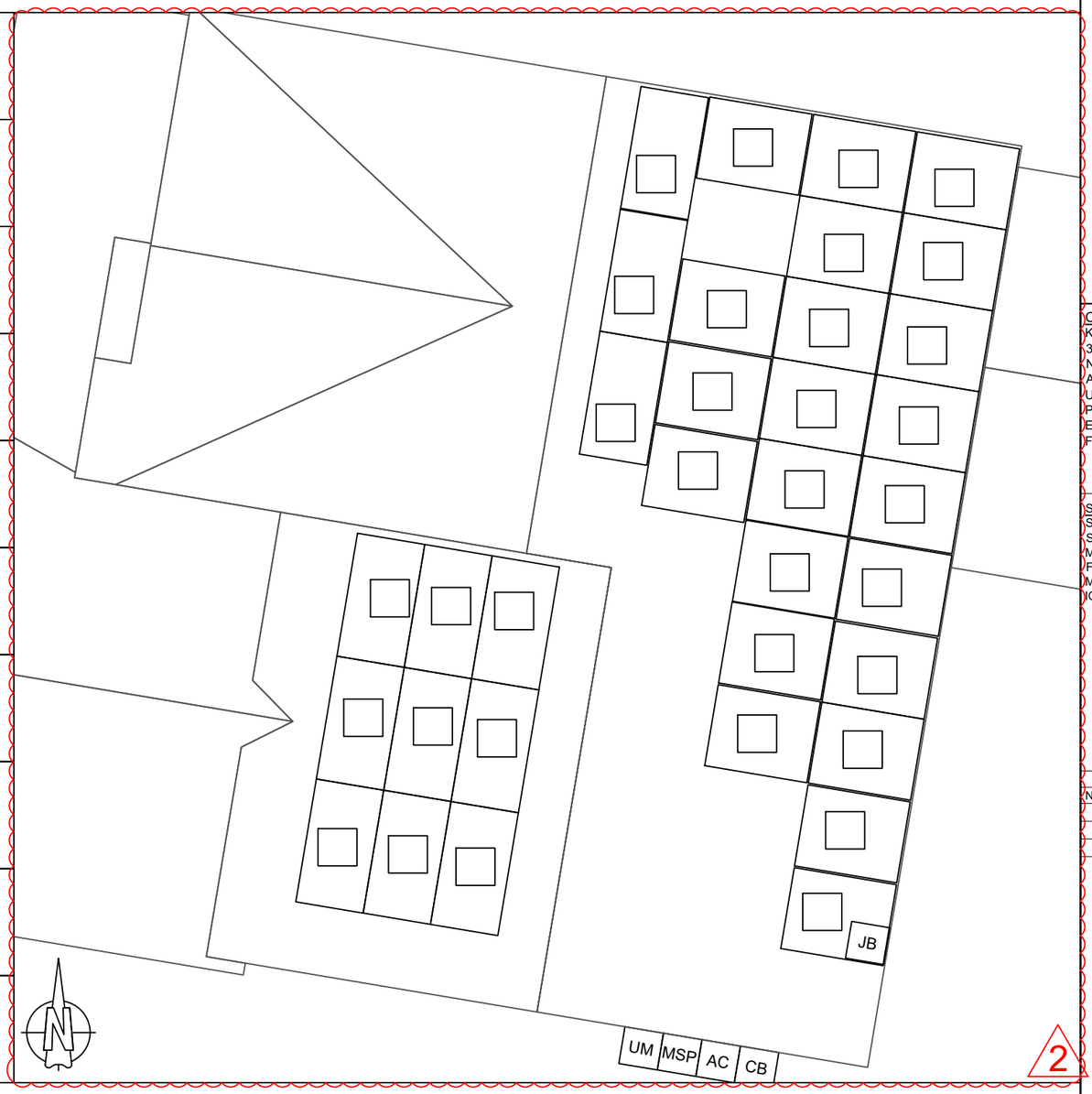
CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

SITE PLACARD

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

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

CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

MICROINVERTER CHART

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

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

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:

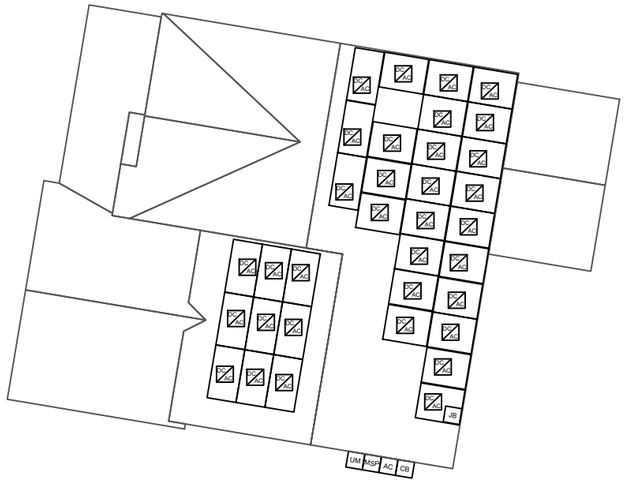
NAME: _____

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.

NAME	SIGNATURE

DATE: _____ TIME: _____



2

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) GAS SHUT OFF
- (H_2O) WATER SHUT OFF
- (7) SERVICE DROP
- (Z) POWER LINES

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

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

SAFETY PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	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 indentified 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:
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

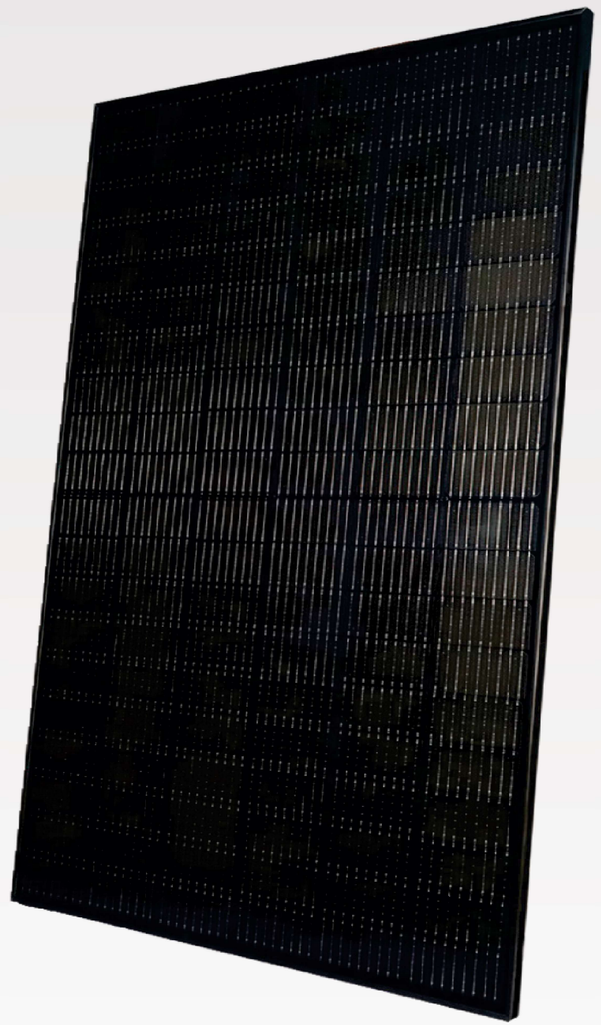
GREG ALBRIGHT

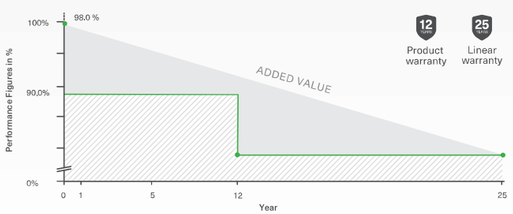
CONTRACTOR LICENSE:
ELECTRICAL CONTRACTOR U.34043

SAFETY PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
302631	6/29/2023	R.V.	PV-10

400W MODULE





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/m², 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/ft2)
Rear Side Design Load	2,400Pa (50lb/ft2)

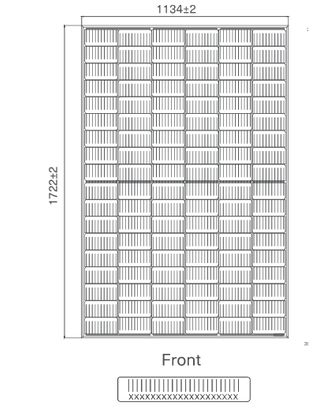
PACKAGING INFORMATION

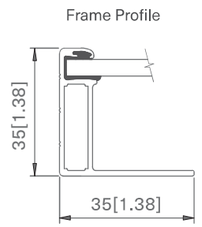
Container	20' GP	40' HC
Pallets per Container	6	26
Panels per Container	186	806
Panels per Pallet	31	31
Packaging Bon Weight	679 kg (1497 lbs)	
Panels per Pallet	1785 x 1130 x 1180 mm (70.28 x 44.49 x 46.46 in)	

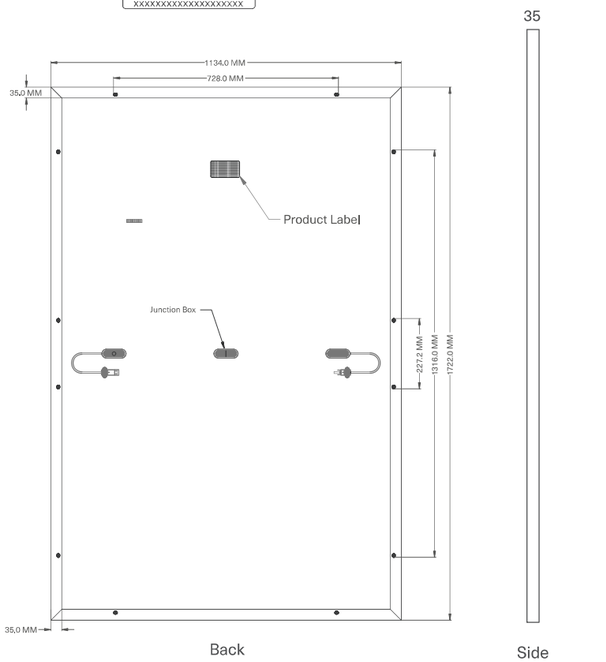
TEMPERATURE RATINGS

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

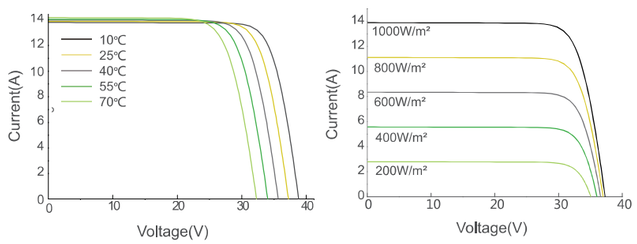
UL 61730 | UL 61215 | ISO 9001 | ISO 14001







CURRENT-VOLTAGE CURVE



CERTIFICATE
OF COMPLIANCE

intertek
Total Quality. Assured.

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 Holbert
for L. Matthew Snyder, Certification Manager

VALID LISTING MARKS

C ETL US LISTED Intertek

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

intertek
Total Quality. Assured.

	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: FF-MP-BBB- followed by 365, 370, 375 or 380. FF-MP-BBB- followed by 395, 400, 405 or 410. BASIC LISTEE MODELS: NUSA120H- followed by 365, 370, 375 or 380; followed by MB. NUSA108H- followed by 395, 400, 405 or 410; followed by MB.

ENPHASE

DATA SHEET

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.

Enphase 25 year limited warranty

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.

UL CERTIFIED SAFETY

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	
Overvoltage class DC port		II	
DC port backfeed current	mA	0	
PV array configuration		1 x 1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	

OUTPUT DATA (AC)		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%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.7	
CEC weighted efficiency	%	97	
Night-time power consumption	mW	60	

MECHANICAL DATA	
Ambient temperature range	-40°C to +60°C (-40°F to +140°F)
Relative humidity range	4% to 100% (condensing)
DC Connector type	MC4
Dimensions (H x W x D)	212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")
Weight	1.08 kg (2.38 lbs)
Cooling	Natural convection – no fans
Approved for wet locations	Yes
Pollution degree	PD3
Enclosure	Class II double-insulated, corrosion resistant polymeric enclosure
Environ. category / UV exposure rating	NEMA Type 6 / outdoor

COMPLIANCE	
Certifications	CA Rule 21 (UL 1741-SA), UL 62109-1, IEEE 1547:2018 (UL 1741-SB 3rd 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.

IQ8SP-12A-DS-0067-03-EN-US-2022-12-27

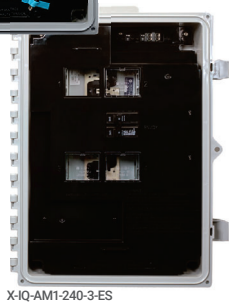
Data Sheet
Enphase Networking

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.

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


X-IQ-AM1-240-3-ES

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

UL LISTED

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE

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	• 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**

ENPHASE

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

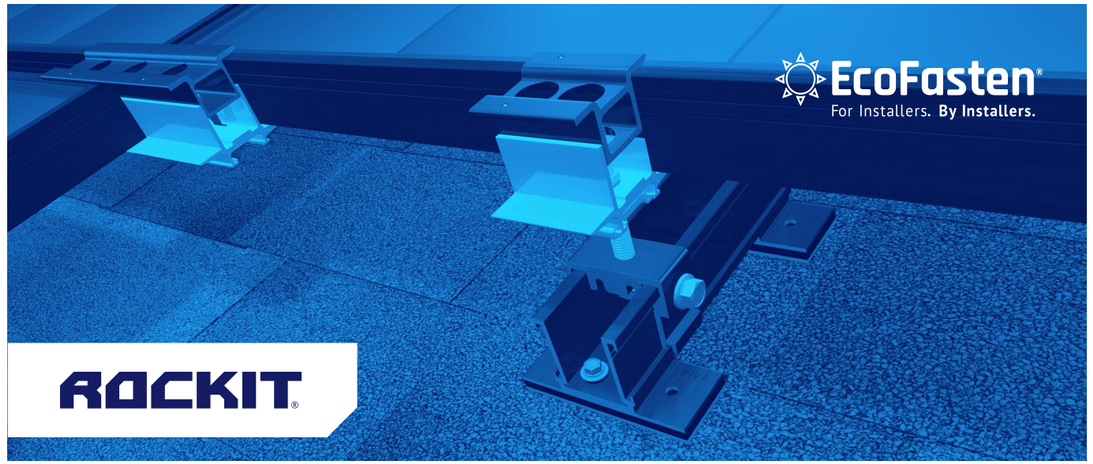
Supporting documents:

- Eatons Volume 2-Commercial Distribution
- Eaton Specification Sheet - DG222URB

Certifications:

- UL Listed

Product compliance: No Data



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:

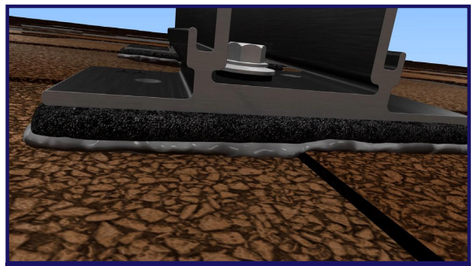
Part Number:	Description:
2011024	RI SMART SLIDE BLK 6.75"
2011025	RI SMART SCRW #12X3" W/BW

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

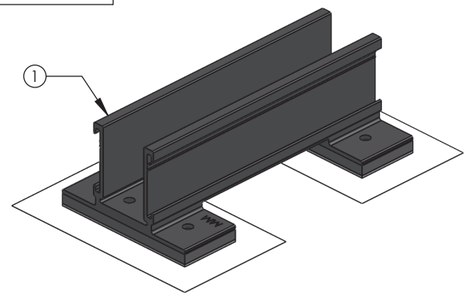
EcoFasten®
An Esdec Solar Group Company
4141 W. VAN BUREN ST, SUITE 2, PHOENIX AZ 85009
1-877-859-3947 | INFO@ECOFASTENSOLAR.COM

PRODUCT CUT SHEET

EcoFasten® For Installers. By Installers.

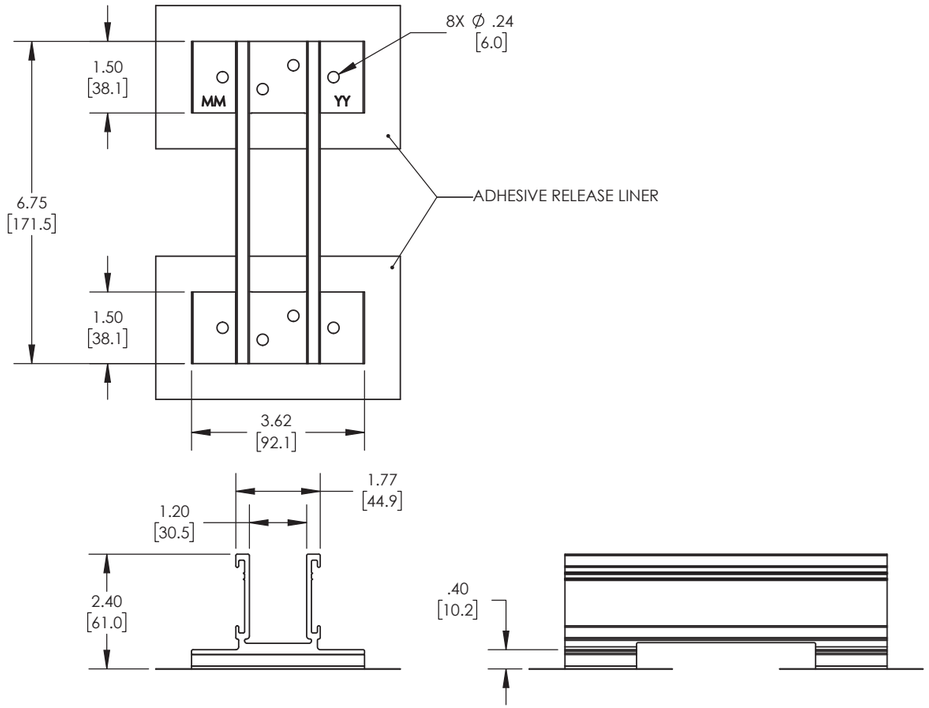
RI SMART SLIDE BLK 6.75"

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

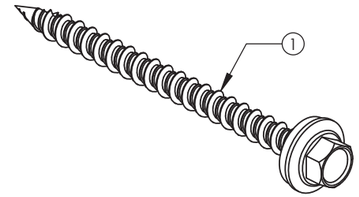
Rev: CS-3

PRODUCT CUT SHEET

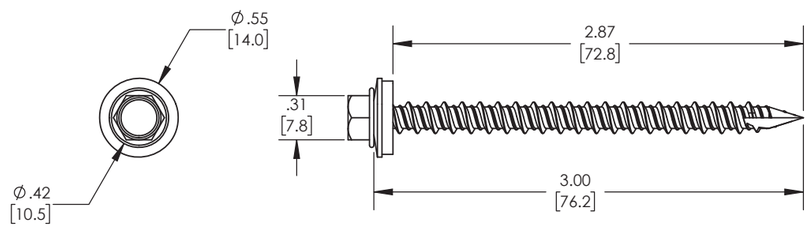
EcoFasten® For Installers. By Installers.

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.

DIGITALLY SIGNED

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

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