RB ENGINEERING
LEADING THE WAY
Structural Engineering Firm
NC License No. C-2499

168 Quade Drive
Cary, North Carolina 27513
www.rbengineering.com

Phone: 919-677-9662 / Cell: 919-280-2695 / Fax: 919-677-9663
E-mail: rbittler@rbengineering.com

Mr. Max Middleton
Yes! Solar Solutions of the Triangle
E-mail: mmiddleton@yessolarsolutions.com

March 23, 2021

Subject: Roof mounted solar panels – Butler Residence
111 Dees Street
Lillington, North Carolina 27546

File No.: RB-216884

Dear Max:

RB Engineering, Inc. is pleased to provide the following summary engineering letter concerning the subject project. The existing roof system is constructed with 2-inch by 6-inch timber framing at 16 inches on center, a plywood roof deck and a corrugated metal roof. Some attic bracing exists. We have reviewed the proposed solar layout and have structurally evaluated the additional proposed roof loading with the following conclusions:

- The total surface area of the new proposed solar array (48 PV modules) is approximately 870 SF. The solar panel installation has been evaluated for an ultimate design wind speed of 120 mph.
- The subject roof mounted PV system attachment method is structurally adequate to transfer the design uplift loads in accordance with the current North Carolina residential building code.
- The existing roof system is structurally adequate to transfer the applicable design loads - including the additional or modified design loading (dead, wind and snow loads) due to the proposed solar panel installation - in accordance with the current North Carolina residential building code.

Our services were provided in accordance with the standard of practice for structural engineering and within the limits imposed by scope, schedule, and budget. If you have any questions or if I can be of further assistance to you on this project, please contact me at (919) 677-9662.

Respectfully submitted,

Ron Bittler, PE
President / Structural Engineer
RB Engineering, Inc.

Ron Bittler, PE

Digitally signed by Ron Bittler, PE
DN: cn=Ron Bittler, PE, o=RB Engineering, Inc., ou, email=rbittler@rbengineering.com, c=US
Date: 2021.03.23 08:42:27 -04'00'

NORTH CAROLINA PROFESSIONAL SEAL 025611 ENGINEER RONALD P. BITTLER

03.23.2021

NEW PV SYSTEM: 15.840 kWp
BUTLER RESIDENCE

111 DEES ST
LILLINGTON, NC 27546
ASSESSOR'S #: 1306400004

GENERAL NOTES

1.1.1 **PROJECT NOTES:**
1.1.2 THIS PHOTOVOLTAIC (PV) SYSTEM SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 690, ALL MANUFACTURERS'S LISTING AND INSTALLATION INSTRUCTIONS, AND THE RELEVANT CODES AS SPECIFIED BY THE AUTHORITY HAVING JURISDICTION'S (AHJ) APPLICABLE CODES.
1.1.3 THE UTILITY INTERCONNECTION APPLICATION MUST BE APPROVED AND PV SYSTEM INSPECTED PRIOR TO PARALLEL OPERATION
1.1.4 ALL PV SYSTEM COMPONENTS; MODULES, UTILITY-INTERACTIVE INVERTERS, AND SOURCE CIRCUIT COMBINER BOXES ARE IDENTIFIED AND LISTED FOR USE IN PHOTOVOLTAIC SYSTEMS AS REQUIRED BY NEC 690.4: **PV MODULES:** UL1703, IEC61730, AND IEC61215, AND NFPA 70 CLASS C FIRE **INVERTERS:** UL 1741 CERTIFIED, IEEE 1547, 929, 519 **COMBINER BOX(ES):** UL 1703 OR UL 1741 ACCESSORY.
1.1.8 MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC. IF UNAVAILABLE, MAX DC VOLTAGE CALCULATED ACCORDING TO NEC 690.7.
1.1.9 ALL INVERTERS, PHOTOVOLTAIC MODULES, PHOTOVOLTAIC PANELS, AND SOURCE CIRCUIT COMBINERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER 690.4 (D). SHALL BE INSTALLED ACCORDING TO ANY INSTRUCTIONS FROM LISTING OR LABELING [NEC 110.3].
1.1.10 ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE. IF EXPOSED TO SUNLIGHT, IT SHALL BE UV RESISTANT. ALL PLAQUES AND SIGNAGE WILL BE INSTALLED AS REQUIRED BY THE NEC AND AHJ.

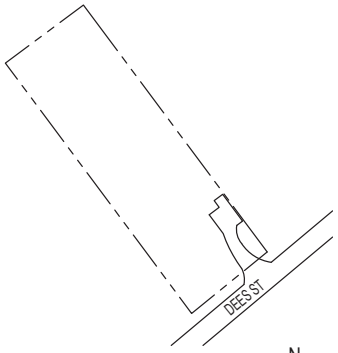
1.2.1 **SCOPE OF WORK:**
1.2.2 PRIME CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND SPECIFICATIONS OF THE GRID-TIED PHOTOVOLTAIC SYSTEM RETROFIT. PRIME CONTRACTOR WILL BE RESPONSIBLE FOR COLLECTING EXISTING ONSITE REQUIREMENTS TO DESIGN, SPECIFY, AND INSTALL THE EXTERIOR ROOF-MOUNTED PORTION OF THE PHOTOVOLTAIC SYSTEMS DETAILED IN THIS DOCUMENT.

1.3.1 **WORK INCLUDES:**
1.3.2 PV ROOF ATTACHMENTS - S!5 PROTEA BRACKET
1.3.3 PV RACKING SYSTEM INSTALLATION - SNAPNRACK UR-40
1.3.4 PV MODULE AND INVERTER INSTALLATION - REC REC330TP3M BLACK / SOLAR EDGE SE7600H-US (240V) / SOLAR EDGE SE6000H-US (240V)
1.3.5 PV EQUIPMENT GROUNDING
1.3.6 PV SYSTEM WIRING TO A ROOF-MOUNTED JUNCTION BOX
1.3.7 PV LOAD CENTERS (IF INCLUDED)
1.3.8 PV METERING/MONITORING (IF INCLUDED)
1.3.9 PV DISCONNECTS
1.3.10 PV FINAL COMMISSIONING
1.3.11 (E) ELECTRICAL EQUIPMENT RETROFIT FOR PV
1.3.12 SIGNAGE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE

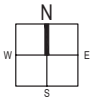
SCOPE OF WORK

SYSTEM SIZE:	STC: 48 x 330W = 15.840kW
	PTC: 48 x 308.8W = 14.822kW DC
	(48) REC REC330TP3M BLACK
	(1) SOLAR EDGE SE7600H-US (240V)
	(1) SOLAR EDGE SE6000H-US (240V)
ATTACHMENT TYPE:	S!5 PROTEA BRACKET
MSP UPGRADE:	NO

01 AERIAL PHOTO
NOT TO SCALE



02 PLAT MAP
NOT TO SCALE



NOTICE TO CONTRACTOR
All construction must comply with current NC Building Codes and is subject to field inspection and verification.
APPROVED
Limited building only review
Permit holder responsible for full compliance with the code
04/22/2021
Harnett COUNTY NORTH CAROLINA

SHEET LIST TABLE

PROJECT INFORMATION

OWNER
NAME: PATRICK BUTLER
PHONE: 913-948-1933
E-MAIL: PATRICKBUTLER1@GMAIL.COM

PROJECT MANAGER
NAME: DUSTIN SMITH
PHONE:

CONTRACTOR
NAME: YES SOLAR SOLUTIONS
PHONE: 919-459-2846

AUTHORITIES HAVING JURISDICTION
BUILDING: CHAPEL HILL
ZONING: CHAPEL HILL
UTILITY: DUKE ELECTRIC

DESIGN SPECIFICATIONS
OCCUPANCY: II
CONSTRUCTION: SINGLE-FAMILY
ZONING: RESIDENTIAL
GROUND SNOW LOAD: 15 PSF
WIND EXPOSURE: B
WIND SPEED: 117 MPH

APPLICABLE CODES & STANDARDS
BUILDING: NCSBC 2018 NCSRC 2018
ELECTRICAL: NEC 2017
FIRE: NCSFC 2018

YES SOLAR SOLUTIONS

CONTRACTOR

YES SOLAR SOLUTIONS

PHONE: (919) 459-2846
ADDRESS: 202 NORTH DIXON AVENUE
CARY, NC 27513

LIC. NO.: 67356
HIC. NO.:
ELE. NO.: 31227-U

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ENGINEER OF RECORD

PAPER SIZE: 11" x 17" (ANSI B)

COVER PAGE

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

T-001.00
(SHEET 1)

2.1.1 **SITE NOTES**:

2.1.2 A LADDER WILL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.

2.1.3 THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM WITH STORAGE BATTERIES.

2.1.4 THE SOLAR PV INSTALLATION WILL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.

2.1.5 PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION NEC 110.26.

2.1.6 ROOF COVERINGS SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THIS CODE AND THE APPROVED MANUFACTURER'S INSTRUCTIONS SUCH THAT THE ROOF COVERING SERVES TO PROTECT THE BUILDING OR STRUCTURE.

2.2.1 **EQUIPMENT LOCATIONS**

2.2.2 ALL EQUIPMENT SHALL MEET MINIMUM SETBACKS AS REQUIRED BY NEC 110.26.

2.2.3 WIRING SYSTEMS INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC 690.31 (A),(C) AND NEC TABLES 310.15 (B)(2)(A) AND 310.15 (B)(3)(C).

2.2.3 JUNCTION AND PULL BOXES PERMITTED INSTALLED UNDER PV MODULES ACCORDING TO NEC 690.34.

2.2.4 ADDITIONAL AC DISCONNECT(S) SHALL BE PROVIDED WHERE THE INVERTER IS NOT WITHIN SIGHT OF THE AC SERVICING DISCONNECT.

2.2.5 ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.

2.2.6 ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.

2.3.1 **STRUCTURAL NOTES:**

2.3.2 RACKING SYSTEM & PV ARRAY WILL BE INSTALLED ACCORDING TO CODE-COMPLIANT INSTALLATION MANUAL. TOP CLAMPS REQUIRE A DESIGNATED SPACE BETWEEN MODULES, AND RAILS MUST ALSO EXTEND A MINIMUM DISTANCE BEYOND EITHER EDGE OF THE ARRAY/SUBARRAY, ACCORDING TO RAIL MANUFACTURER'S INSTRUCTIONS.

2.3.3 JUNCTION BOX WILL BE INSTALLED PER MANUFACTURERS' SPECIFICATIONS. IF ROOF-PENETRATING TYPE, IT SHALL BE FLASHED & SEALED PER LOCAL REQUIREMENTS.

2.3.4 ROOFTOP PENETRATIONS FOR PV RACEWAY WILL BE COMPLETED AND SEALED W/ APPROVED CHEMICAL SEALANT PER CODE BY A LICENSED CONTRACTOR.

2.3.5 ALL PV RELATED ROOF ATTACHMENTS TO BE SPACED NO GREATER THAN THE SPAN DISTANCE SPECIFIED BY THE RACKING MANUFACTURER.

2.3.6 WHEN POSSIBLE, ALL PV RELATED RACKING ATTACHMENTS WILL BE STAGGERED AMONGST THE ROOF FRAMING MEMBERS.

2.4.1 **GROUNDING NOTES:**

2.4.2 GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVISES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR SUCH USE.

2.4.3 PV SYSTEMS REQUIRE AN EQUIPMENT GROUNDING CONDUCTOR. ALL METAL ELECTRICAL EQUIPMENT AND STRUCTURAL COMPONENTS BONDED TO GROUND, IN ACCORDANCE WITH 250.134 OR 250.136(A). ONLY THE DC CONDUCTORS ARE UNGROUNDED.

2.4.4 PV EQUIPMENT SHALL BE GROUNDED ACCORDING TO NEC 690.43 AND MINIMUM NEC TABLE 250.122.

2.4.5 METAL PARTS OF MODULE FRAMES, MODULE RACKING, AND ENCLOSURE CONSIDERED GROUNDED IN ACCORD WITH 250.134 AND 250.136(A).

2.4.6 EACH MODULE WILL BE GROUNDED USING WEEB GROUNDING CLIPS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ. IF WEEBS ARE NOT USED, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE SPECIFIED GROUNDING LUG HOLES PER THE MANUFACTURERS' INSTALLATION REQUIREMENTS.

2.4.7 THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDING CONDUCTOR TO ANOTHER MODULE.

2.4.8 GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLORED GREEN OR MARKED GREEN IF #4 AWG OR LARGER [NEC 250.119]

2.4.9 THE GROUNDING ELECTRODE SYSTEM COMPLIES WITH NEC 690.47 AND NEC 250.50 THROUGH 250.106. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, A GROUNDING ELECTRODE SYSTEM PROVIDED ACCORDING TO NEC 250, NEC 690.47 AND AHJ.

2.4.10 DC PV ARRAYS SHALL BE PROVIDED WITH DC GROUND-FAULT PROTECTION MEETING THE REQUIREMENTS OF 690.41(B)(1) AND (2) TO REDUCE FIRE HAZARDS

2.5.1 **INTERCONNECTION NOTES:**

2.5.2 LOAD-SIDE INTERCONNECTION SHALL BE IN ACCORDANCE WITH [NEC 705.12 (B)]

2.5.3 THE SUM OF THE UTILITY OCPD AND INVERTER CONTINUOUS OUTPUT MAY NOT EXCEED 120% OF BUSBAR RATING [NEC 705.12(B)(2)(3)].

2.5.4 THE SUM OF 125 PERCENT OF THE POWER SOURCE(S) OUTPUT CIRCUIT CURRENT AND THE RATING OF THE OVERCURRENT DEVICE PROTECTING THE BUSBAR SHALL NOT EXCEED 120 PERCENT OF THE AMPACITY OF THE BUSBAR, PV DEDICATED BACKFEED BREAKERS MUST BE LOCATED OPPOSITE END OF THE BUS FROM THE UTILITY SOURCE OCPD [NEC 705.12(B)(2)(3)].

2.5.5 AT MULTIPLE ELECTRIC POWER SOURCES OUTPUT COMBINER PANEL, TOTAL RATING OF ALL OVERCURRENT DEVICES SHALL NOT EXCEED AMPACITY OF BUSBAR. HOWEVER, THE COMBINED OVERCURRENT DEVICE MAY BE EXCLUDED ACCORDING TO NEC 705.12 (B)(2)(3)(C).

2.5.6 FEEDER TAP INTERCONECTION (LOAD SIDE) ACCORDING TO NEC 705.12 (B)(2)(1)

2.5.7 SUPPLY SIDE TAP INTERCONNECTION ACCORDING TO NEC 705.12 (A) WITH SERVICE ENTRANCE CONDUCTORS IN ACCORDANCE WITH NEC 230.42

2.5.8 BACKFEEDING BREAKER FOR ELECTRIC POWER SOURCES OUTPUT IS EXEMPT FROM ADDITIONAL FASTENING [NEC 705.12 (B)(5)].

2.6.1 **DISCONNECTION AND OVER-CURRENT PROTECTION NOTES:**

2.6.2 DISCONNECTING SWITCHES SHALL BE WIRED SUCH THAT WHEN THE SWITCH IS OPENED THE CONDUCTORS REMAINING ENERGIZED ARE CONNECTED TO THE TERMINALS MARKED "LINE SIDE" (TYPICALLY THE UPPER TERMINALS).

2.6.3 DISCONNECTS TO BE ACCESSIBLE TO QUALIFIED UTILITY PERSONNEL, BE LOCKABLE, AND BE A VISIBLE-BREAK SWITCH.

2.6.4 BOTH POSITIVE AND NEGATIVE PV CONDUCTORS ARE UNGROUNDED. THEREFORE BOTH MUST OPEN WHERE A DISCONNECT IS REQUIRED, ACCORDING TO NEC 690.13.

2.6.5 ISOLATING DEVICES OR EQUIPMENT DISCONNECTING MEANS SHALL BE INSTALLED IN CIRCUITS CONNECTED TO EQUIPMENT AT A LOCATION WITHIN THE EQUIPMENT, OR WITHIN SIGHT AND WITHIN 10 FT OF THE EQUIPMENT. AN EQUIPMENT DISCONNECTING MEANS SHALL BE PERMITTED TO BE REMOTE FROM THE EQUIPMENT WHERE THE EQUIPMENT DISCONNECTING MEANS CAN BE REMOTELY OPERATED FROM WITHIN 10 FT OF THE EQUIPMENT, ACCORDING TO NEC 690.15 (A).

2.6.6 PV SYSTEM CIRCUITS INSTALLED ON OR IN BUILDINGS SHALL INCLUDE A RAPID SHUTDOWN FUNCTION TO REDUCE SHOCK HAZARD FOR EMERGENCY RESPONDERS IN ACCORDANCE WITH 690.12(A) THROUGH (D)

2.6.7 ALL OCPD RATINGS AND TYPES SPECIFIED ACCORDING TO NEC 690.8, 690.9, AND 240.

2.6.8 BOTH POSITIVE AND NEGATIVE PV CONDUCTORS ARE UNGROUNDED, THEREFORE BOTH REQUIRE OVER-CURRENT PROTECTION, ACCORDING TO NEC 240.21. (SEE EXCEPTION IN NEC 690.9)

2.6.9 IF REQUIRED BY AHJ, SYSTEM WILL INCLUDE ARC-FAULT CIRCUIT PROTECTION ACCORDING TO NEC 690.11 AND UL1699B.

2.7.1 **WIRING & CONDUIT NOTES:**

2.7.2 ALL CONDUIT AND WIRE WILL BE LISTED AND APPROVED FOR THEIR PURPOSE. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING.

2.7.3 ALL CONDUCTORS SIZED ACCORDING TO NEC 690.8, NEC 690.7.

2.7.4 EXPOSED PV SOURCE CIRCUITS AND OUTPUT CIRCUITS SHALL USE WIRE LISTED AND IDENTIFIED AS PHOTOVOLTAIC (PV) WIRE [690.31 (C)]. PV MODULES WIRE LEADS SHALL BE LISTED FOR USE ON PV ARRAYS, ACCORDING TO NEC 690.31 (A).

2.7.5 PV WIRE BLACK WIRE MAY BE FIELD-MARKED WHITE [NEC 200.6 (A)(6)].

2.7.6 MODULE WIRING SHALL BE LOCATED AND SECURED UNDER THE ARRAY.

2.7.7 ACCORDING TO NEC 200.7, UNGROUNDED SYSTEMS DC CONDUCTORS COLORED OR MARKED AS FOLLOWS:
- DC POSITIVE- RED, OR OTHER COLOR EXCLUDING WHITE, GREY AND GREEN
- DC NEGATIVE- BLACK, OR OTHER COLOR EXCLUDING WHITE, GREY AND GREEN

2.7.8 AC CONDUCTORS COLORED OR MARKED AS FOLLOWS:
- PHASE A OR L1- BLACK
- PHASE B OR L2- RED, OR OTHER CONVENTION IF THREE PHASE
- PHASE C OR L3- BLUE, YELLOW, ORANGE*, OR OTHER CONVENTION
- NEUTRAL- WHITE OR GREY

* IN 4-WIRE DELTA CONNECTED SYSTEMS THE PHASE WITH HIGHER VOLTAGE TO BE MARKED ORANGE [NEC 110.15].

YES SOLAR SOLUTIONS

CONTRACTOR

YES SOLAR SOLUTIONS

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CARY, NC 27513

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HIC. NO.:
ELE. NO.: 31227-U

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NEW PV SYSTEM: 15.840 kWp

BUTLER RESIDENCE

. . 111 DEES ST
LILLINGTON, NC 27546
APN: 1306400004

ENGINEER OF RECORD

PAPER SIZE: 11" x 17" (ANSI B)

NOTES

DATE: 03.20.2021

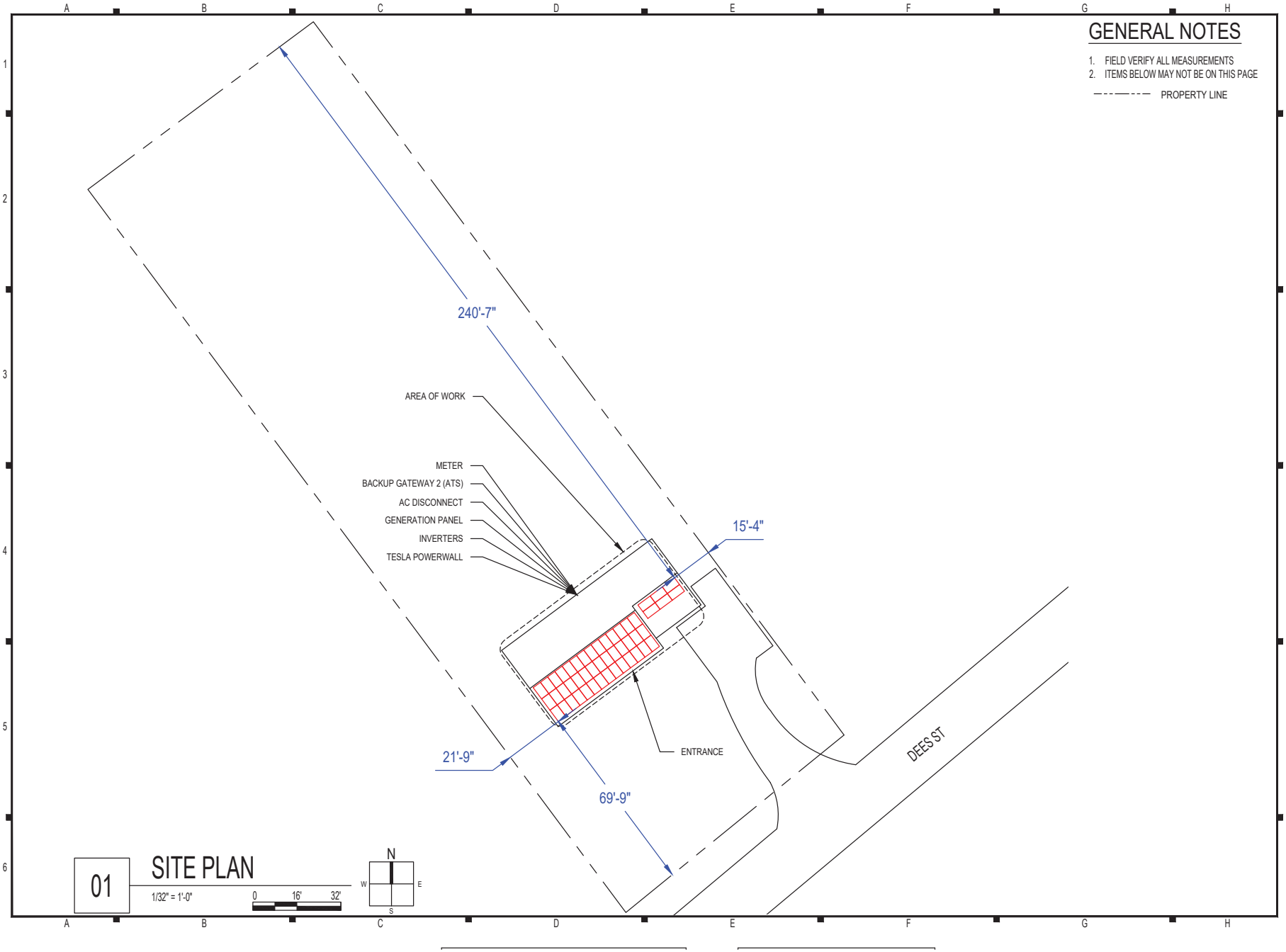
DESIGN BY: P.A.

CHECKED BY: M.M.

REVISIONS

G-001.00

(SHEET 2)



GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS
2. ITEMS BELOW MAY NOT BE ON THIS PAGE

PROPERTY LINE

01 SITE PLAN

1/32" = 1'-0"

0 16' 32'

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PAPER SIZE: 11" x 17" (ANSI B)

SITE PLAN

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

A-101.00
(SHEET 3)

EXTERIOR PV EQUIPMENT

(E) (1) METER

(N) (1) BACKUP GATEWAY 2 (ATS)

(N) (1) AC DISCONNECT

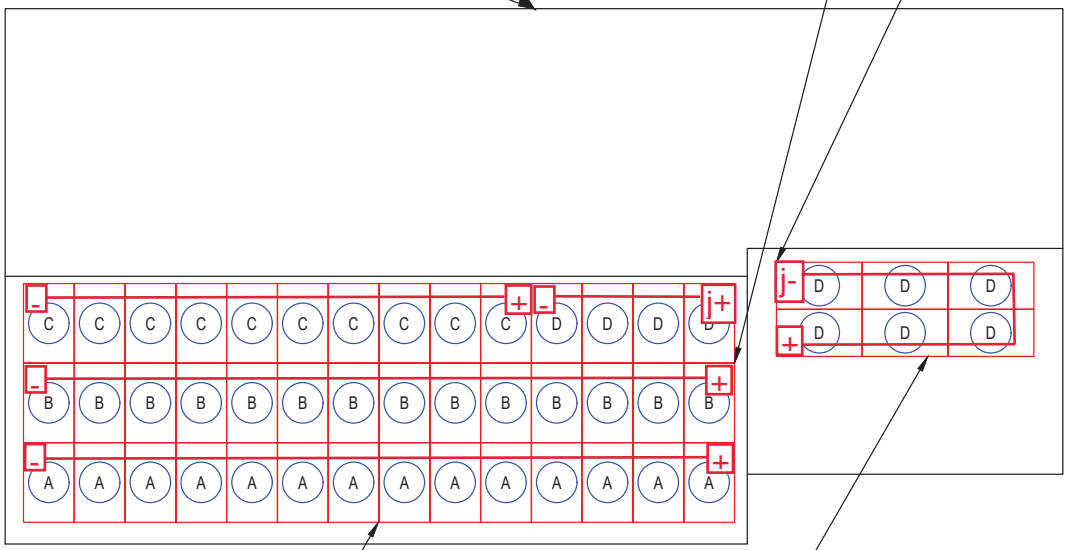
(N) (1) AC GENERATION PANEL

(N) (2) INVERTERS

(N) (2) TESLA POWERWALLS

INTERIOR PV EQUIPMENT

(E) (1) MAIN ELECTRICAL PANEL



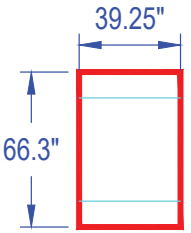
ARRAY 1 - 13.860 kW
[x42] (N) MODULES
TILT: 22 DEGREES
ROOF PITCH: 5:12
AZIMUTH: 145 DEGREES

ARRAY 2 - 1.980 kW
[x6] (N) MODULES
TILT: 22 DEGREES
ROOF PITCH: 5:12
AZIMUTH: 145 DEGREES

01 ELECTRICAL PLAN

1/8"=1'-0"

0 4' 8'



MODULE:
REC
REC330TP3M BLACK
330 WATTS

GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS
2. ITEMS BELOW MAY NOT BE ON THIS PAGE

A MODULE STRINGING

B MODULE STRINGING

C MODULE STRINGING

D MODULE STRINGING

YES SOLAR SOLUTIONS

CONTRACTOR

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ELECTRICAL PLAN

DATE: 03.20.2021

DESIGN BY: P.A.

CHECKED BY: M.M.

REVISIONS

A-102.00

(SHEET 4)

GENERAL NOTES

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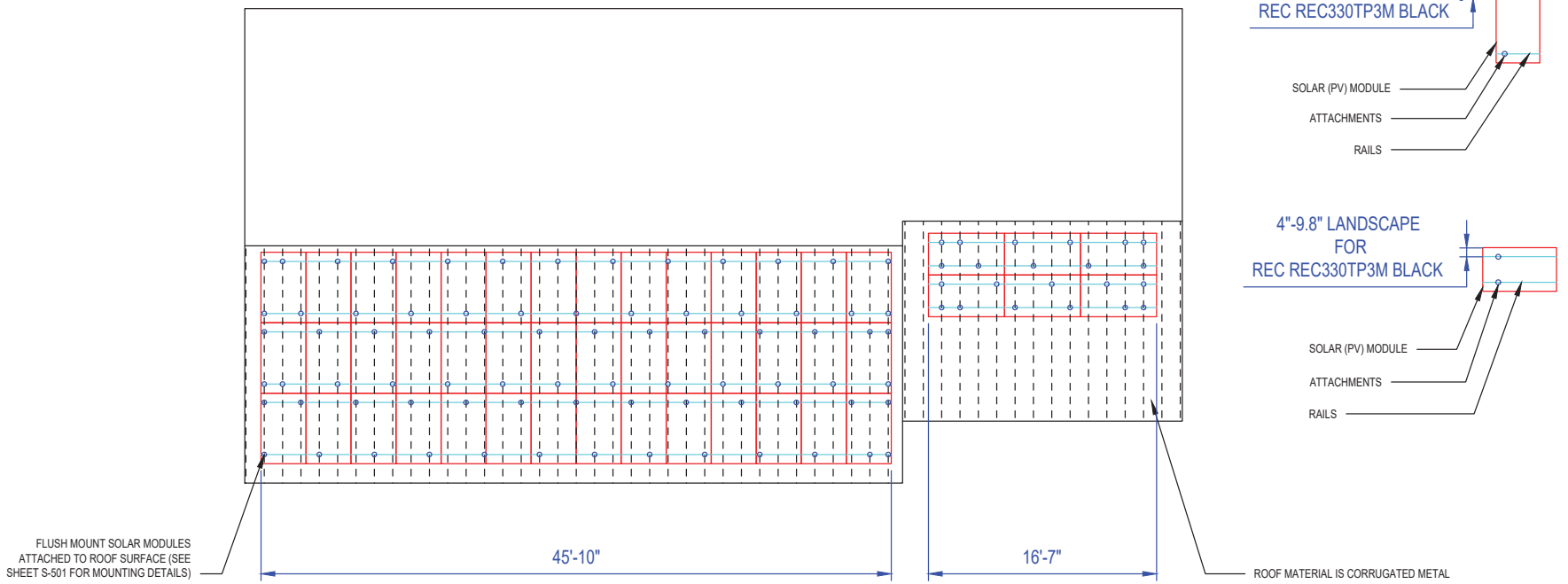
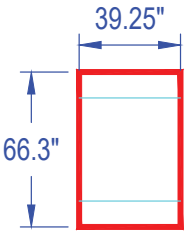


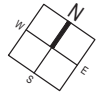


MODULE:
REC
REC330TP3M BLACK
330 WATTS

01 SOLAR ATTACHMENT PLAN

1/8" = 1'

0 4' 8'



YES SOLAR SOLUTIONS

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SOLAR ATTACHMENT PLAN

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

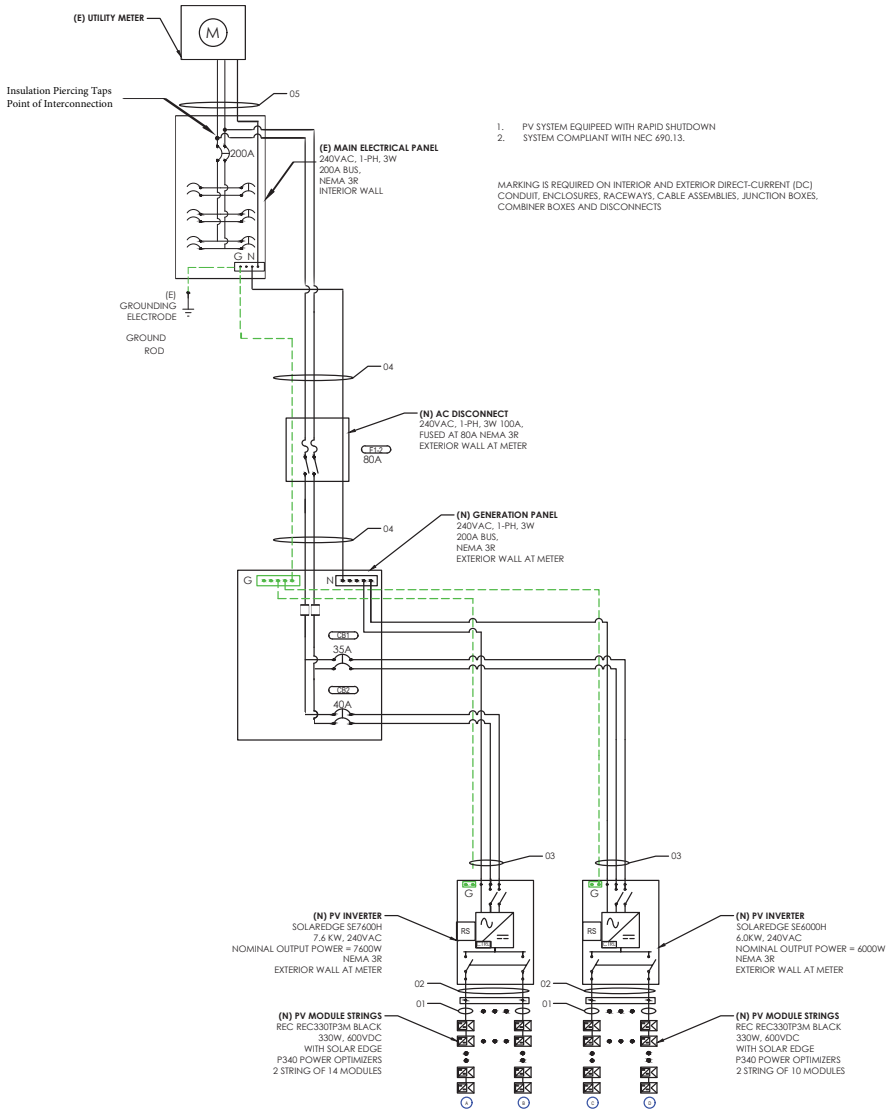
A-103.00
(SHEET 5)

A MODULE STRINGING

B MODULE STRINGING

C MODULE STRINGING

D MODULE STRINGING



1. PV SYSTEM EQUIPEED WITH RAPID SHUTDOWN
2. SYSTEM COMPLIANT WITH NEC 690.13.

MARKING IS REQUIRED ON INTERIOR AND EXTERIOR DIRECT-CURRENT (DC) CONDUIT, ENCLOSURES, RACEWAYS, CABLE ASSEMBLIES, JUNCTION BOXES, COMBINER BOXES AND DISCONNECTS

YES SOLAR SOLUTIONS

CONTRACTOR

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ELE. NO.: 31227-U

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NEW PV SYSTEM: 15.840 kWp

BUTLER RESIDENCE

. . 111 DEES ST
LILLINGTON, NC 27546
APN: 1306400004

ENGINEER OF RECORD

PAPER SIZE: 11" x 17" (ANSI B)

LINE DIAGRAM

DATE: 03.20.2021

DESIGN BY: P.A.

CHECKED BY: M.M.

REVISIONS

E-601.00

(SHEET 6)

SYSTEM SUMMARY				
	INVERTER #1		INVERTER #2	
	STRING #1	STRING #2	STRING #1	STRING #2
POWERBOX MAX OUTPUT CURRENT	15A	15A	15A	15A
OPTIMIZERS IN SERIES	14	14	10	10
NOMINAL STRING VOLTAGE	400V	400V	380V	380V
ARRAY OPERATING CURRENT	11.55A	11.55A	8.68A	8.68A
ARRAY STC POWER	9,240W		6,600W	
ARRAY PTC POWER	8,646W		6,176W	
MAX AC CURRENT	32A		25A	
MAX AC POWER	7,600W		6,000W	
DERATED (CEC) AC POWER	7,600W		6,000W	
TOTAL STC POWER	15,840W			
TOTAL PTC POWER	14,822W			
MAX AC CURRENT	57A			
MAX AC POWER	13,600W			
DERATED (CEC) AC POWER	13,600W			

MODULES										
REF.	QTY.	MAKE AND MODEL	PMAX	PTC	ISC	IMP	VOC	VMP	TEMP. COEFF. OF VOC	FUSE RATING
PM1-48	48	REC REC330TP3M BLACK	330W	308.8W	10.39A	9.62A	39.9V	33.6V	-0.112V/°C (-0.28%/°C)	20A

POWER OPTIMIZERS							
REF.	QTY.	MODEL	RATED INPUT POWER	MAX OUTPUT CURRENT	MAX INPUT ISC	MAX DC VOLTAGE	WEIGHTED EFFICIENCY
PO1-48	48	SOLAR EDGE P340	340W	15A	11A	48V	98.8%

INVERTERS										
REF.	QTY.	MAKE AND MODEL	AC VOLTAGE	GROUND	OCPD RATING	RATED POWER	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX INPUT VOLTAGE	CEC WEIGHTED EFFICIENCY
I1	1	SOLAR EDGE SE7600H-US (240V)	240V	FLOATING	40A	7600W	32A	20A	480V	99.0%
I2	1	SOLAR EDGE SE6000H-US (240V)	240V	FLOATING	35A	6000W	25A	16.5A	480V	99.0%

DISCONNECTS				
REF.	QTY.	MAKE AND MODEL	RATED CURRENT	MAX RATED VOLTAGE
SW1	1	EATON DG224NRK OR EQUIV.	200A	240VAC

OCPDS			
REF.	QTY.	RATED CURRENT	MAX VOLTAGE
CB1-2	2	40A	240VAC
F1-2	2	80A	240VAC

ASHRAE EXTREME LOW	-11.1°C (12.0°F), SOURCE: HARTNETT COUNTY (35.38°; -78.73°)
ASHRAE 2% HIGH	37.1°C (98.8°F), SOURCE: HARTNETT COUNTY (35.38°; -78.73°)

CONDUCTOR AND CONDUIT SCHEDULE W/ELECTRICAL CALCULATIONS														
ID	TYPICAL	CONDUCTOR	CONDUIT	CURRENT-CARRYING CONDUCTORS IN CONDUIT	OCPD	EGC	TEMP. CORR. FACTOR	CONDUIT FILL FACTOR	CONT. CURRENT	MAX. CURRENT (125%)	BASE AMP.	DERATED AMP.	TERM. TEMP. RATING	AMP. @ TERMINAL
1	4	10 AWG PV WIRE, COPPER	FREE AIR	2	N/A	6 AWG BARE, COPPER	0.91 (37.1 °C)	1	15A	18.75A	55A	50.05A	75°C	50A
2	2	10 AWG THWN-2, COPPER	0.75" DIA EMT	4	N/A	10 AWG THWN-2, COPPER	0.91 (37.1 °C)	0.8	15A	18.75A	40A	29.12A	75°C	35A
3	2	8 AWG THWN-2, COPPER	0.75" DIA EMT	2	40A	10 AWG THWN-2, COPPER	0.91 (37.1 °C)	1	32A	40A	55A	50.05A	75°C	50A
4	2	4 AWG THWN-2, COPPER	1" DIA EMT	2	80A	8 AWG THWN-2, COPPER	0.91 (37.1 °C)	1	57A	71.25A	125A	154.7A	75°C	125A
5	1	3/O AWG THWN-2, COPPER	2" DIA EMT	2	N/A	3/O AWG THWN-2, COPPER	0.91 (37.1 °C)	1	57A	71.25A	225A	204.75A	75°C	200A

YES SOLAR SOLUTIONS

CONTRACTOR

YES SOLAR SOLUTIONS

PHONE: (919) 459-2846

ADDRESS: 202 NORTH DIXON AVENUE
CARY, NC 27513

LIC. NO.: 67356
HIC. NO.:
ELE. NO.: 31227-U

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ENGINEER OF RECORD

PAPER SIZE: 11" x 17" (ANSI B)

DESIGN TABLES

DATE: 03.20.2021

DESIGN BY: P.A.

CHECKED BY: M.M.

REVISIONS

E-602.00

(SHEET 7)

LABELING NOTES
1.1 LABELING REQUIREMENTS BASED ON THE 2017 NATIONAL ELECTRICAL CODE, INTERNATIONAL FIRE CODE 605.11, OSHA STANDARD 1910.145, ANSI Z535
1.2 MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
1.3 LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
1.4 LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8" AND PERMANENTLY AFFIXED.
1.5 ALERTING WORDS TO BE COLOR CODED. "DANGER" WILL HAVE RED BACKGROUND; "WARNING" WILL HAVE ORANGE BACKGROUND; "CAUTION" WILL HAVE YELLOW BACKGROUND. [ANSI Z535]
1.6 ALL SIGNAGE MUST BE PERMANENTLY ATTACHED AND BE WEATHER RESISTANT/SUNLIGHT RESISTANT AND CANNOT BE HAND-WRITTEN PER NEC 110.21(B)

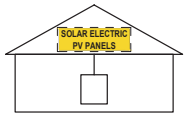
WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL 1
AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT (2" X 4").
[NEC 690.13].

WARNING
POWER SOURCE OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL 2
AT POINT OF INTERCONNECTION OVERCURRENT DEVICE (2" X 4").
[NEC 705.12(B)(2)(3)(B)].

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN



TURN RAPID SHUTDOWN SWICH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY

LABEL 3
AT RAPID SHUTDOWN SYSTEM (3 3/4" X 5 1/4"). [NEC 690.56(C)(1)(A)].

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL 4
AT EXPOSED RACEWAYS, CABLE TRAYS, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10 FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS (5 3/4" X 1 1/8").
[NEC 690.31(G)]
LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE
[IFC 605.11.1.1]

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL 5
AT RAPID SHUTDOWN DISCONNECT SWITCH (5 1/4" X 2").
[NEC 690.56(C)(3)].

CAUTION
SOLAR ELECTRIC SYSTEM CONNECTED

LABEL 6
AT UTILITY METER (5 3/4" X 1 1/8")
[NEC 690.56(B)]

WARNING
TRIPLE POWER SUPPLY
SOURCES: UTILITY GRID, BATTERY AND PV SOLAR ELECTRIC SYSTEM

LABEL 7
AT POINT OF INTERCONNECTION (2 3/4" X 1 5/8").
[NEC 705.12(B)(3)]

WARNING
SOLAR ELECTRIC CIRCUIT BREAKER IS BACKFED

LABEL 8
AT POINT OF INTERCONNECTION (2" X 1").
[NEC 705.12(B)(3)]

INTERACTIVE PHOTOVOLTAIC SYSTEM CONNECTED
PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED NW SIDE OF THE HOUSE

DIRECTORY
PERMANENT PLAQUE OR DIRECTORY PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS IF NOT IN THE SAME LOCATION (5 3/4" X 1 1/8").
[NEC 690.56(B)]
WHERE THE PV SYSTEMS ARE REMOTELY LOCATED FROM EACH OTHER, A DIRECTORY IN ACCORDANCE WITH 705.10 SHALL BE PROVIDED AT EACH PV SYSTEM DISCONNECTING MEANS.
PV SYSTEM EQUIPMENT AND DISCONNECTING MEANS SHALL NOT BE INSTALLED IN BATHROOMS
[NEC 690.4(D),(E)]

PHOTOVOLTAIC SOLAR AC DISCONNECT

LABEL 9
AT EACH AC DISCONNECTING MEANS (4" X 1").
[NEC 690.13(B)].

PHOTOVOLTAIC SOLAR DC DISCONNECT

LABEL 10
AT EACH DC DISCONNECTING MEANS (4" X 1").
[NEC 690.13(B)].

PHOTOVOLTAIC SYSTEM AC DISCONNECT

RATED AC OUTPUT CURRENT 57 A
NOMINAL OPERATING AC VOLTAGE 240 V

LABEL 11
AT POINT OF INTERCONNECTION, MARKED AT DISCONNECTING MEANS (4" X 2").
[NEC 690.54]

DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE

MAXIMUM VOLTAGE: 480 V DC
MAXIMUM CIRCUIT CURRENT: 20 A DC
MAX RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER OR DC-TO-DC CONVERTER 30 A DC

LABEL 12
AT EACH DC DISCONNECTING MEANS (3" X 4").
[NEC 690.53].

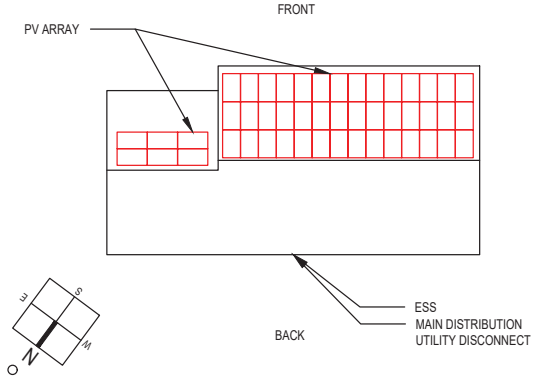
DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE

MAXIMUM VOLTAGE: 480 V DC
MAXIMUM CIRCUIT CURRENT: 16.5 A DC
MAX RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER OR DC-TO-DC CONVERTER 30 A DC

LABEL 13
AT EACH DC DISCONNECTING MEANS (3" X 4").
[NEC 690.53].

!CAUTION!

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM ROOF MOUNTED SOLAR ARRAYS WITH SAFETY DISCONNECTS AS SHOWN:



YES SOLAR SOLUTIONS

CONTRACTOR

YES SOLAR SOLUTIONS

PHONE: (919) 459-2846
ADDRESS: 202 NORTH DIXON AVENUE CARY, NC 27513

LIC. NO.: 67356
HIC. NO.:
ELE. NO.: 31227-U

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. . 111 DEES ST
LILLINGTON, NC 27546
APN: 1306400004

ENGINEER OF RECORD

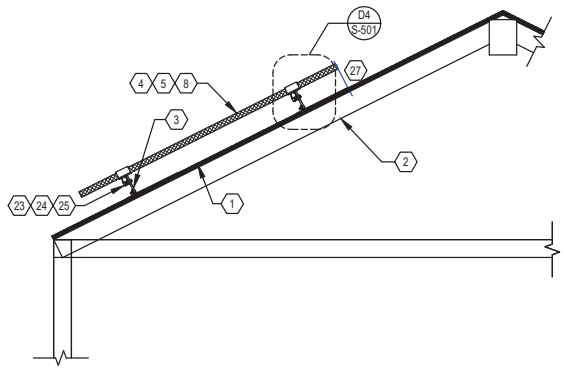
PAPER SIZE: 11" x 17" (ANSI B)

PLACARDS

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

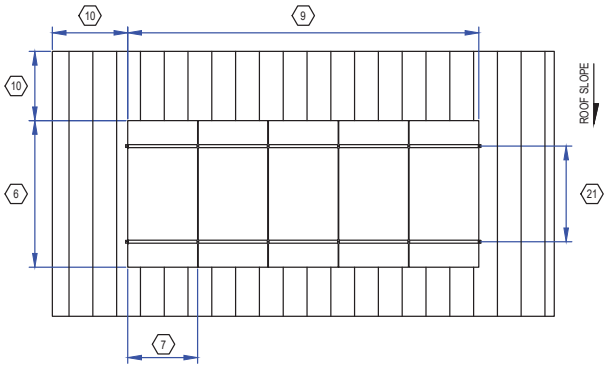
REVISIONS

E-603.00
(SHEET 8)



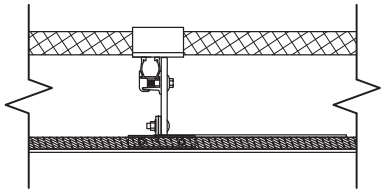
D1 RACKING DETAIL (TRANSVERSE)

NOT TO SCALE



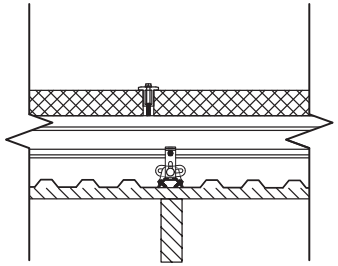
D3 RACKING DETAIL (TOP)

NOT TO SCALE



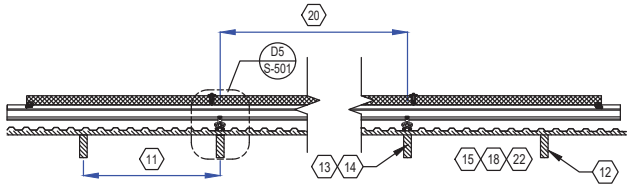
D4 DETAIL (TRANSVERSE)

NOT TO SCALE



D5 DETAIL (LONGITUDINAL)

NOT TO SCALE



D2 RACKING DETAIL (LONGITUDINAL)

NOT TO SCALE

GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS

SHEET KEYNOTES

1. ROOF MATERIAL: CORRUGATED METAL
2. ROOF STRUCTURE: SINGLE SPAN RAFTER
3. ATTACHMENT TYPE: S!5 PROTEA BRACKET
4. MODULE MANUFACTURER: REC
5. MODULE MODEL: REC330TP3M BLACK
6. MODULE LENGTH: 66.3"
7. MODULE WIDTH: 39.25"
8. MODULE WEIGHT: 41.7 LBS.
9. SEE SHEET A-103 FOR DIMENSION(S)
10. MIN. FIRE OFFSET: NO FIRE CODE ENFORCED
11. TRUSS SPACING: 16 IN. O.C.
12. TRUSS SIZE: 2X6 IN. NOMINAL
13. LAG BOLT DIAMETER: 5/16 IN.
14. LAG BOLT EMBEDMENT: 2-1/2 IN.
15. TOTAL # OF ATTACHMENTS: 100
16. TOTAL AREA: 867.43 SQ. FT.
17. TOTAL WEIGHT: 2212.04 LBS.
18. WEIGHT PER ATTACHMENT: 22.12 LBS.
19. DISTRIBUTED LOAD: 2.55 PSF
20. MAX. HORIZONTAL STANDOFF: 48 IN.
21. MAX. VERTICAL STANDOFF: LANDSCAPE: 26 IN., PORTRAIT: 33 IN.
22. STANDOFF STAGGERING: YES
23. RAIL MANUFACTURER (OR EQUIV.): SNAP N RACK
24. RAIL MODEL (OR EQUIVALENT): UR-40 RAIL
25. RAIL WEIGHT: 0.42 PLF.
26. MAX. TRUSS SPAN: N/A
27. MODULE CLEARANCE: 3 IN. MIN., 6 IN. MAX.

Ron Bittler, PE

Digitally signed by Ron Bittler, PE
DN: cn=Ron Bittler, PE, o=RB Engineering, Inc., ou, email=rbittler@rbengineering.com, c=US
Date: 2021.03.23 08:41:08 -04'00'

STRUCTURAL REVIEW PROVIDED BY:
RONALD P. BITTLER, PE
RB ENGINEERING, INC. (C-2499)
168 QUADE DRIVE
CARY, NC 27513
919-677-9662
PROJECT #RB-216884

YES SOLAR SOLUTIONS

CONTRACTOR

YES SOLAR SOLUTIONS

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ADDRESS: 202 NORTH DIXON AVENUE CARY, NC 27513

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HIC. NO.:
ELE. NO.: 31227-U

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NEW PV SYSTEM: 15.840 kWp

BUTLER RESIDENCE

. . 111 DEES ST
LILLINGTON, NC 27546
APN: 1306400004

ENGINEER OF RECORD

NORTH CAROLINA PROFESSIONAL SEAL 025811 ENGINEER RONALD P. BITTLER

03.23.2021

PAPER SIZE: 11" x 17" (ANSI B)

ASSEMBLY DETAILS

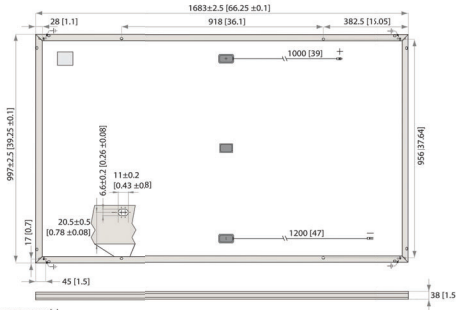
DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

S-501.00

(SHEET 9)

REC TWINPEAK 3 MONO BLACK SERIES



20.0% EFFICIENCY

20 YEAR PRODUCT WARRANTY

25 YEAR LINEAR POWER OUTPUT WARRANTY

ELECTRICAL DATA @ STC	Product code*: RECxxxTP3M Black				
Power Output - P_{MAX} (Wp)	315	320	325	330	335
Watt Class Sorting - (W)	-0/+5	-0/+5	-0/+5	-0/+5	-0/+5
Nominal Power Voltage - V_{MPP} (V)	33.6	33.8	34.1	34.3	34.6
Nominal Power Current - I_{MPP} (A)	9.40	9.50	9.54	9.62	9.69
Open Circuit Voltage - V_{OC} (V)	38.7	39.1	39.5	39.9	40.2
Short Circuit Current - I_{SC} (A)	10.30	10.30	10.36	10.39	10.42
Panel Efficiency (%)	18.8	19.1	19.4	19.7	20.0

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 P_{MAX}, V_{OC} & I_{SC} ±3% within one watt class. At a low irradiance of 200 W/m² at least 95% of the STC module efficiency will be achieved.
*Where xxx indicates the nominal power class (P_{MAX}) at STC indicated above.

ELECTRICAL DATA @ NMOT	Product code*: RECxxxTP3M Black				
Power Output - P_{MAX} (Wp)	235	238	242	246	250
Nominal Power Voltage - V_{MPP} (V)	31.3	31.5	31.7	31.9	32.2
Nominal Power Current - I_{MPP} (A)	7.51	7.57	7.63	7.70	7.75
Open Circuit Voltage - V_{OC} (V)	36.1	36.4	36.8	37.1	37.5
Short Circuit Current - I_{SC} (A)	8.23	8.26	8.29	8.31	8.34

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

TEMPERATURE RATINGS	
Nominal Module Operating Temperature:	44.6°C (±2°C)
Temperature coeffcient of P_{MAX}:	-0.37 %/°C
Temperature coeffcient of V_{OC}:	-0.28 %/°C
Temperature coeffcient of I_{SC}:	0.04 %/°C

GENERAL DATA	
Cells:	120 half-cut mono-Si p-type PERC cells 6 strings of 20 cells in series
Glass:	0.13" (3.2 mm) solar glass with anti-reflective surface treatment
Back sheet:	Highly resistant polyester polyolefin construction (black)
Frame:	Anodized aluminum (black)
Junction box:	3-part with 3 bypass diodes, IP67 rated 12 AWG (4 mm²) PV wire, 39" + 47" (1.0 m + 1.2 m)
Connectors:	Stäubli MC4 PV-KBT4/PV-KST4, 12 AWG (4 mm²)

MAXIMUM RATINGS	
Operational temperature:	-40 ... +185°F (-40 ... +85°C)
Maximum system voltage:	1000 V
Design load (+): snow Maximum test load (+):	3600 Pa (75.2 lbs/ft²)* 5400 Pa (112.8 lbs/ft²)*
Design load (-): wind Maximum test load (-):	1600 Pa (33.4 lbs/ft²)* 2400 Pa (50 lbs/ft²)*
Max series fuse rating:	20 A
Max reverse currert:	20 A

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

MECHANICAL DATA	
Dimensions:	66.3 x 39.25 x 1.5 (1683 x 997 x 38 mm)
Area:	17.98 ft² (1.68 m²)
Weight:	41.7 lbs (18.9 kg)

Note! Specificatiors subject to change without notice.

Specifications subject to change without notice.

Ref: PM/05-07/16 Rev: A 05.20

CERTIFICATIONS

UL 1703, Fire classification: Type 2; IEC 61215, IEC 61730; ISO 9001: 2015, ISO 14001: 2004, OHSAS 18001: 2007

WARRANTY

	Standard	REC ProTrust	
Installed by an REC Certified Solar Professional	No	Yes	Yes
System Size	Any	≤25 kW	25-500 kW
Product Warranty (yrs)	20	25	25
Power Warranty (yrs)	25	25	25
Labor Warranty (yrs)	0	25	10
Power in Year 1	97.5%	97.5%	97.5%
Annual Degradation	0.7%	0.7%	0.7%
Power in Year 25	80.7%	80.7%	80.7%

See warranty documents for details. Some conditions apply.

REC Group is an international pioneering solar energy company dedicated to empowering consumers with clean, affordable solar power in order to facilitate global energy transitions. Committed to quality and innovation, REC offers photovoltaic modules with leading high quality, backed by an exceptional low warranty claims rate of less than 100ppm. Founded in Norway in 1996, REC employs 2,000 people and has an annual solar panel capacity of 1.8 GW. With over 10 GW installed worldwide, REC is empowering more than 16 million people with clean solar energy. REC Group is a Bluestar Elkem company with headquarters in Norway, operational headquarters in Singapore, and regional bases in North America, Europe, and Asia-Pacific.

REC
www.recgroup.com

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RESOURCE DOCUMENT

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

R-001.00
(SHEET 10)

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

INVERTERS

12-25 YEAR WARRANTY

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking efficiency
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Extremely small
- Built-in module-level monitoring
- Outdoor and indoor installation
- Optional: Revenue grade data, ANSI C12.20 Class 0.5 (0.5% accuracy)

solaredge.com

solaredge

Single Phase Inverter with HD-Wave Technology for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)				59.3 - 60 - 60.5[1]				Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
GFDI Threshold				1				A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds				Yes				
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded				Yes				
Maximum Input Voltage				480				Vdc
Nominal DC Input Voltage			380			400		Vdc
Maximum Input Current @240V[2]	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V[2]	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current				45				Adc
Reverse-Polarity Protection				Yes				
Ground-Fault Isolation Detection				600kΩ Sensitivity				
Maximum Inverter Efficiency	99			99.2				%
CEC Weighted Efficiency				99			99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption				< 2.5				W
ADDITIONAL FEATURES								
Supported Communication Interfaces				RS485, Ethernet, ZigBee (optional), Cellular (optional)				
Revenue Grade Data, ANSI C12.20				Optional[3]				
Rapid Shutdown - NEC 2014 and 2017 690.12				Automatic Rapid Shutdown upon AC Grid Disconnect				
STANDARD COMPLIANCE								
Safety				UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07				
Grid Connection Standards				IEEE1547, Rule 21, Rule 14 (HI)				
Emissions				FCC Part 15 Class B				
INSTALLATION SPECIFICATIONS								
AC Output Conduit Size / AWG Range				3/4" minimum / 14-6 AWG			3/4" minimum /14-4 AWG	
DC Input Conduit Size / # of Strings / AWG Range				3/4" minimum / 1-2 strings / 14-6 AWG			3/4" minimum / 1-3 strings / 14-6 AWG	
Dimensions with Safety Switch (HxWxD)				17.7 x 14.6 x 6.8 / 450 x 370 x 174			21.3 x 14.6 x 7.3 / 540 x 370 x 185	in / mm
Weight with Safety Switch		22 / 10		25.1 / 11.4	26.2 / 11.9		38.8 / 17.6	lb / kg
Noise				< 25			<50	dBA
Cooling				Natural Convection				
Operating Temperature Range				-40 to +140 / -25 to +60[4] (-40°F / -40°C option)[5]				°F / °C
Protection Rating				NEMA 4X (Inverter with Safety Switch)				

[1] For other regional settings please contact SolarEdge support
[2] A higher current source may be used; the inverter will limit its input current to the values stated
[3] Revenue grade inverter P/N: SExxxxH-US000NNC2
[4] For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf
[5] -40 version P/N: SExxxxH-US000NNU4

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NEW PV SYSTEM: 15.840 kWp

BUTLER RESIDENCE

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LILLINGTON, NC 27546
APN: 1306400004

ENGINEER OF RECORD

PAPER SIZE: 11" x 17" (ANSI B)

RESOURCE DOCUMENT

DATE: 03.20.2021
DESIGN BY: P.A.
CHECKED BY: M.M.

REVISIONS

R-002.00
(SHEET 11)

Power Optimizer

For North America

P320 / P340 / P370 / P400 / P405 / P505

POWER OPTIMIZER

PV power optimization at the module-level

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module-level monitoring
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)
- Module-level voltage shutdown for installer and firefighter safety

solaredge.com

solaredge

Power Optimizer

For North America

P320 / P340 / P370 / P400 / P405 / P505

Optimizer model (typical module compatibility)	P320 (for 60-cell modules)	P340 (for high-power 60-cell modules)	P370 (for higher-power 60 and 72-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	P505 (for higher current modules)	
INPUT							
Rated Input DC Power[1]	320	340	370	400	405	505	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48		60	80	125[2]	83[2]	Vdc
MPPT Operating Range	8 - 48		8 - 60	8 - 80	12.5 - 105	12.5 - 83	Vdc
Maximum Short Circuit Current (Isc)	11			10.1		14	Adc
Maximum DC Input Current	13.75			12.63		17.5	Adc
Maximum Efficiency	99.5						%
Weighted Efficiency	98.8					98.6	%
Overvoltage Category	II						
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)							
Maximum Output Current	15						Adc
Maximum Output Voltage	60				85		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)							
Safety Output Voltage per Power Optimizer	1 ± 0.1						Vdc
STANDARD COMPLIANCE							
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3						
Safety	IEC62109-1 (class II safety), UL1741						
RoHS	Yes						
INSTALLATION SPECIFICATIONS							
Maximum Allowed System Voltage	1000						Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters						
Dimensions (W x L x H)	128 x 152 x 28 / 5 x 5.97 x 1.1			128 x 152 x 36 / 5 x 5.97 x 1.42	128 x 152 x 50 / 5 x 5.97 x 1.96	128 x 152 x 59 / 5 x 5.97 x 2.32	mm / in
Weight (including cables)	630 / 1.4			750 / 1.7	845 / 1.9	1064 / 2.3	gr / lb
Input Connector	MC4[3]						
Output Wire Type / Connector	Double Insulated; MC4						
Output Wire Length	0.95 / 3.0		1.2 / 3.9				m / ft
Input Wire Length	0.16 / 0.52						m / ft
Operating Temperature Range	-40 - +85 / -40 - +185						°C / °F
Protection Rating	IP68 / NEMA6P						
Relative Humidity	0 - 100						%

(1) Rated STC power of the module. Module of up to +5% power tolerance allowed
(2) NEC 2017 requires max input voltage be not more than 80V
(3) For other connector types please contact SolarEdge

PV System Design Using a SolarEdge Inverter[4][5]		Single Phase HD-Wave		Single phase	Three Phase 208V	Three Phase 480V	
Minimum String Length (Power Optimizers)	P320, P340, P370, P400	8			10	18	
	P405 / P505	6			8	14	
Maximum String Length (Power Optimizers)		25			25	50[6]	
Maximum Power per String		5700 (6000 with SE7600-US - SE11400-US)		5250	6000[7]	12750[8]	W
Parallel Strings of Different Lengths or Orientations		Yes					

(4) For detailed string sizing information refer to: http://www.solaredge.com/sites/default/files/string_sizing_na.pdf
(5) It is not allowed to mix P405/P505 with P320/P340/P370/P400 in one string
(6) A string with more than 30 optimizers does not meet NEC rapid shutdown requirements; safety voltage will be above the 30V requirement
(7) For SE14.4KUS/SE43.2KUS: It is allowed to install up to 6,500W per string when 3 strings are connected to the inverter (3 strings per unit for SE43.2KUS) and when the maximum power difference between the strings is up to 1,000W
(8) For SE30KUS/SE33.3KUS/SE66.6KUS/SE100KUS: It is allowed to install up to 15,000W per string when 3 strings are connected to the inverter (3 strings per unit for SE66.6KUS/SE100KUS) and when the maximum power difference between the strings is up to 2,000W

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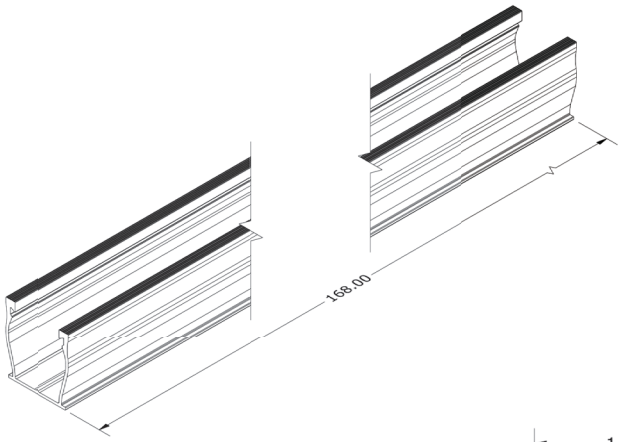
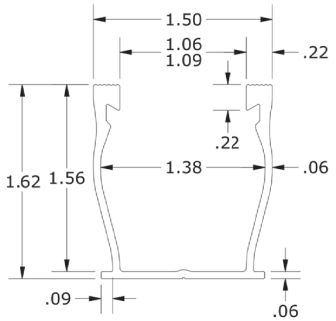
CHECKED BY: M.M.

REVISIONS

R-003.00
(SHEET 12)

DESCRIPTION:	DRAWN BY:	SnapNrack Solar Mounting Solutions
SNAPNRACK, UR-40 RAIL	mwatkins	
PART NUMBER(S):	REVISION:	595 MARKET STREET,29TH FLOOR • SAN FRANCISCO, CA 94105 USA PHONE (415) 580-6900 • FAX (415) 580-6902
232-02449, 232-02450, 232-02451	A	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.





UR-40 RAIL PROPERTIES	
SKU	FINISH
232-02449	MILL
232-02450	CLEAR
232-02451	BLACK

ALL DIMENSIONS IN INCHES

MATERIALS:	6000 SERIES ALUMINUM	OPTIONS:
DESIGN LOAD (LBS):	N/A	CLEAR / BLACK ANODIZED
ULTIMATE LOAD (LBS):	N/A	MILL FINISH
TORQUE SPECIFICATION:	N/A LB-FT	BUNDLES OF 144
CERTIFICATION:	UL 2703, FILE E359313	
WEIGHT (LBS):	5.85	

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R-006.00

SHEET 15

S-5!®

The Right Way!

ProteaBracket™

ProteaBracket™ is the most versatile standing seam metal roof attachment solution on the market, fitting most trapezoida sheet profiles with and without intermediate insulation. It features an adjustable attachment base and multiple solar module attachment options (illustrated on back) to accommodate varying widths and heights. There are no messy sealants to apply and no chance for leaks; the FroteaBracket comes with factory-applied, adhesive rubber sealant to ensure cuick installation and a weather-proof fit.

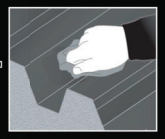
Installation is simple! The ProteaBracket is mountec directly onto the crown of the panel, straddling the profile. No surface preparation is necessary; simply wipe away excess oil and debris, align, and apply. Secure ProteaBracket through its pre-punched holes, using the hardened drill point S-5!® screws.

ProteaBracket is the perfect match for our S-5-PV Kit and spares you the hassle of cold-bridging! For a solar attachment solution that is both economical and easy to use, choose ProteaBracket.*

*When ProteaBracket is used in conjunction with the S-5-PV Kit, an additional nutis required during installation.

The right way to attach almost anything to metal roofs!

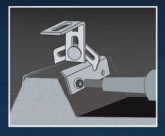
1



2

3

4



ProteaBracket™

S-5!® ProteaBracket™ is a versatile bracket that adjusts easily to most trapezoidal roof profiles.

888-825-3432 | www.S-5.com

S-5!®

The Right Way!

ProteaBracket™ is the perfect solar attachment solution for most trapezoidal exposed-fastened metal roof profiles! No messy sealants to apply. The factory-applied adhesive rubber sealant weather-proofs and makes installation easy!

Each **ProteaBracket™** comes with a factory-applied, adhesive rubber sealant on the base. A structural A2 stainless steel bimetal attachment bracket, ProteaBracket is compatible with most common metal roofing materials. All four pre-punched holes must be used to achieve tested strength. Mounting hardware is furnished with the ProteaBracket. For design assistance, ask your distributor, or visit **www.S-5.com** for the independent lab test data that can be used for load-critical designs and applications. Also, please visit our website for more information including metallurgical compatibilities and specifications. S-5!® holding strength is unmatched in the industry.

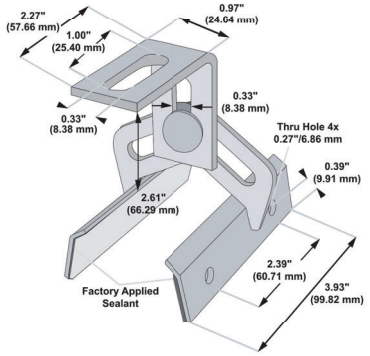
Multiple Attachment Options:

Side Rail Option

Top Rail Option

S-5-PV Kit Option

ProteaBracket™



Please note: All measurements are rounded to the second decimal place.

Example Applications

S-5-PV Kit demonstrated with a ProteaBracket on a trapezoidal profile.

Example Profile

S-5!® Warning! Please use this product responsibly!

Products are protected by multiple U.S. and foreign patents. For published data regarding holding strength, bolt torque, patents, aad trademarks, visit the S-5! website at www.S-5.com.

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S-5! aggressively protects its patents, trademarks, and copyrights. Version 112513.

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SHEET 16