PHOTOVOLTAIC ROOF MOUNT SYSTEM

CODE AND STANDARDS

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

- 2020 NATIONAL ELECTRICAL CODE
- 2018 NORTH CAROLINA RESIDENTIAL CODE
- 2018 NORTH CAROLINA BUILDING CODE
- ALL OTHER ORDINANCE ADOPTED BY THE LOCAL GOVERNING AGENCIES

SITE NOTES / OSHA REGULATION

1. A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
2. THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
3. ROOFTOP MOUNTED PHOTOVOLTAIC PANELS AND MODULES SHALL BE TESTED, LISTED AND IDENTIFIED BY RECOGNIZED ELECTRICAL TESTING LABORATORY.
4. MODULES AND SUPPORT STRUCTURES SHALL BE GROUNDED
5. SOLAR INVERTER SHALL BE LISTED TO UL1741
6. ALL CONDUCTORS SHALL BE COPPER AND SHOULD BE 75 AND 90 DEG RATED
7. REMOVAL OF AN INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR, THE PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUIT GROUNDED CONDUCTORS.
8. LIVE PARTS OF PV SOURCE CIRCUITS AND PV OUTPUT CIRCUITS OVER 150V TO GROUND SHALL NOT BE ACCESSIBLE TO OTHER THAN QUALIFIED PERSONS WHILE ENERGIZED.
9. ALL PV MODULES AND ASSOCIATED EQUIPMENT AND WIRING SHALL BE PROTECTED FROM PHYSICAL DAMAGE.

SOLAR CONTRACTOR

1. MODULE CERTIFICATIONS INCLUDE UL1703, IEC61646, IEC61370.
2. IF APPLICABLE, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE MARKED GROUNDING LUG HOLES PER THE MANUFACTURERS INSTALLATION REQUIREMENTS.
3. AS INDICATED BY DESIGN, OTHER NRTL LISTED MODULE GROUNDING DEVICES MAY BE USED IN PLACE OF STANDARD GROUNDING LUGS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ.
4. ALL MICROINVERTERS, PHOTOVOLTAIC MODULES, AC COMBINERS, DC-AC CONVERTERS AND SOURCE CIRCUIT COMBINERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER NEC690.4(B).
5. ALL SIGNAGE TO BE INSTALLED IN ACCORDANCE WITH LOCAL BUILDING CODE.
6. TERMINALS AND LUGS WILL BE TIGHTENED TO MANUFACTURER TORQUE SPECIFICATIONS (WHEN PROVIDED) IN ACCORDANCE WITH NEC CODE 110.14(D) ON ALL ELECTRICAL CONNECTIONS.
7. MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC UNLESS NOT AVAILABLE.

SR.#	PROJECT INFORMATION	
1	PV MODULES	17 x SILFAB ELITE SIL-410 BG
2	MICRO INVERTERS	17 X IQ8PLUS-72-2-US
3	ROOF TYPE	ASPHALT SHINGLES
4	RACKING	PSR-B84 RAILS (BLACK)
5	MOUNTING TYPE	CompMount Flashing (Black)
6	DC SIZE	6.97 KW
7	AC SIZE	4.93 KVA

SR.#	PROJECT INFORMATION	
1	PV1	DRAWING INDEX
2	PV2	SITE LAYOUT
3	PV3	STRING MAPPING
4	PV4	ELECTRICAL ONE LINE DIAGRAM
5	PV5	DETAILED ELECTRICAL WIRING SCHEMATIC
6	PV6	PV LABELS
7	PV7	BILL OF MATERIALS
8	PV8	ATTACHMENT DETAIL

VICINITY MAP

TOP VIEW OF THE BUILDING

DESIGN CRITERIA
WIND SPEED: 135 MPH
GROUND SNOW LOAD: 20 PSF
WIND EXPOSURE FACTOR: B

UTILITY COMPANY:
DUKE ENERGY

PERMIT ISSUER (AHJ):
HARNETT COUNTY

SCOPE OF WORK
INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM.

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Fuquay Varina NC 27526

Customer Signature:

Sheet Name:

Drawing Index

JOB NUMBER:

23-511-LG

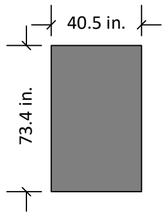
Date:	Revision:
10/12/2023	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV1

NABCEP CERTIFIED
PV Installation Professional
Ali Buttar
PVIP #031310-32

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	43°	200°	17

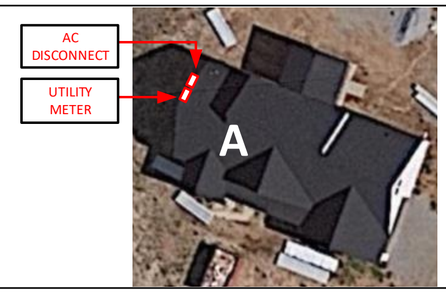
MODULE DIMENSIONS



PV System Dead Load
(Panel + Racking weight) / PV System Area
(No. of panels x Weight of panel(lbs.) +Length of racking(ft.) x 1.15 lb.ft) /
(No. of panels x Height x Width) = Total psf

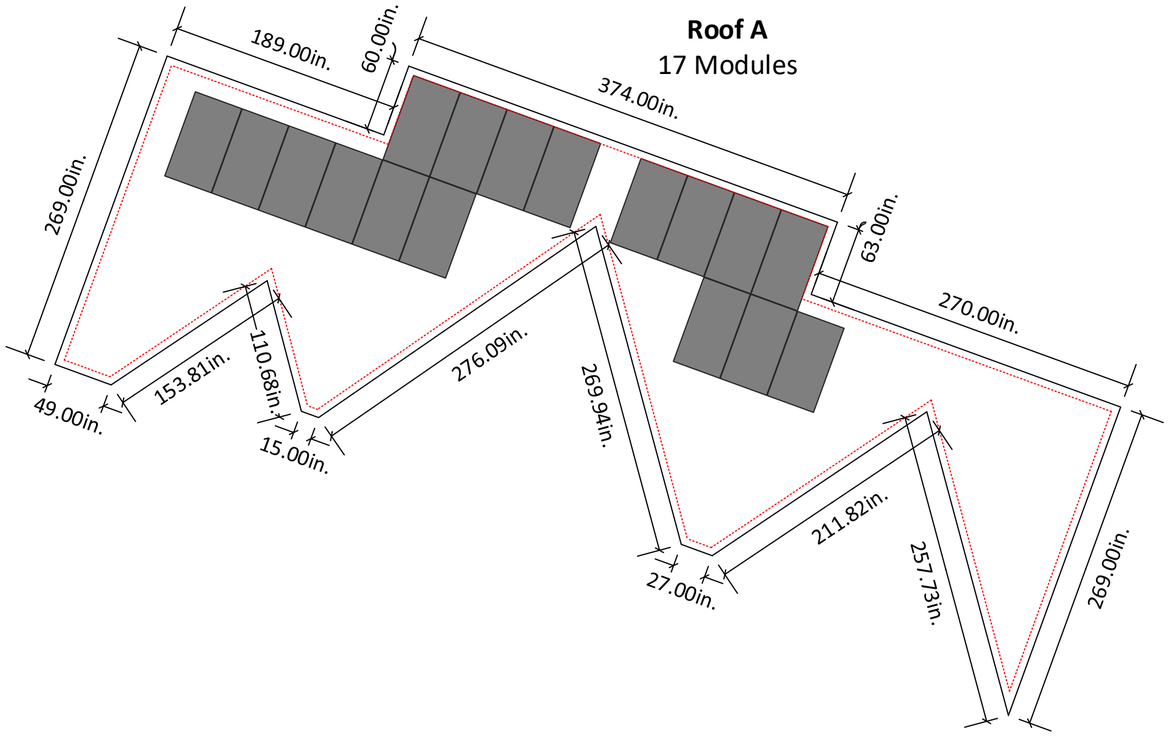
ROOFS	A		
DEAD LOAD (PSF)	2.60		

Vent	■	• Roof A has no vents. • No vents will be covered by PV Module during the installation



SYSTEM DETAILS

NUMBER OF PANELS : 17
PANELS MODEL : SILFAB ELITE SIL-410 BG
DC SIZE : 6.97 KW
AC SIZE : 4.93 KVA



6in. setback from sides of the roof

SITE LAYOUT
SCALE: 1/8" - 1'

N

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Sheet Name:

Site Layout

JOB NUMBER:

23-511-LG

Date:	Revision:
10/12/2023	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV2

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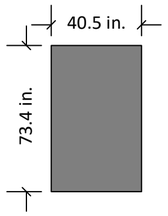
PV Installation Professional
Ali Buttar
PVIP #031310-32

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	43°	200°	17

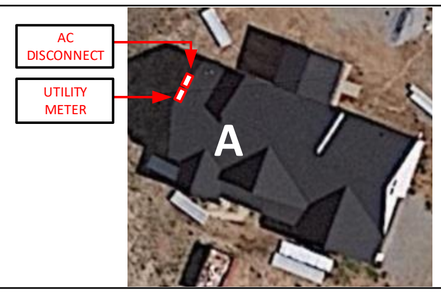
MODULE DIMENSIONS



STRING LAYOUT

ENPHASE IQ COMBINER 4

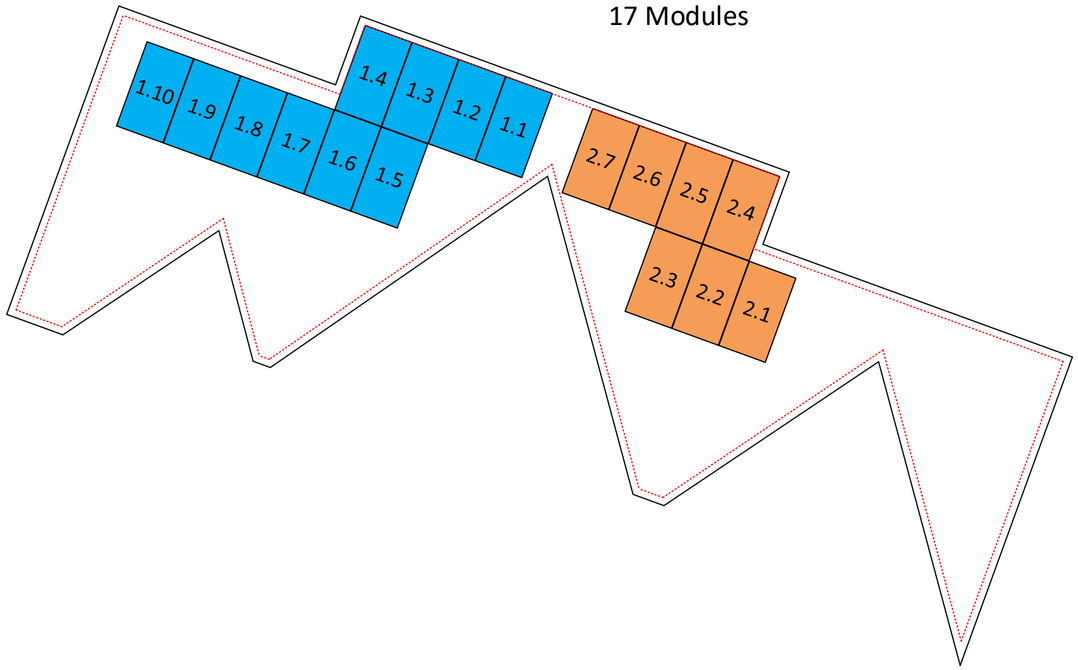
Strings #	No. of Modules	Color	Strings #	No. of Modules	Color
String 1	10				
String 2	07				



SYSTEM DETAILS

NUMBER OF PANELS : 17
PANELS MODEL : SILFAB ELITE SIL-410 BG
DC SIZE : 6.97 KW
AC SIZE : 4.93 KVA

Roof A
17 Modules



6in. setback from sides of the roof

STRING MAPPING
SCALE: 1/8" - 1'

N

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String Mapping

JOB NUMBER:

23-511-LG

Date:	Revision:
10/12/2023	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV3

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PV Installation Professional
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PVIP #031310-32

STRING CALCULATION

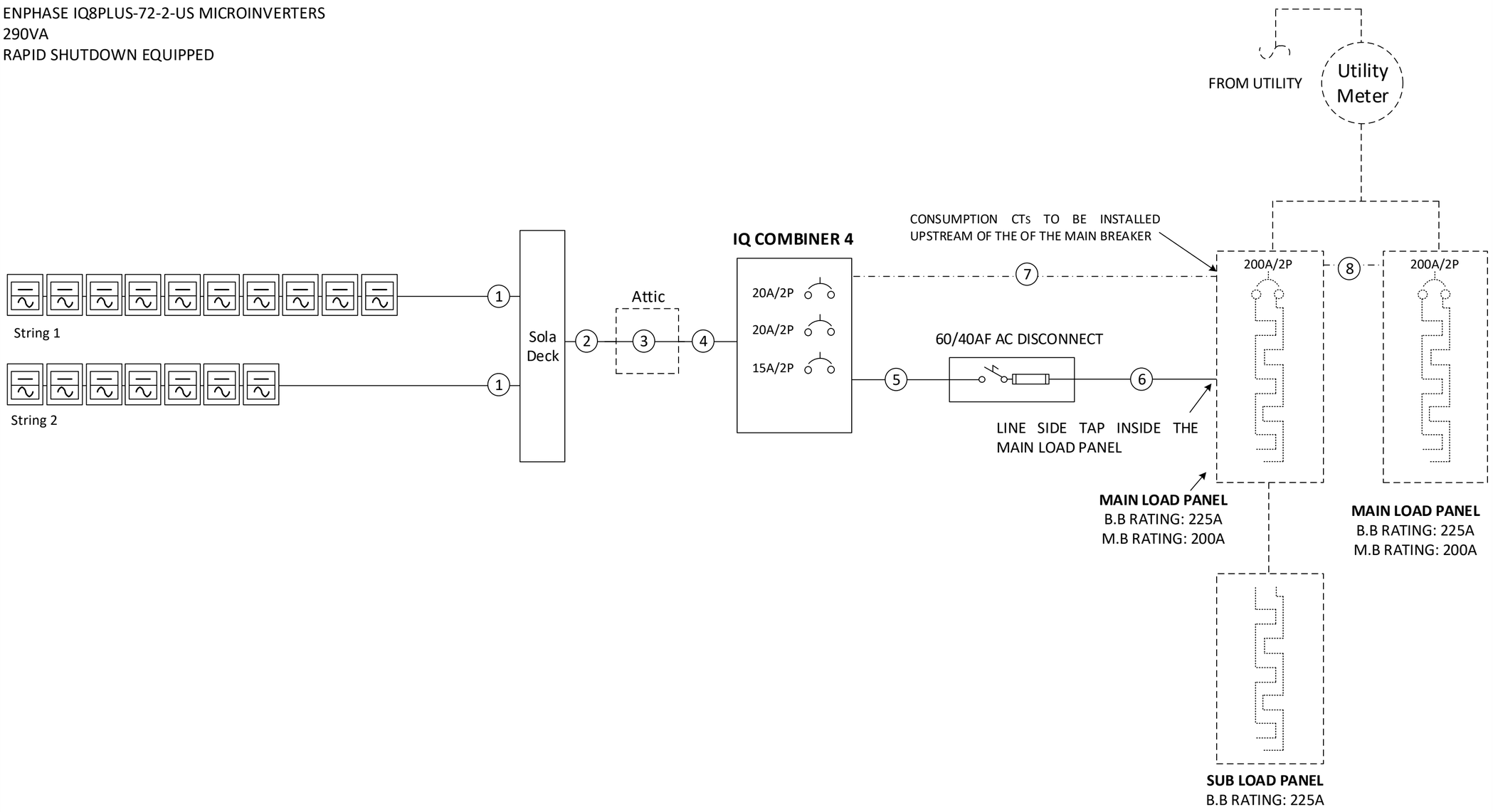
String #	No of Modules	Estimated Power	Imax	Voc	Vmpp	Vrise (< 2%)
1	10	4,100W	15.12A	<30 VAC	240 AC	0.47+0.48=0.95
2	07	2,870W	10.58A	<30 VAC	240 AC	0.47+0.38=0.85

NEC Code 2020 and UL Standard Refrences

Rapid Shut Down	NEC 690.12 (A-D), UL1741	Grounding	NEC Article 250.30(A)
Disconnecting Means	NEC 690.13	Conduit Fill	NEC Table C.9, 310.15(B)(3)(a)
Feeder Sizing	NEC Table 310, 15(B)(16, 17)	Interconnection	NEC 705.12
Over current Protection	NEC 690.9		

17 X SILFAB ELITE SIL-410 BG
410W

ENPHASE IQ8PLUS-72-2-US MICROINVERTERS
290VA
RAPID SHUTDOWN EQUIPPED



- System Size: 6,970W DC
- (17) SILFAB ELITE SIL-410 BG
- (17) ENPHASE IQ8PLUS-72-2-US MICROINVERTERS
- Inverter Output: 1.21A max @ 240 VAC (each microinverter)
- 290 VA AC output max (each micro inverter)
- 4.93 kVA AC output max

- Grounding will be done via Pegasus grounding lugs and mid-clamps to ensure the rail and panels are continuously grounded.
- Rapid Shutdown is included in the Micro Inverters, refer to Micro Inverter attached datasheets.
- The load center / disconnect will be visible, lockable accessible to utility linesmen and will be properly labelled as per NEC requirements. It will be located on the exterior wall of the building, next to the utility meter.

Sr.No	#Wire	Conduit Size	Ground Wire	Amperage
1	1 x #12 Q Cable		#10 Bare CU	20A
2	2 x #10 MC Cable			20A
3	4 x #10 THHN Cu	3/4" LFMC	#10 Green	20A
4	4 x #10 THHN Cu	3/4" EMT	#10 Green	20A
5	3 x #6 THHN Cu	3/4" LFNC	#8 Green	40A
6	3 x #6 THHN Cu	3/4" EMT		40A
7	Lead Wire 18AWG, PVC Extruded	3/4" EMT		
8	Lead Wire 18AWG, PVC Extruded	3/4" LFNC		

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Sheet Name:

Electrical One Line Diagram

JOB NUMBER:

23-511-LG

Date:

10/12/2023

Revision:

A

Sheet Size:

ANSI C
17" X 22"

Sheet Number:

PV4

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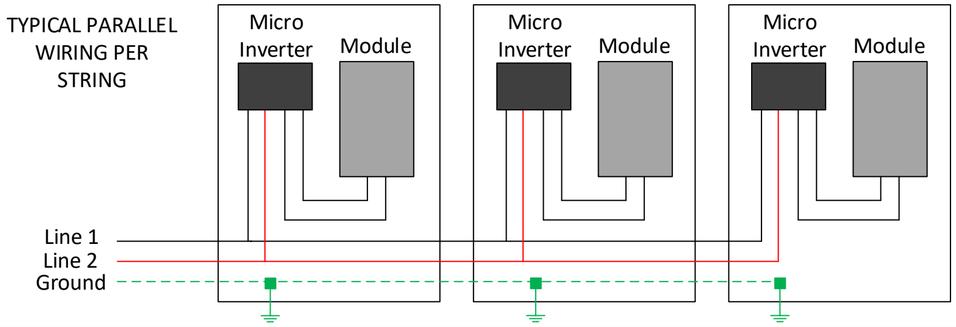
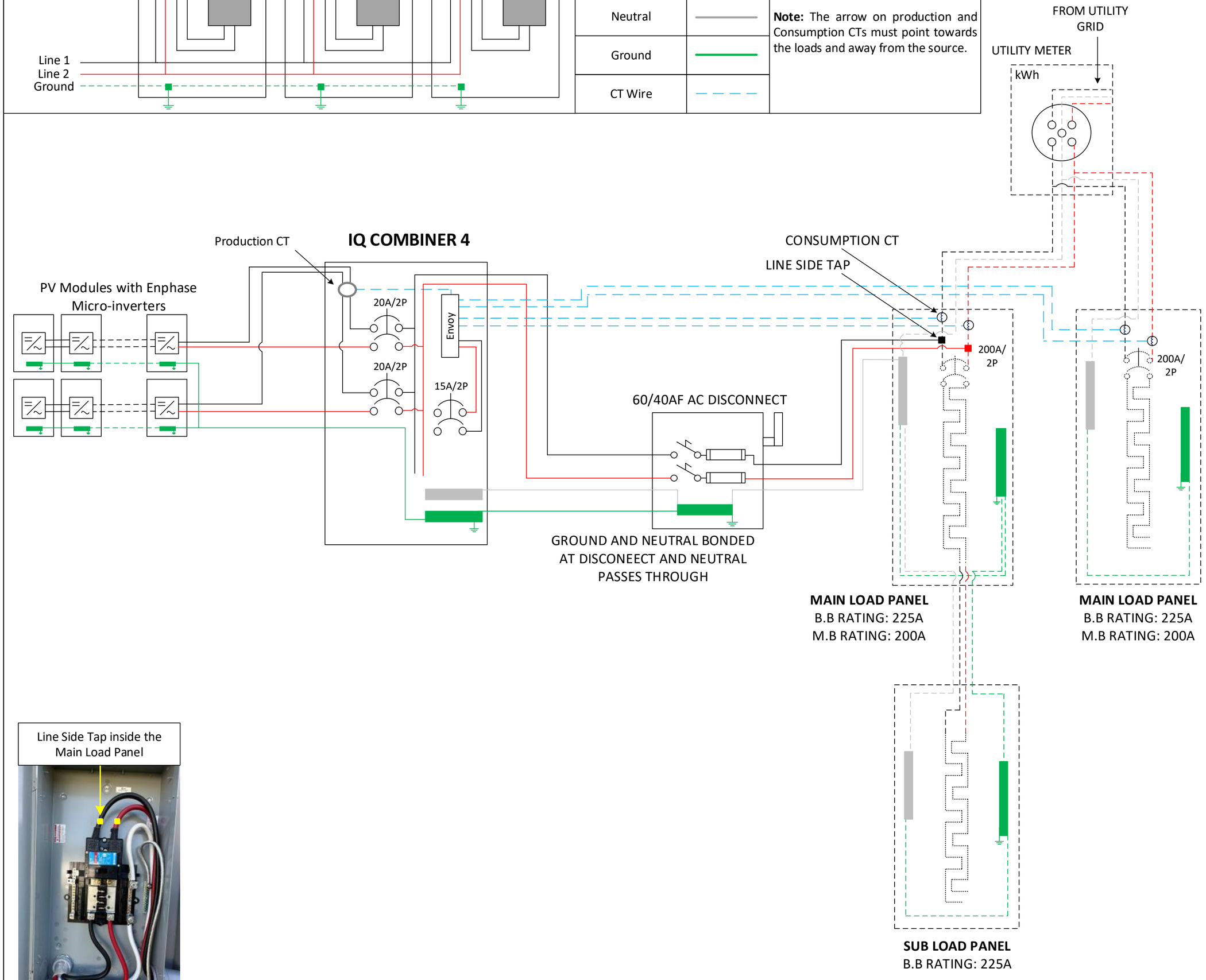


Line 1	
Line 2	
Neutral	
Ground	
CT Wire	

Note: Line 1 from all strings will be passed from the production CT.

Note: The arrow on production and Consumption CTs must point towards the loads and away from the source.



Line Side Tap inside the Main Load Panel

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Sheet Name:

Detailed Electrical Diagram

JOB NUMBER:

23-511-LG

Date:	**Revision:**
10/12/2023	A
Sheet Size: ANSI C 17" X 22"	**Sheet Number:** PV5

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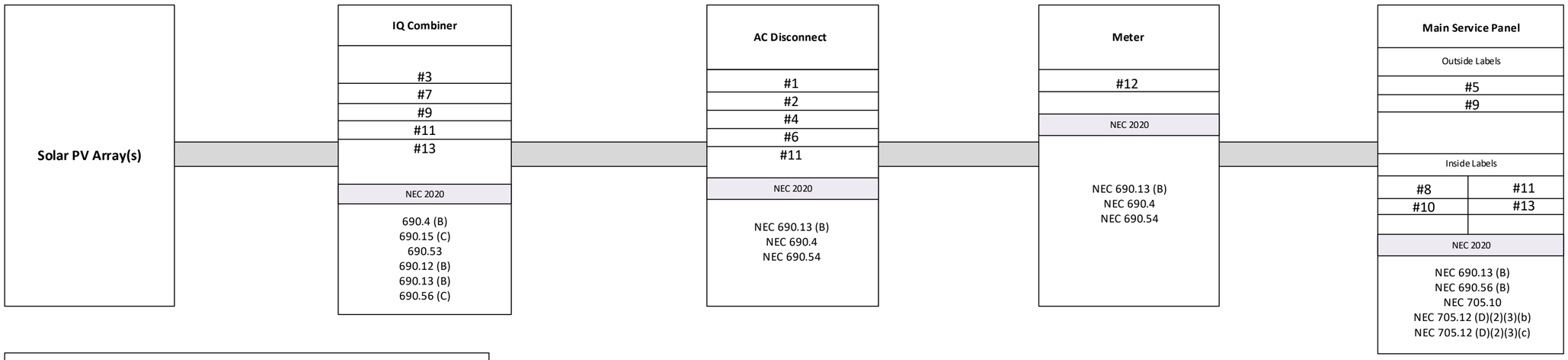


LABELING AND WARNING SIGNS: NEC 2020

A. PURPOSE
PROVIDE EMERGENCY RESPONDERS WITH APPROPRIATE WARNING AND GUIDANCE WITH RESPECT TO ISOLATING THE SOLAR ELECTRIC SYSTEM. THIS CAN FACILITATE IDENTIFYING ENERGIZED ELECTRICAL LINES THAT CONNECT THE SOLAR PANELS TO THE INVERTER, AS SHOULD NOT BE CUT WHEN VENTING FOR SMOKE REMOVAL.

B. MAIN SERVICE DISCONNECT:

1. RESIDENTIAL BUILDINGS- THE MARKING MAY BE PLACED WITHIN THE MAIN SERVICE DISCONNECT. THE MARKING SHALL BE PLACED ON THE OUTSIDE COVER IF THE MAIN SERVICE DISCONNECT IS OPERABLE WITH THE SERVICE PANEL CLOSED.

2. COMMERCIAL BUILDINGS- THE MARKINGS SHALL BE PLACED ADJACENT TO THE MAIN SERVICE DISCONNECTCLEARLY VISIBLE FROM THE LOCATION WHERE THE LEVER IS OPERATED

3. MARKINGS, VERBIAGE, FORMAT AND TYPE OF MATERIAL

a. VERBIAGE: CAUTION; SOLAR ELECTRIC SYSTEM CONNECTED
b. FORMAT:

(1) WHITE LETTERING ON A RED BACKGROUND
(2) MINIMUM 3/8 INCH LETTER HEIGHT
(3) ALL LETTERS SHALL BE CAPITALIZED
(4) ARIAL OR SIMILAR FONT, NON-BOLD

c. MATERIAL:

(1) REFLECTIVE, WEATHER RESISTANT MATERIAL SUITABLE FOR THE ENVIRONMENT (USE UL-969) AS STANDARD FOR WEATHER RATING): DURABLE ADHESIVE MATERIALS MEET THIS REQUIREMENT.

C. MARKING REQUIREMENTS ON CONDUIT, RACEWAYS, ENCLOSURES, CABLE ASSEMBLIES, COMBINERS AND JUNCTION BOXES;

1. MARKING: PLACEMENT, VERBIAGE, FORMAT AND TYPE OF MATERIAL.

a. PLACEMENT: MARKINGS SHALL BE PLACED EVERY 10 (TEN) FEET ON ALL INTERIOR AND EXTERIOR DC CONDUITS, RACEWAYS, ENCLOSURES AND CABLE ASSEMBLIES, AT TURNS ABOVE AND/OR BELOW PENETRATIONS, ALL COMBINERS AND JUNCTION BOXES.
b. VERBIAGE: CAUTION SOLAR CIRCUIT
c. THE FORMAT AND TYPE OF MATERIAL SHALL ADHERE TO SECTION B-3.B & C ABOVE

D. INVERTERS ARE NOT REQUIRED TO HAVE CAUTION MARKINGS

#1

PHOTOVOLATIC

AC DISCONNECT

#2

RAPID SHUTDOWN
SWITCH FOR
SOLAR PV SYSTEM

#3

PHOTOVOLTIVC POWER SOURCE

OPERATING AC VOLTAGE	240	V
MAXIMUN OPERATING AC OUTPUT CURRENT	25.71	A

#4

AC DISCONNECT
PHOTOVOLTAIC SYSTEM
POWER SOURCE

RATED AC OUTPUT CURRENT	25.71	AMPS
NOMINAL OPERATING AC VOLTAGE	240	VOLTS

#5

SOLAR AC DISCONNECT
LOCATED AT WEST SIDE WALL
OF THE HOUSE BESIDE THE
UTILITY METER

#6

SERVICE DISCONNECT LOCATED
INSIDE THE MAIN LOAD PANEL

#7

PHOTOVOLTAIC SYSTEM
COMBINER PANEL
DO NOT ADD LOADS

#8

WARNING

THIS EQUIPMENT FED BY MULTIPLE SOURCES.TOTAL RATING OF ALL OVERCURRENT DEVICES,EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,SHALL NOT EXCEED AMPACITY OF BUSBAR

#9

WARNING

DUAL POWER SUPPLY
SOURCES: UTILITY GRID AND
PV SOLAR ELECTRIC SYSTEM

#10

WARNING

TURN OFF PHOTOVOLTAIC
AC DISCONNECT PRIOR TO
WORKIN INSIDRE PANEL

#11

WARNING

ELECTRIC SHOCK HAZARD
TERMIONAL OM THE LINE AND LOAD
SIDES MAY BE ENERGIZED IN THE OPEN
POSITION

#12

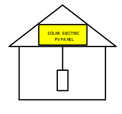
WARNING

THIS SERVICE METER
IS ALSO SERVED BY A PHOTOVOLTAIC
SYSTEM

#13

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



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PV Labels

JOB NUMBER:

23-511-LG

Date:	Revision:
10/12/2023	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV6

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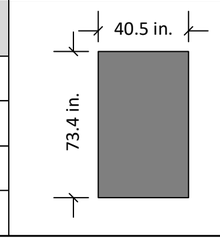
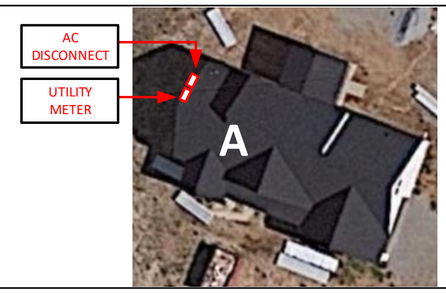
PV Installation Professional
Ali Buttar
PVIP #031310-32

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	43°	200°	17

MODULE DIMENSIONS

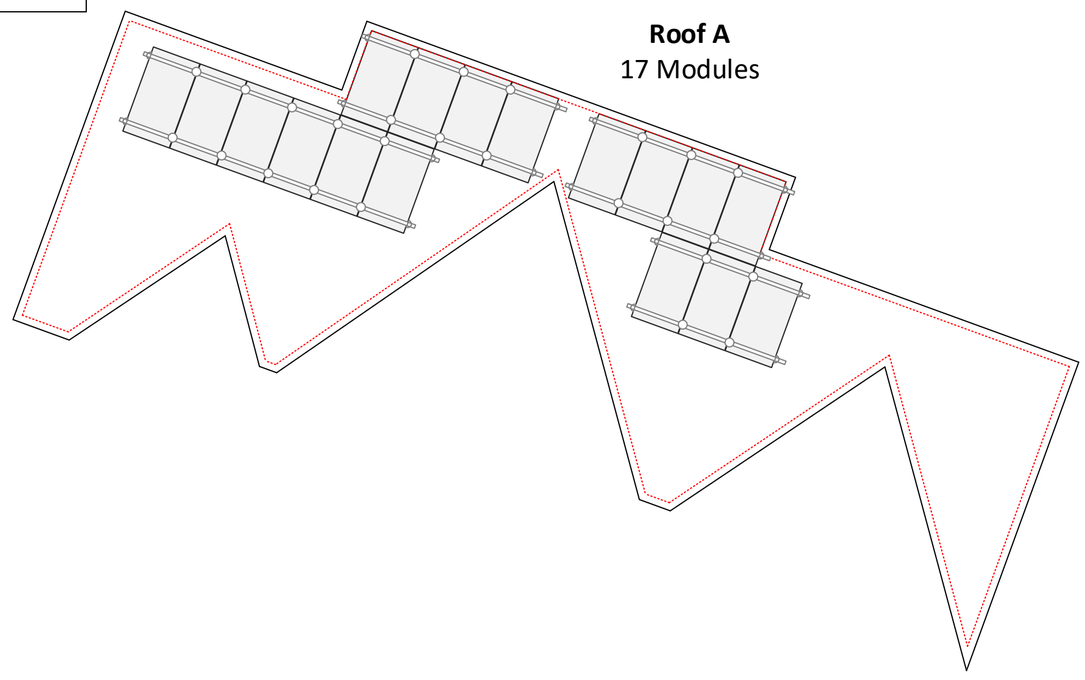


Rails and Splices : PSR-B84 (BLACK)	Roof Attachment : Pegasus Comp Mount
Rafter Spacing : 16 in	There is one layer of shingles Roofing material is asphalt shingles
Attachment Span: 4ft	The roof is located in 135mph wind zone



PV LABELS

Sr No	Code	Qty
01	03-302	01
02	02-316	01
03	03-390	01
04	03-306	01
05	8M-001	01
06	8M-002	01
07	03-355	01
08	05-108	01
09	05-211	02
10	05-372	01
11	05-215	03
12	07-359	01
13	07-111	02



6in. setback from sides of the roof

RAILS AND MOUNTING SYSTEM

- 18 x PSR-B84: Pegasus Rail, Black, 84" (7 Feet)
- 10 x PSR-SPL: Pegasus - Bonded, Structural Splice
- 26 x PSR-MCB: Pegasus - Multiclamp, Mid/End, 30 to 40 mm, Black
- 16 x PSR-HEC: Pegasus - Hidden End Clamp
- 17 x PSR-MLP: Pegasus - MLPE Mount
- 08 x PSR-LUG: Pegasus - Grounding Lug
- 26 x PSR-WMC: Pegasus - Wire Management Clip
- 03 x PSR-CBG: Pegasus - Cable Grip
- 16 x PSR-CAP: Pegasus - End Cap
- 34 x PSCR-UBBDT: Pegasus Comp Mount - Open Slot, Black L Foot, Black Flashing, Dovetail 3/8" T-Bolt
- 34 x Heyco Wire Clips

SOLAR MODULES

- 17 x SILFAB ELITE SIL-410 BG

INVERTER & SUPPORTING ITEMS

- 17 x Enphase IQ8PLUS-72-2-US micro inverter
- 01 x X-IQ-AM1-240-4 IQ Combiner 4
- 02 x CT-200-SPLIT

ENPHASE CABLES AND ACCESSORIES

- 21 x Q-12-10-240: Q Cable
- 01 x Q-12-RAW-300:Q Cable, 12 AWG (30ft)
- 06 x Q-CONN-10M Male Field-wireable connector
- 06 x Q-CONN-10F Female Field-wireable connector
- 02 x Q-TERM-10: Terminator Cap
- 02 x Q-SEAL-10: Female Sealing Cap
- 01 x Q-CLIP-100: Q Cable rail mount cable management clip (Pack of 100)
- 01 x Q-DISC-10: Disconnect tool

ELECTRICAL ITEMS

- 02 x Eaton BR220B with hold down kit support (Circuit breaker, 2 pole, 20A)
- 02 x IPCS 4002: Line/Load Side Hot Taps (#4/0 main - #2-10 tap) Medium types
- 01 x D222NRB: 250volt/60amp/2pole fusible disconnect (NEMA 3R)
- 02 x FRNR40: 250volt/40amp fuses
- 02 x EZSLR JB-1.2:SolaDeck Boxes

BILL OF MATERIAL
SCALE: 1/8" - 1'

N

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Bill of Material

JOB NUMBER:

23-511-LG

Date:	Revision:
10/12/2023	A
Sheet Size: ANSI C 17" X 22"	**Sheet Number:** PV7

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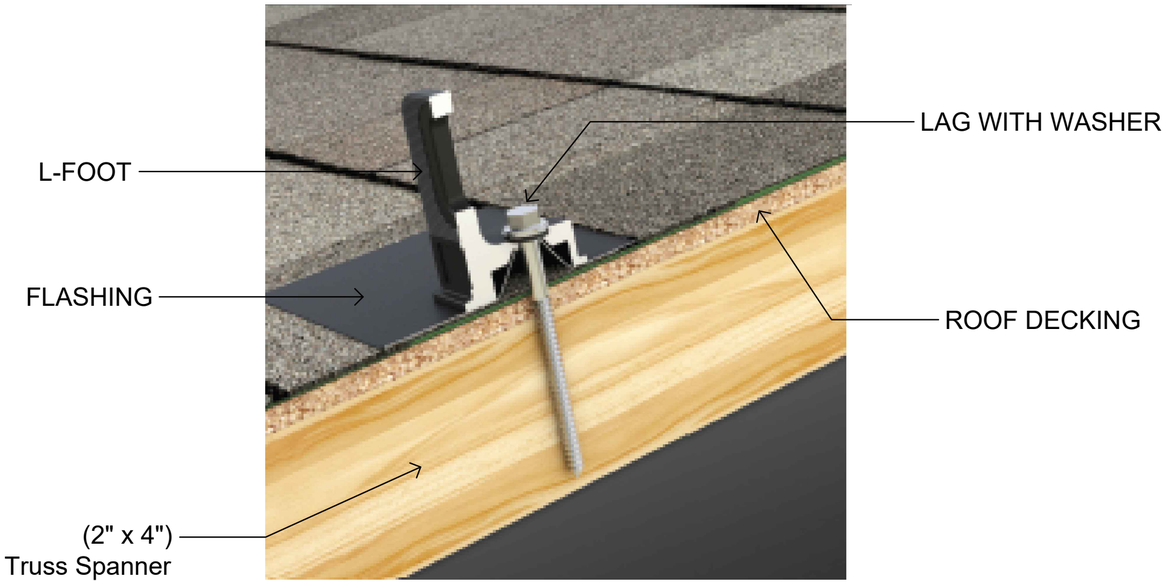
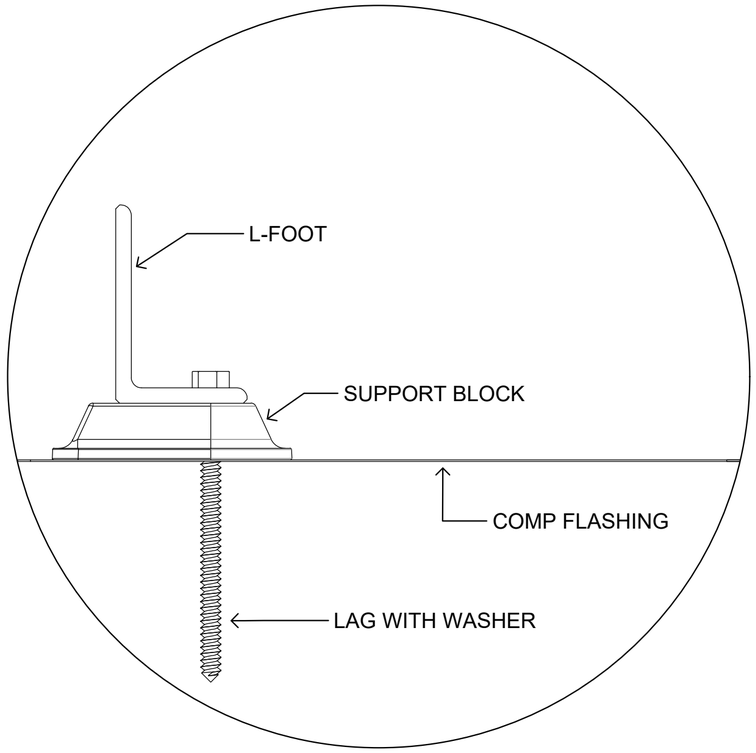
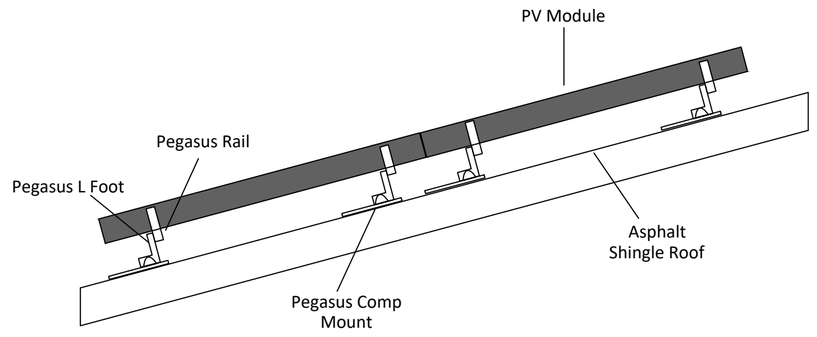
PVIP #031310-32





					
Multi-Clamp	Hidden End Clamp	MLPE Mount	Dovetail T-Bolt	Ground Lug	Cable Grip
Torque Value 100 in-lbs.	Torque Value 135 in-lbs.	Torque Value 135 in-lbs.	Torque Value 300 in-lbs.	Torque Value 135 in-lbs.	Torque Value 135 in-lbs.



SIDE VIEW

PV Dead Load	
Roof A	**PV System Dead Load** **(Panel + Racking weight) / PV System Area** (17 panels x 45.8 lbs./panel + 116 ft. of racking x 1.17 lb.ft) / (17 panels x 6.11' x 3.37') = 2.60 psf

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Customer Signature:

Sheet Name:

Attachment Detail

JOB NUMBER:

23-511-LG

Date:	**Revision:**
10/12/2023	A
Sheet Size: ANSI C 17" X 22"	**Sheet Number:** PV8

NABCEP CERTIFIED
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