PHOTOVOLTAIC ROOF MOUNT SYSTEM

14 MODULES-ROOF MOUNTED - 4.48 kW DC, 3.36 kW AC

43 DOONBEG DR, FUQUAY-VARINA, NC 27526 USA

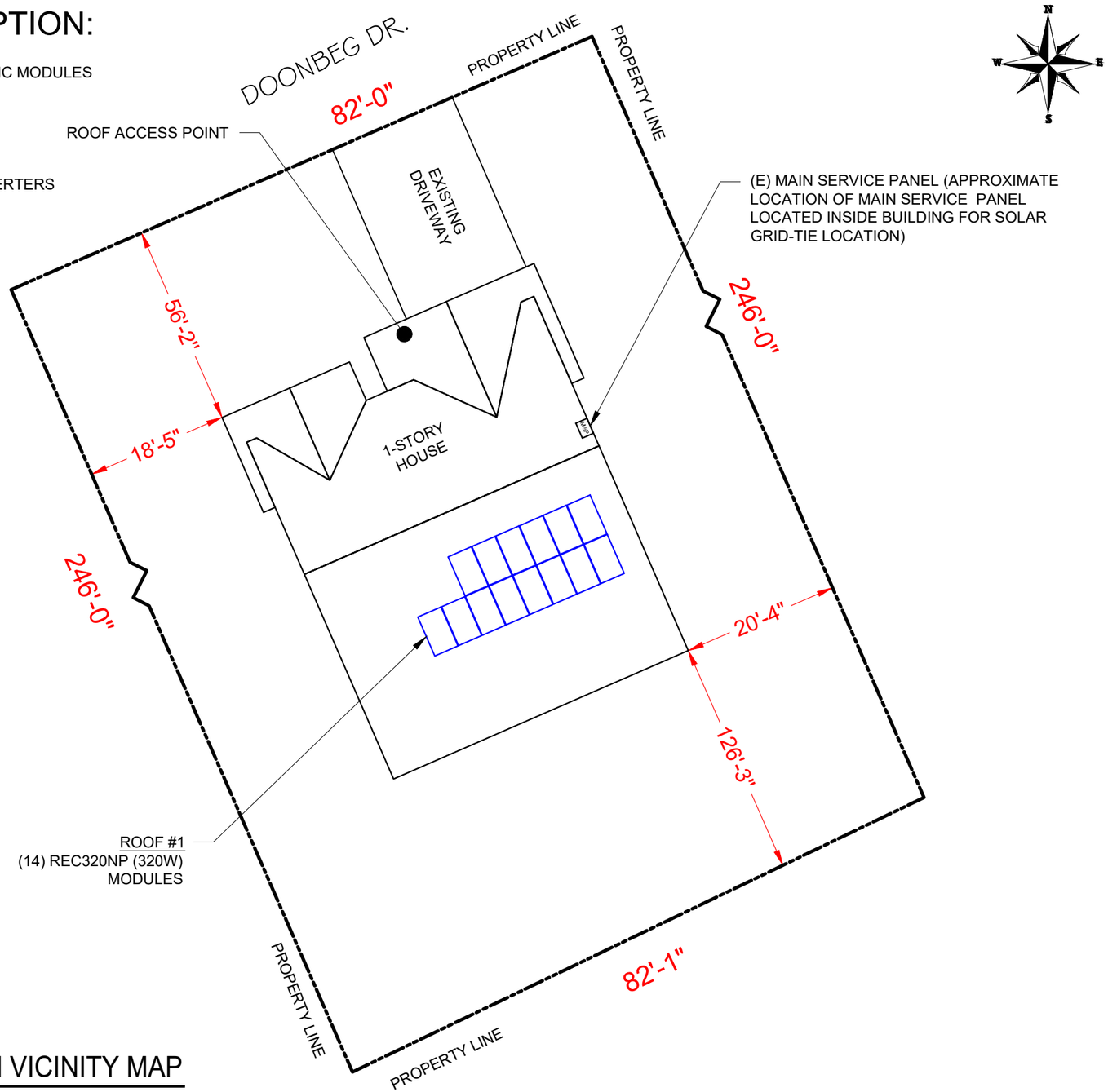
PROJECT DESCRIPTION:

14 x 320 REC320NP (320W) MODULES
ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES

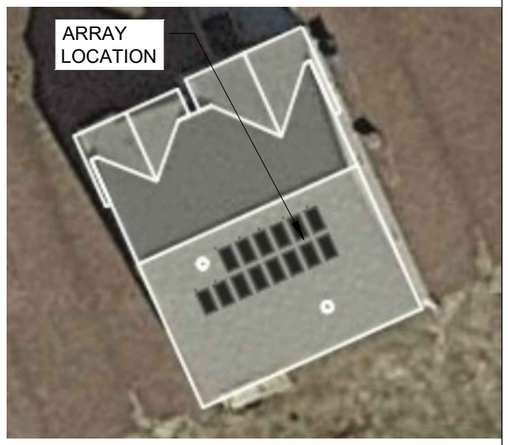
SYSTEM SIZE: 4.48 kW DC STC
ARRAY AREA #1: 251.58 SQ FT.

EQUIPMENT SUMMARY

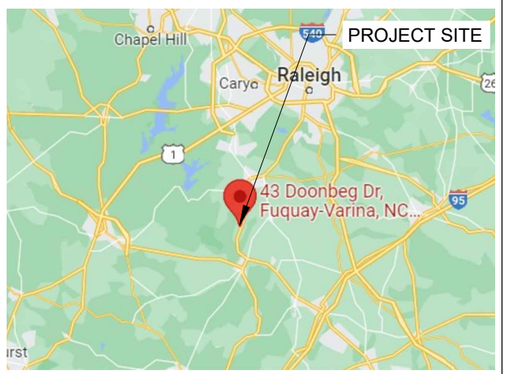
14	REC320NP (320W) MODULES
14	ENPHASE IQ7-60-2-US MICROINVERTERS



1 | SITE PLAN WITH VICINITY MAP
PV-1 SCALE: 1/16" = 1'-0"



2 | HOUSE PHOTO
PV-1 SCALE: NTS



3 | VICINITY MAP
PV-1 SCALE: NTS

SHEET INDEX

GOVERNING CODES:
NORTH CAROLINA BUILDING CODE (NCBC 2018)
NORTH CAROLINA RESIDENTIAL CODE (NCRC 2018)
NORTH CAROLINA PLUMBING CODE (NCPC 2018)
NORTH CAROLINA MECHANICAL CODE (NCMC 2018)
NATIONAL ELECTRICAL CODE (2017)

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ATTN KIM JONES
400 DOMINION DRIVE STE 105
MORRISVILLE, NC 25760

REVISIONS

DESCRIPTION	DATE	REV
INITIAL DESIGN	07/21/2022	00

Signature with Seal

NORTH CAROLINA PROFESSIONAL SEAL 050296 ENGINEER ARASH ZANDIEH
Exp. 12/31/2022

PROJECT NAME
SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

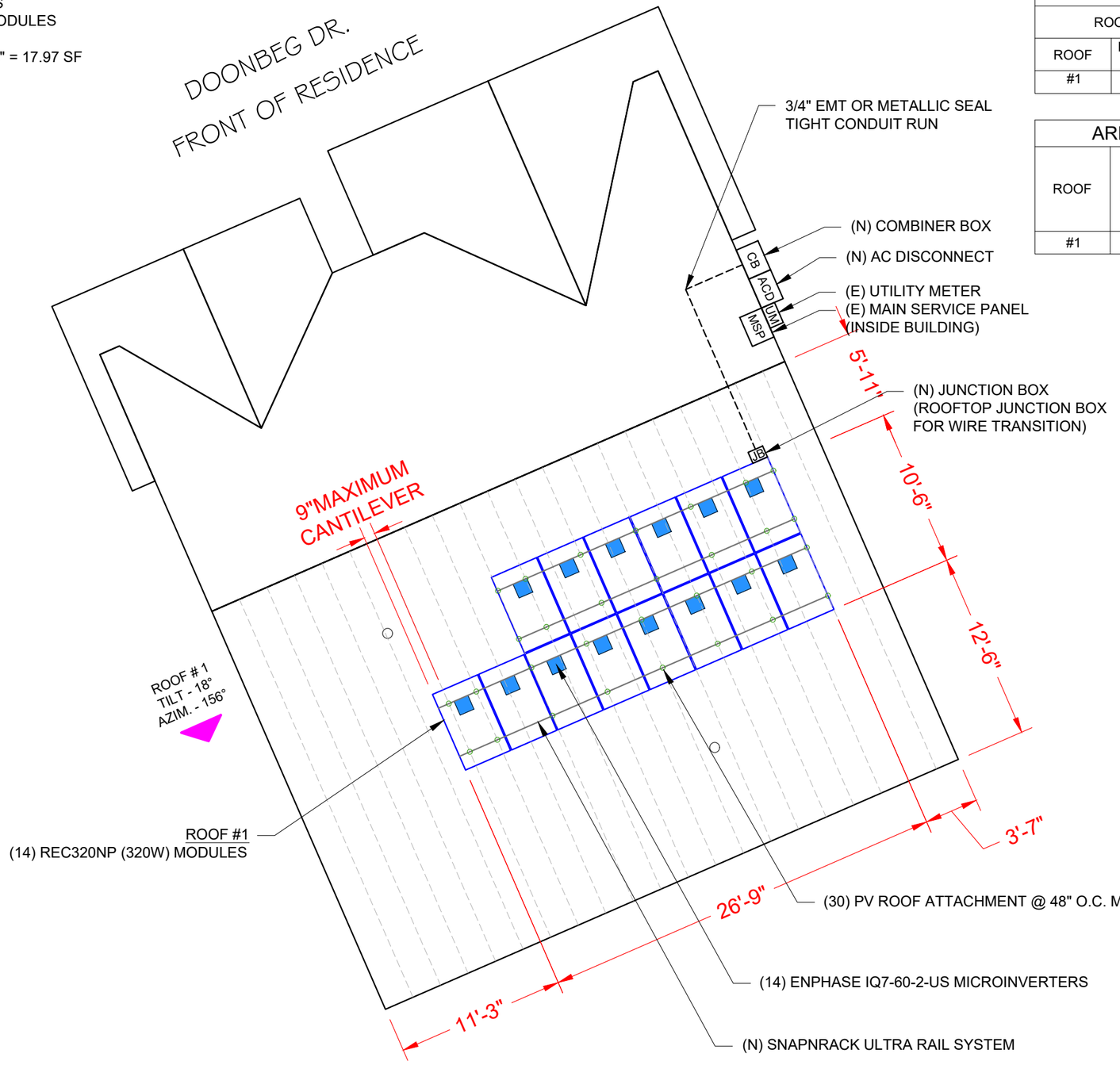
SHEET NAME
SITE PLAN & VICINITY MAP

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-1

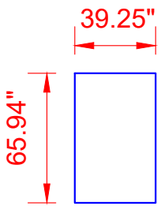
MODULE TYPE, DIMENSIONS & WEIGHT

NUMBER OF MODULES = 14 MODULES
MODULE TYPE = REC320NP (320W) MODULES
MODULE WEIGHT = 39.7 LBS / 18.0KG.
MODULE DIMENSIONS = 65.94" x 39.25" = 17.97 SF
UNIT WEIGHT OF ARRAY = 2.21 PSF



ROOF DESCRIPTION				
ROOF TYPE			ASPHALT SHINGLE ROOF	
ROOF	ROOF TILT	AZIMUTH	TRUSS SIZE	TRUSS SPACING
#1	18°	156°	2"X4"	24" O.C.

ARRAY AREA & ROOF AREA CALC'S				
ROOF	# OF MODULES	ARRAY AREA (Sq. Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)
#1	14	251.58	1202.24	21



REC320NP (320W) MODULES

LEGEND

- JB - JUNCTION BOX
- CB - COMBINER BOX
- ACD - AC DISCONNECT
- MSP - MAIN SERVICE PANEL
- UM - UTILITY METER
- MICROINVERTER
- TRUSS
- CONDUIT
- VENT (ROOF OBSTRUCTIONS)

1 ROOF PLAN AND MODULES
PV-2 SCALE: 1/8" = 1'-0"

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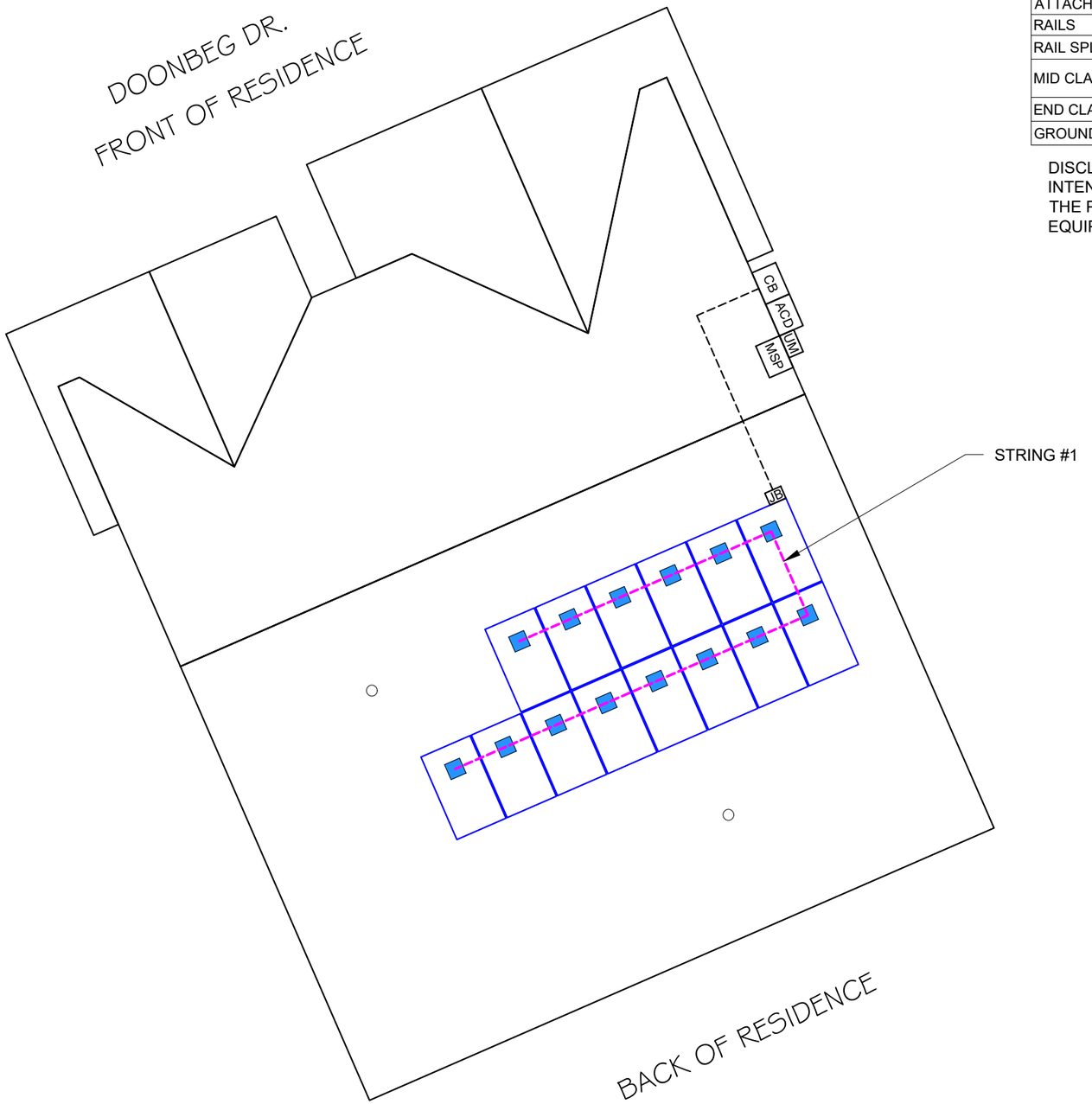
Exp. 12/31/2022

PROJECT NAME
SAM KWON RESIDENCE
43 DOONBEG DR, FUQUAY-VARINA, NC 27526 USA

SHEET NAME
ROOF PLAN & MODULES

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-2



BILL OF MATERIALS		
EQUIPMENT	QTY	DESCRIPTION
SOLAR PV MODULE	14	REC320NP (320W) MODULES
INVERTER	14	ENPHASE IQ7-60-2-US MICROINVERTERS
AC DISCONNECT	1	60A FUSED, (2P) 20A FUSES, 240V NEMA 3R, UL LISTED
ATTACHMENT	30	SNAPNRACK, ULTRA RAIL COMP KIT
RAILS	8	SNAPNRACK, UR-60 RAIL, 172IN, MILL (232-02539)
RAIL SPLICE	4	SNAPNRACK, UR-60 SPLICE, SILVER (242-01270)
MID CLAMPS	24	SNAPNRACK, ULTRA RAIL MID CLAM , BLACK (242-02071)
END CLAMPS	8	UNIVERSAL END CLAM (242-02215)
GROUNDING LUG	2	GROUNDING LUG R, 6-12 AWG (242-02101)

DISCLAIMER: MATERIALS REQUIRED LIST FOR CONCEPTUAL USE ONLY THE INTENT IS TO AID CONTRACTOR FOR ORDERING REQUIRED MATERIALS FOR THE PROJECT. CONTRACTOR RESPONSIBLE TO VERIFY PRIOR TO SOLAR EQUIPMENT ORDERING

1 STRING LAYOUT

PV-3 SCALE: 1/8" = 1'-0"

LEGEND

- VENT (ROOF OBSTRUCTION)
- STRINGS

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REVISIONS		
DESCRIPTION	DATE	REV
INITIAL DESIGN	07/21/2022	00

Signature with Seal

PROJECT NAME

SAM KWON RESIDENCE

43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
STRING LAYOUT

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-3

SNAPNRACK ULTRA RAIL UMBRELLA L FOOT WITH UMBRELLA FLASHING FOR COMPOSTION ROOF MOUNTING

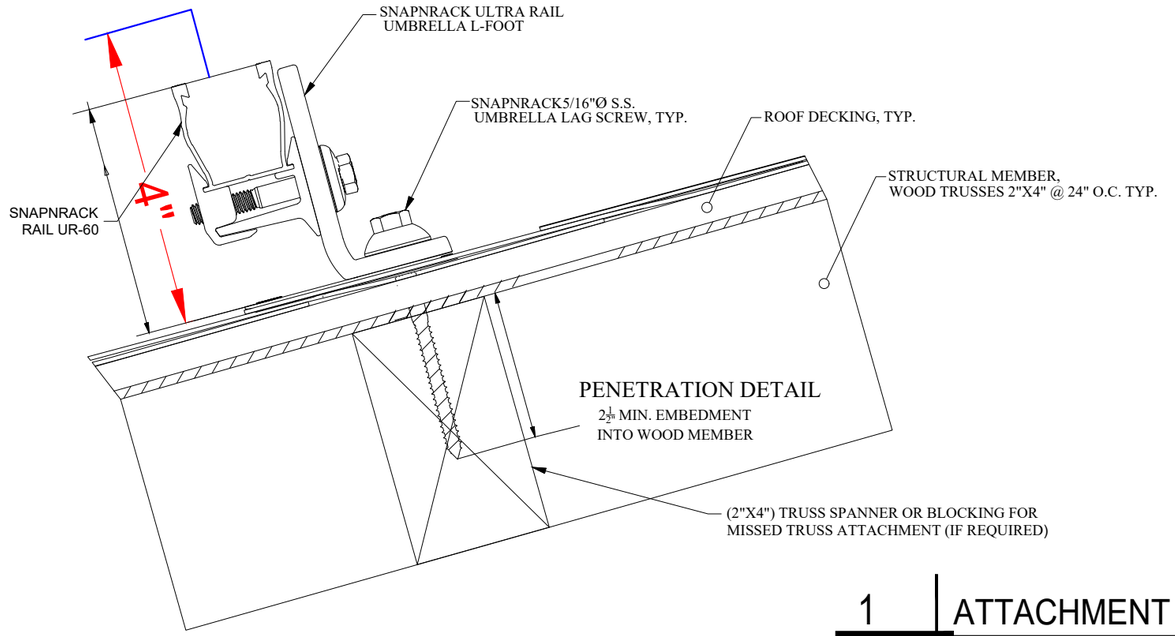
REFER TO SNAPNRACK ENGINEERING CHARTS FOR APPLICABLE RAIL SPANS. "BIN" NUMBER ON CHART SHOULD MATCH "BIN" NUMBER ON THIS DRAWING

5/16"Ø S.S. UMBRELLA LAG SCREW MUST EMBED A MIN. OF 2½" INTO STRUCTURAL MEMBER

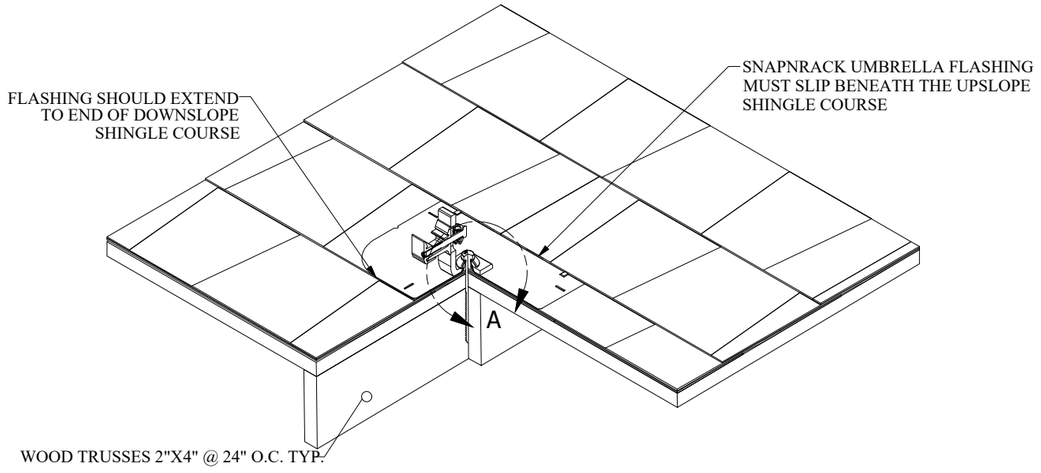
REFER TO SNAPNRACK INSTALLATION MANUAL FOR 5/16"Ø HARDWARE TORQUE SPECIFICATIONS

RAIL CAN BE MOUNTED ON EITHER SIDE OF THE L-FOOT

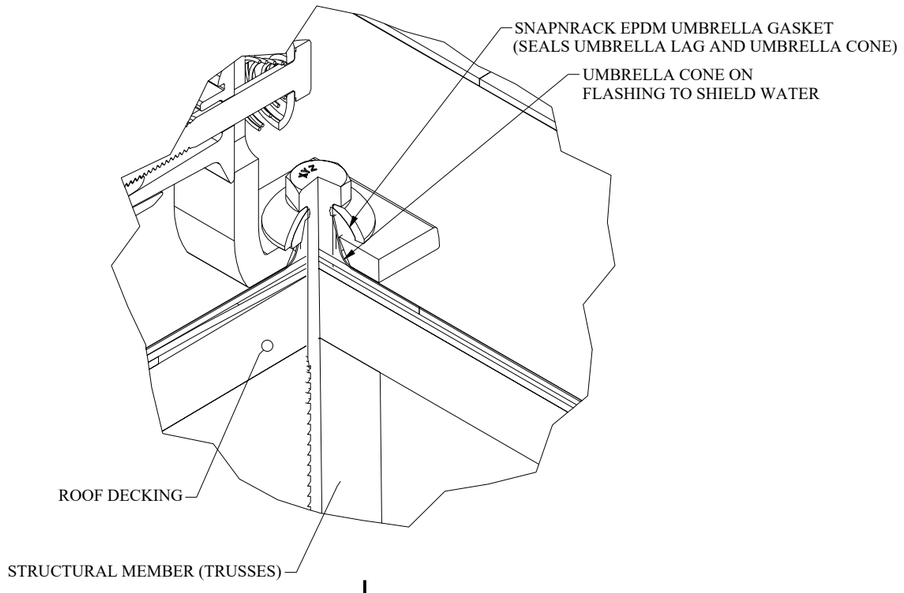
FOR LEVELING DETAILS, REFER TO SNAPNRACK DETAIL DRAWING "SNR-DC-00332 ULTRA RAIL, COMPONENT DETAIL, LEVELING EXTENSION KIT"



1 ATTACHMENT DETAIL
PV-4 SCALE: NTS



2 ENLARGED DETAIL A
PV-4 SCALE: NTS



3 SECTION VIEW DETAIL
PV-4 SCALE: NTS

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NORTH CAROLINA PROFESSIONAL SEAL 050296 ENGINEER ARASH ZANDIEH

Exp. 12/31/2022

PROJECT NAME

SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
ATTACHMENT DETAILS

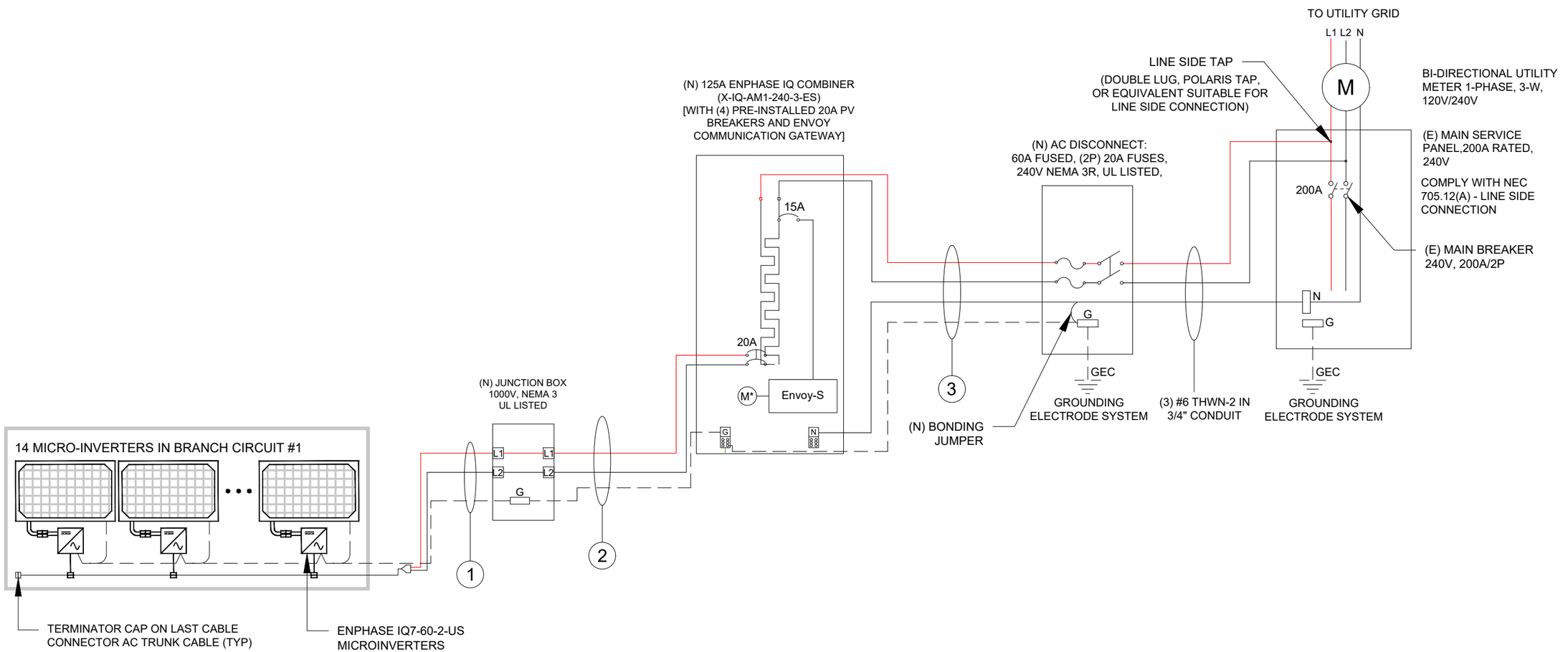
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-4

(14) REC320NP (320W) MODULES
(14) ENPHASE IQ7-60-2-US MICROINVERTERS
(1) BRANCH CIRCUIT OF 14 MODULES WITH MICROINVERTERS
(CONNECTED IN SERIES PER BRANCH CIRCUIT)

INVERTER SPECIFICATIONS	
MANUFACTURER / MODEL #	ENPHASE IQ7-60-2-US
NOMINAL OUTPUT VOLTAGE	240V
NOMINAL OUTPUT CURRENT	1.0A

SYSTEM SIZE:
TOTAL DC SYSTEM SIZE: 4.48 kW DC
TOTAL AC SYSTEM SIZE: 3.36 KW AC
MAXIMUM AC POWER: 240 VA
MAXIMUM AC CURRENT: 1.0 A



Conduit Conductor Schedule (ALL CONDUCTORS MUST BE COPPER)					
Tag # ◯	Description	Wire Gauge	# of Conductors/Color	Conduit Type	Conduit Size
1	PV WIRE	10 AWG	2 (1V+, 1V-)	N/A-Free Air	N/A-Free Air
1	Bare Copper Ground (EGC/GEC)	6 AWG	1 BARE	N/A-Free Air	N/A-Free Air
2	THWN-2	10 AWG	2 (1V+, 1V-) B/R	EMT OR METALLIC SEAL TIGHT	3/4"
2	THWN-2 - Ground (EGC/GEC)	8 AWG	1 (GRN)	EMT OR METALLIC SEAL TIGHT	3/4"
3	THWN-2	10 AWG	3 (1L1, 1L2, 1N) B/R/W	EMT OR METALLIC SEAL TIGHT	3/4"
3	THWN-2 - Ground (GEC)	8 AWG	1 (GRN)	EMT OR METALLIC SEAL TIGHT	3/4"

1 ELECTRICAL LINE DIAGRAM
PV-5 SCALE: NTS

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REVISIONS		
DESCRIPTION	DATE	REV
INITIAL DESIGN	07/21/2022	00

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PROJECT NAME
SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
ELECTRICAL LINE DIAGRAM

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-5

SOLAR MODULE SPECIFICATIONS	
MANUFACTURER	REC SOLAR
MODEL #	REC320NP
PMAX	320W
VMP	34.2V
IMP	9.37A
VOC	40.8V
ISC	10.18A
MODULE DIMENSION	65.94"L x 39.25"W x 1.1"D (In Inch)

INVERTER SPECIFICATIONS	
MANUFACTURER / MODEL #	ENPHASE IQ7-60-2-US
NOMINAL OUTPUT VOLTAGE	240V
NOMINAL OUTPUT CURRENT	1.0A

PERCENT OF VALUES	NUMBER OF CURRENT CARRYING CONDUCTORS IN CONDUIT
0.80	4-6
0.70	7-9
0.50	10-20

OCPD Calculations

Breakers sized according to continuous duty output current. PV circuit nominal current based off # of modules per Circuit X (1.25[art. 210.19(A)(1)(a)]X (1.0 Max AC current per micro-inverter)
Circuit #1 = 14 modules, Output Current w/ continuous duty = 17.5 <= 20A Breaker
Breaker System output current w/ continuous duty = 17.5 <= 20A (System OCPD)

Conductor Calculations

Wire gauge calculated from art. code 310.15(B)(16) with ambient temperature calculations from art. 310.15(2)(a).
For "On Roof" conductors we use the 90°C column ampacity, 0.5"-3.5" off-the-roof temperature adjustment from 310.15(B)(3)(c), and raceway fill adjustments from 310.15(B)(16).
For "Off Roof" conductors we use the 75°C column ampacity, or the 90°C column ampacity with the relevant ambient temperature and raceway fill adjustments, whichever is less.
The rating of the conductor after adjustments MUST be greater than, or equal to, the continuous duty uprated output current.
Calculation Example - Wire Rating (90°C) x Ambient Temperature Adjustment x Conduit Fill Adjustment >= Continuous Duty Output Current
(On Roof): 10 gauge wire rated for 40A, 40A x 0.96 x 1.0 (2 Conductors) = 38.4A > 17.5A
(Off Roof): 10 gauge wire rated for 35A, 35A > 20A

ELECTRICAL NOTES

1.) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
2.) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT.
3.) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
4.) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
5.) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
6.) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
7.) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
8.) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
9.) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.

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INITIAL DESIGN	07/21/2022	00

Signature with Seal

PROJECT NAME
SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
WIRING CALCULATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-6

⚠ WARNING

ELECTRIC SHOCK HAZARD

IF A GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

LABEL LOCATION:
DC DISCONNECT, INVERTER
(PER CODE: NEC 690.35(F))
[To be used when inverter is ungrounded]

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL LOCATION:
CONDUIT, COMBINER BOX
(PER CODE: NEC690.31(G)(E)(4) 10 FT
MAX SPACING OF LABELS

⚠ WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:
POINT OF INTERCONNECTION
(PER CODE: NEC 690.59)

ADHESIVE FASTENED SIGNS:
- THE LABEL SHALL BE SUITABLE FOR THE ENVIRONMENT WHERE IT IS INSTALLED.
- WHERE REQUIRED ELSEWHERE IN THIS CODE, ALL FIELD APPLIED LABELS, WARNINGS, AND MARKINGS SHOULD COMPLY WITH ANSI Z535.4 [NEC 110.21(B) FIELD MARKING].
- ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT [IFC 605.11.1.3]

PHOTOVOLTAIC SYSTEM AC DISCONNECT
RATED AC OPERATING CURRENT 14.0 AMPS
AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:
AC DISCONNECT, POINT OF INTERCONNECTION
(PER CODE: NEC690.54)

WARNING
INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

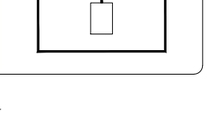
LABEL LOCATION:
POINT OF INTERCONNECTION
(PER CODE: NEC 705.12(B)(2)(c))
[Not required if panelboard is rated not less than sum of ampere ratings of all overcurrent devices supplying it]

6"

3.5"

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.



LABEL LOCATION:
MAIN SERVICE PANEL
(PER CODE: NEC 690.56(C)(1)(a))

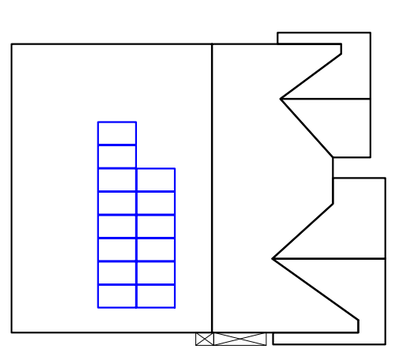
PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

LABEL PER NEC 690.56(C)- PROVIDE AT NEW SUB PANEL OR SERVICE PANEL FOR RAPID SHUTDOWN COMPLIANT SYSTEM

CAUTION:

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

AT: ☒ METER AND MAIN SERVICE PANEL
AC DISCONNECT
ENPHASE COMBINER BOX



MARKING CONTENT AND FORMAT

NOTE : LABELS MAY COME IN DIFFERENT COLORS

ELECTRICAL NOTES :

1). UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
2). WORKING CLEARANCES AROUND THE EXISTING AND NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC ARTICLE 110.26.
3). ALL EQUIPMENT INSTALLED SHALL BE LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) PER NEC ARTICLE 110.3.
4). RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
5). ALL LABELS OR MARKINGS SHALL BE VISIBLE AFTER INSTALLATION. THE LABELS SHALL BE REFLECTIVE, AND ALL LETTERS SHALL BE CAPITALIZED AND SHALL BE A MINIMUM HEIGHT OF 9.5 MM (3/8 IN) IN WHITE ON A RED BACKGROUND.
6). CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.8 (D).
7). CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.8 (C).

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REVISIONS

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INITIAL DESIGN	07/21/2022	00

Signature with Seal

PROJECT NAME

SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
PLACARD

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-7

SOLAR'S MOST TRUSTED REC

REC N-PEAK SERIES

PREMIUM MONO N-TYPE SOLAR PANELS WITH SUPERIOR PERFORMANCE

MONO N-TYPE: THE MOST EFFICIENT C-SI TECHNOLOGY

NO LIGHT INDUCED DEGRADATION

SUPER-STRONG FRAME UP TO 7000 PA SNOW LOAD

FLEXIBLE INSTALLATION OPTIONS

IMPROVED PERFORMANCE IN SHADED CONDITIONS

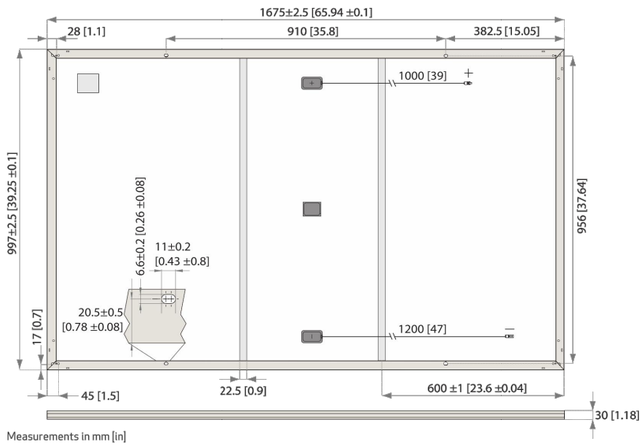
GUARANTEED HIGH POWER OVER LIFETIME

330 Wp POWER

20 YEAR PRODUCT WARRANTY

0.5% ANNUAL DEGRADATION OVER 25-YEAR POWER WARRANTY

REC N-PEAK SERIES



Measurements in mm [in]

ELECTRICAL DATA @ STC	Product code*: RECxxxNP				
Nominal Power - P_{MPP} (Wp)	310	315	320	325	330
Watt Class Sorting - (W)	-0/+5	-0/+5	-0/+5	-0/+5	-0/+5
Nominal Power Voltage - V_{MPP} (V)	33.6	33.9	34.2	34.4	34.6
Nominal Power Current - I_{MPP} (A)	9.24	9.31	9.37	9.46	9.55
Open Circuit Voltage - V_{OC} (V)	40.2	40.5	40.8	41.0	41.3
Short Circuit Current - I_{SC} (A)	10.01	10.09	10.18	10.27	10.36
Panel Efficiency (%)	18.6	18.9	19.2	19.5	19.8

Values at standard test conditions (STC: air mass AM 1.5, irradiance 1000 W/m², temperature 25°C), based on a production spread with a tolerance of V_{OC} & I_{SC} ±3% within one watt class. * Where xxx indicates the nominal power class (P_{MPP}) at STC above.

ELECTRICAL DATA @ NOCT	Product code*: RECxxxNP				
Nominal Power - P_{MPP} (Wp)	234	238	241	245	249
Nominal Power Voltage - V_{MPP} (V)	31.1	31.4	31.7	31.9	32.1
Nominal Power Current - I_{MPP} (A)	7.51	7.56	7.62	7.69	7.76
Open Circuit Voltage - V_{OC} (V)	37.3	37.5	37.8	38.0	38.3
Short Circuit Current - I_{SC} (A)	8.01	8.07	8.14	8.22	8.29

Nominal operating cell temperature (NOCT: air mass AM 1.5, irradiance 800 W/m², temperature 20°C, windspeed 1 m/s).
* Where xxx indicates the nominal power class (P_{MPP}) at STC above.

CERTIFICATIONS

UL 1703 (Fire type 2); IEC 61215, IEC 61730
IEC 62804 (PID), IEC 61701 (Salt Mist), IEC 62716 (Ammonia),
ISO 9001: 2015, ISO 14001: 2004, OHSAS 18001: 2007

WARRANTY

20 year product warranty
25 year linear power output warranty, maximum degression in performance of 0.5% p.a., giving 86% at end of year 25.
See warranty conditions for further details.

GENERAL DATA

Cell type:	120 half-cut n-type mono c-Si cells 6 strings of 20 cells in series
Glass:	0.13" (3.2 mm) solar glass with anti-reflection surface treatment
Backsheet:	Highly resistant polymeric construction
Frame:	Anodized aluminum (black)
Junction box:	3-part, 3 bypass diodes, IP67 rated in accordance with IEC 62790
Cable:	12 AWG (4 mm²) PV wire, 39 + 47" (1 m + 1.2 m) in accordance with EN 50618
Connectors:	Stäubli MC4 PV-KBT4/KST4, 12 AWG(4 mm²) in accordance with IEC 62852 IP68 only when connected
Origin:	Made in Singapore

MECHANICAL DATA

Dimensions:	65.9 x 39.25 x 1.1" (1675 x 997 x 30 mm)
Area:	17.98 ft² (1.67 m²)
Weight:	39.7 lbs (18 kg)

MAXIMUM RATINGS

Operational temperature:	-40 ... +85°C
Maximum system voltage:	1000 V
Design load (+): snow Maximum test load (+):	4666 Pa (97.5 lbs/ft²)* 7000 Pa (146 lbs/ft²)*
Design load (-): wind Maximum test load (-):	1600 Pa (33.4 lbs/ft²)* 2400 Pa (50 lbs/ft²)*
Max series fuse rating:	25 A
Max reverse current:	25 A

* Calculated using a safety factor of 1.5
* See installation manual for mounting instructions

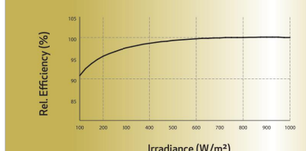
TEMPERATURE RATINGS *

Nominal Operating Cell Temperature:	44°C (±2°C)
Temperature coefficient of P_{MPP}:	-0.35 %/°C
Temperature coefficient of V_{OC}:	-0.27 %/°C
Temperature coefficient of I_{SC}:	0.04 %/°C

*The temperature coefficients stated are linear values

LOW LIGHT BEHAVIOUR

Typical low irradiance performance of module at STC.



Specifications subject to change without notice

Ref: NE-05-11-Rev- B 01.19

Founded in Norway in 1996, REC is a leading vertically integrated solar energy company. Through integrated manufacturing from silicon to wafers, cells, high-quality panels and extending to solar solutions, REC provides the world with a reliable source of clean energy. REC's renowned product quality is supported by the lowest warranty claims rate in the industry. REC is a Bluestar Elkem company with headquarters in Norway and operational headquarters in Singapore. REC employs more than 2,000 people worldwide, producing 1.5 GW of solar panels annually.

REC
www.recgroup.com

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REVISIONS

DESCRIPTION	DATE	REV
INITIAL DESIGN	07/21/2022	00

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PROJECT NAME

SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
EQUIPMENT SPECIFICATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-8

Data Sheet
Enphase Microinverters

PRELIMINARY / US

Enphase IQ 7, IQ7+, and IQ 7X Microinverters

The high-powered smart grid-ready **Enphase IQ 7 Micro™** and **Enphase IQ 7+ Micro™** dramatically simplify the installation process while achieving the highest system efficiency.

Part of the Enphase IQ System, the IQ 7, IQ 7+ and IQ 7X Micro integrate seamlessly with the Enphase IQ Envoy™, Enphase Q Aggregator™, Enphase IQ Battery™, and the Enphase Enlighten™ monitoring and analysis software.

The IQ Series Microinverters extend the reliability standards set forth by previous generations and undergo over a million hours of power-on testing, enabling Enphase to provide an industry-leading warranty of up to 25 years.

Easy to Install

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

Productive and Reliable

- Optimized for high powered 60-cell, 72-cell*, and 96-cell** modules
- More than a million hours of testing
- Class II double-insulated enclosure
- UL listed

Smart Grid Ready

- Complies with advanced grid support, voltage and frequency ride-through requirements
- Remotely updates to respond to changing grid requirements
- Configurable for varying grid profiles
- Meets CA Rule 21 (UL 1741-SA)

* The IQ 7+ Micro is required to support 72-cell modules.
** The IQ 7X is required to support 96-cell modules.

UL CERTIFIED SAFETY US-CA E341165

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

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Enphase IQ 7, IQ 7+, and IQ 7X Microinverters

INPUT DATA (DC)	IQ7-60-2-US	IQ7PLUS-72-2-US	IQ7X-96-2-US
Commonly used module pairings[1]	195 W - 330 W +	235 W - 400 W +	235 W - 400 W +
Module compatibility	60-cell PV modules only	60-cell and 72-cell PV modules	96-cell PV modules
Maximum input DC voltage	48 V	60 V	80 V
Peak power tracking voltage	27 V - 37 V	27 V - 45 V	53 V - 64 V
Operating range	16 V - 48 V	16 V - 60 V	25 V - 80 V
Min/Max start voltage	22 V / 48 V	22 V / 60 V	30 V / 80 V
Max DC short circuit current (module Isc)	15 A	15 A	10 A
Overvoltage class DC port	II	II	II
DC port backfeed current	0 A	0 A	0 A
PV array configuration	1 x 1 ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit		

OUTPUT DATA (AC)	IQ 7 Microinverter		IQ 7+ Microinverter		IQ 7X Microinverter	
Peak output power	250 VA		295 VA		320 VA	
Maximum continuous output power	240 VA		290 VA		315 VA	
Nominal (L-L) voltage/range[2]	240 V / 211-264 V	208 V / 183-229 V	240 V / 211-264 V	208 V / 183-229 V	240 V / 211-264 V	208 V / 183-229 V
Maximum continuous output current	1.0 A	1.15 A	1.21 A	1.39 A	1.31 A	1.51 A
Nominal frequency	60 Hz		60 Hz		60 Hz	
Extended frequency range	47 - 68 Hz		47 - 68 Hz		47 - 68 Hz	
AC short circuit fault curent over 3 cycles	5.8 Arms		5.8 Arms		5.8 Arms	
Maximum units per 20 A (L-L) branch circuit	16 (240 VAC) 13 (208 VAC)		13 (240 VAC) 11 (208 VAC)		12 (240 VAC) 10 (208 VAC)	
Overvoltage class AC port	III		III		III	
AC port backfeed current	0 A		0 A		0 A	
Power factor setting	1.0		1.0		1.0	
Power factor (adjustable)	0.7 leading ... 0.7 lagging		0.7 leading ... 0.7 lagging		0.7 leading ... 0.7 lagging	

EFFICIENCY	@240 V	@208 V	@240	@208 V	@240 V	@208 V
CEC weighted efficiency	97.0 %	97.0 %	97.0 %	96.5 %	97.0 %	96.5 %

MECHANICAL DATA	IQ 7 Microinverter	IQ 7+ Microinverter	IQ 7X Microinverter
Ambient temperature range	-40°C to +65°C	-40°C to +65°C	-40°C to +60°C
Relative humidity range	4% to 100% (condensing)		
Connector type	MC4 (or Amphenol H4 UTX with additional Q-DCC-5 adapter)		
Dimensions (WxHxD)	212 mm x 175 mm x 30.2 mm (without bracket)		
Weight	.92 kg (2.03 lbs)		
Cooling	Natural convection - No fans		
Approved for wet locations	Yes		
Pollution degree	PD3		
Enclosure	Class II double-insulated		
Environmental category / UV exposure rating	NEMA Type 6 / outdoor		

FEATURES	
Communication	Power line
Monitoring	Enlighten Manager and MyEnlighten monitoring options Compatible with Enphase IQ Envoy
Disconnecting means	The AC and DC connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.
Compliance	CA Rule 21 (UL 1741-SA) UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC-2014 and NEC-2017 section 690.12 and C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according manufacturer's instructions.

1. No enforced DC/AC ratio. See the compatibility calculator at enphase.com/en-us/support/module-compatibility.
2. Nominal voltage range can be extended beyond nominal if required by the utility.

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2017-11-15 PRELIM

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PROJECT NAME
SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
EQUIPMENT SPECIFICATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-9

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 Envoy™ 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 Envoy 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

LISTED

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Enphase IQ Combiner 3-ES / 3C-ES

MODEL NUMBER	
IQ Combiner 3-ES (X-IQ-AM1-240-3-ES)	IQ Combiner 3-ES with Enphase IQ Envoy 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 Encharge storage system and Enpower smart switch and to deflect heat.
IQ Combiner 3C-ES (X-IQ-AM1-240-3C-ES)	IQ Combiner 3C-ES with Enphase IQ Envoy 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 Encharge storage system and Enpower smart switch and to deflect heat.
ACCESSORIES and REPLACEMENT PARTS	(not included, order separately)
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 Envoy 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 Envoy breaker included
Envoy breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200 A solid core pre-installed and wired to IQ Envoy
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	To 2000 meters (6,560 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 Envoy	UL 60601-1/CANCSA 22.2 No. 61010-1

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REVISIONS

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Signature with Seal

PROJECT NAME

SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
EQUIPMENT SPECIFICATIONS

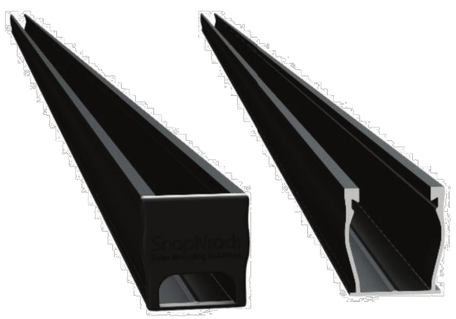
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-10

SnapNrack™
Solar Mounting Solutions

UR-40
UR-60

Ultra Rail



The Ultimate Value in Rooftop Solar

- Industry leading Wire Management Solutions
- Mounts available for all roof types
- Single Tool Installation
- All SnapNrack Module Clamps & Accessories are compatible with both rail profiles

Start Installing Ultra Rail Today

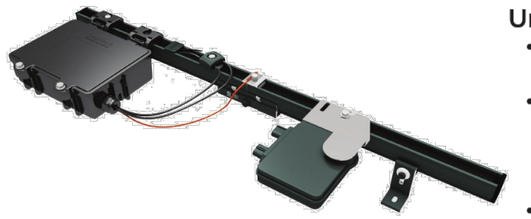
RESOURCES	snapnrack.com/resources
DESIGN	snapnrack.com/configurator
WHERE TO BUY	snapnrack.com/where-to-buy

SnapNrack Ultra Rail System

A sleek, straightforward rail solution for mounting solar modules on all roof types. Ultra Rail features two rail profiles; UR-40 is a lightweight rail profile that is suitable for most geographic regions and maintains all the great features of SnapNrack rail, while UR-60 is a heavier duty rail profile that provides a larger rail channel and increased span capabilities. Both are compatible with all existing mounts, module clamps, and accessories for ease of install.

The Entire System is a Snap to Install

- New Ultra Rail Mounts include snap-in brackets for attaching rail
- Compatible with all the SnapNrack Mid Clamps and End Clamps customers love
- Universal End Clamps and snap-in End Caps provide a clean look to the array edge



Unparalleled Wire Management

- Open rail channel provides room for running wires resulting in a long-lasting quality install
- Industry best wire management offering includes Junction Boxes, Universal Wire Clamps, MLPE Attachment Kits, and Conduit Clamps
- System is fully bonded and listed to UL 2703 Standard

Heavy Duty UR-60 Rail

- UR-60 rail profile provides increased span capabilities for high wind speeds and snow loads
- Taller, stronger rail profile includes profile-specific rail splice and end cap
- All existing mounts, module clamps, and accessories are retained for the same great install experience

Quality. Innovative. Superior.

SnapNrack Solar Mounting Solutions are engineered to optimize material use and labor resources and improve overall installation quality and safety.

877-732-2860 **www.snapnrack.com** **contact@snapnrack.com**

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REVISIONS

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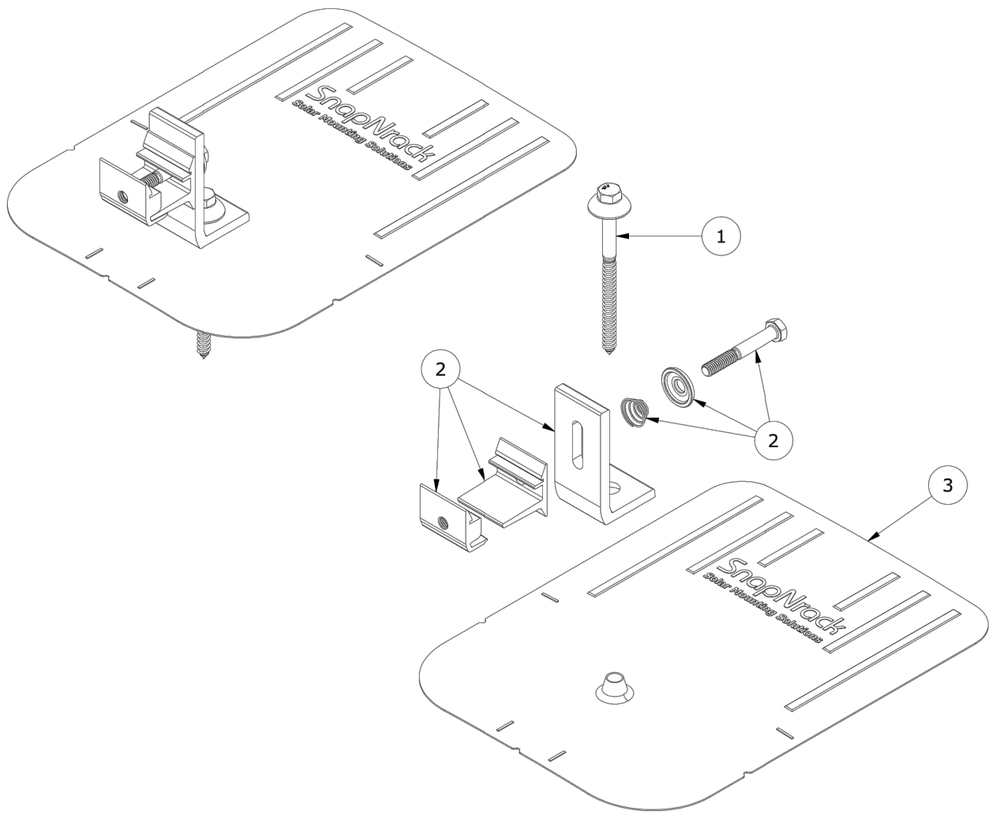
SAM KWON RESIDENCE
43 DOONBEG DR,
FUQUAY-VARINA, NC 27526 USA

SHEET NAME
EQUIPMENT SPECIFICATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11

DESCRIPTION:	DRAWN BY:	SnapNrack™ Solar Mounting Solutions
SNAPNRACK, ULTRA RAIL COMP KIT	mwatkins	
PART NUMBER(S):	REVISION:	595 MARKET STREET, 29TH FLOOR • SAN FRANCISCO, CA 94105 USA PHONE (415) 580-6900 • FAX (415) 580-6902
SEE BELOW	B	THE INFORMATION IN THIS DRAWING IS CONFIDENTIAL AND PROPRIETARY. ANY REPRODUCTION, DISCLOSURE, OR USE THEREOF IS PROHIBITED WITHOUT THE WRITTEN CONSENT OF SUNRUN SOUTH LLC.



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	242-92266	SNAPNRACK, UMBRELLA LAG, TYPE 3, 4IN, SS
2	1	242-01219, 242-01220	SNAPNRACK, ULTRA FOOT FOR U FLASHING, SILVER / BLACK
3	1	232-01375, 232-01376	SNAPNRACK, COMP FLASHING, 9IN X 12IN, SILVER / BLACK ALUM

MATERIALS:	6000 SERIES ALUMINUM, STAINLESS STEEL, RUBBER
DESIGN LOAD (LBS):	802 UP, 1333 DOWN, 356 SIDE
ULTIMATE LOAD (LBS):	2005 UP, 4000 DOWN, 1070 SIDE
TORQUE SPECIFICATION:	12 LB-FT
CERTIFICATION:	UL 2703, FILE E359313; WIND-DRIVEN RAIN TEST FROM UL SUBJECT 2582
WEIGHT (LBS):	0.80

DESCRIPTION:	DRAWN BY:	SnapNrack™ Solar Mounting Solutions
SNAPNRACK, ULTRA RAIL COMP KIT	mwatkins	
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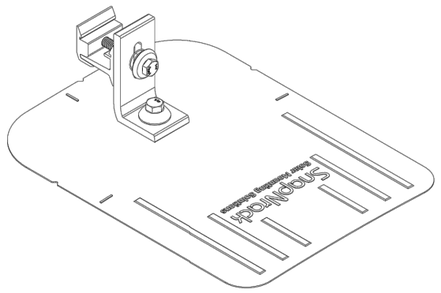
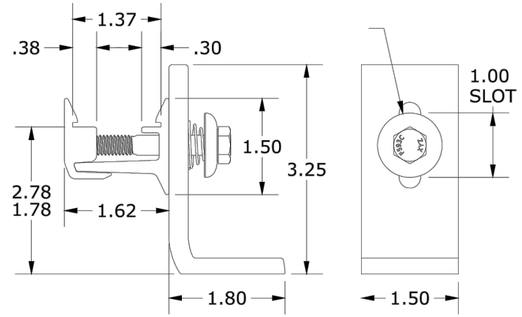
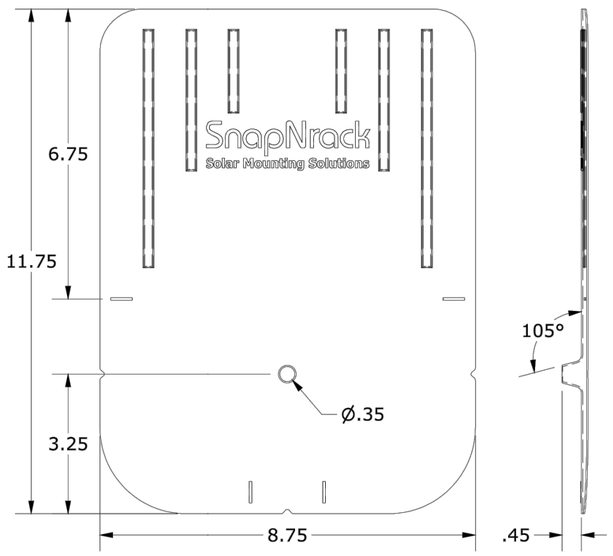
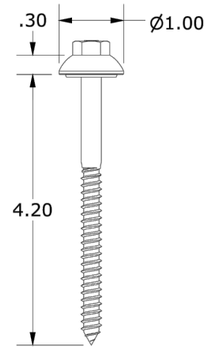


UMBRELLA L FOOT PROPERTIES	
SKU	DESCRIPTION
242-01219	ULTRA RAIL UMBRELLA L FOOT, SILVER
242-01220	ULTRA RAIL UMBRELLA L FOOT, BLACK



COMP FLASHING PROPERTIES	
SKU	DESCRIPTION
232-01375	COMP FLASHING, 9" X 12", BLACK ALUM
232-01376	COMP FLASHING, 9" X 12", SILVER ALUM





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ATTN KIM JONES
400 DOMINION DRIVE STE 105
MORRISVILLE, NC 25760

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SHEET NAME
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SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-12