

# 11.68kW DC SOLAR ELECTRIC SYSTEM AC :10.57kW ONE STORY HOUSE

## SCOPE OF WORK

INSTALL A 11.68 KW PV ARRAY THAT INCLUDES 32 ROOF MOUNTED SOLAR PANELS.  
INSTALL A NEW 225AMP BUS BAR W/200AMP BREAKER UPGRADE ELECTRICAL SERVICE .

MODULE MODEL : HT-SAAE SOLAR HT60-166M-365  
MODULE MAX POWER (P/MAX): 365W  
MODULE QTY : [32]  
INVERTER MODEL : ALTENERGY POWER SYSTEM QS-1  
INVERTER QTY : [8]

ROOF PITCH : 20°  
PV ARRAY PITCH : 20°

AZIMUTH: (32) MODULES @ 120°

ROOF TYPE: COMP. SHINGLE  
ROOF LAYER(S): 01  
RAFTERS: 2X6 [24"] ON CENTER

ELECTRIC UTILITY COMPANY: DEP  
MAIN SERVICE AMPERAGE: 225AMP BUS BAR



**NOTE TO INSTALLERS: VERIFY THE ROOF FRAMING INFO BEFORE INSTALLATION AND NOTIFY THE EOR AT 951.405.1733 IF THERE IS ANY INCONSISTENCY BETWEEN SITE VERIFICATION AND FOLLOWING: 2x6 RAFTERS @ 24" OC SPACING WITH MAX UNSUPPORTED SPAN EQUAL OR LESS THAN 10 FT.**

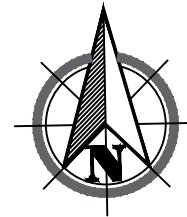
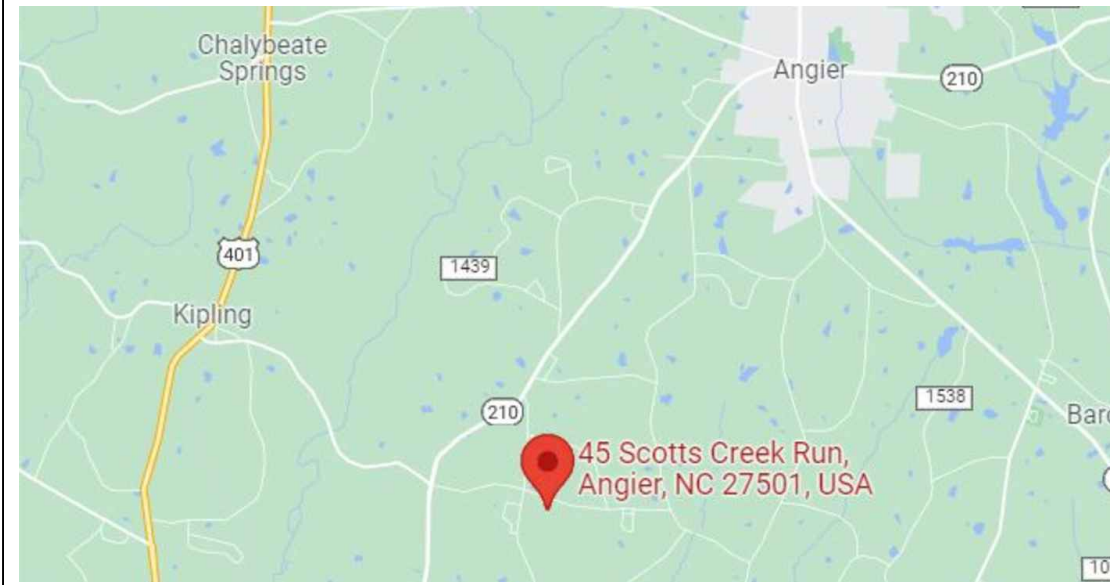
1. Prior to commencement of work, the contractor shall verify the framing sizes, spacings, and spans noted in the stamped plans and accompanying calculations and notify the Engineer of Record of any discrepancies prior to starting construction.
2. These plans are stamped for structural code compliance of the roof framing supporting the proposed PV installation referenced only. These plans are not stamped for water leakage. PV modules, racking, and attachment components must follow manufacturer guidelines and requirements.
3. Please see accompanying Structural Calculations report for details regarding calculations as well as limits of scope of work and liability.

## CODE SUMMARY:

2018 NORTH CAROLINA BUILDING CODE  
2018 NORTH CAROLINA RESIDENTIAL CODE  
2018 NORTH CAROLINA EXISTING BUILDING CODE  
2018 NORTH CAROLINA MECHANICAL CODE  
2018 NORTH CAROLINA FIRE PREVENTION CODE  
2018 NORTH CAROLINA ENERGY CONSERVATION CODE 2017  
NORTH CAROLINA ELECTRICAL CODE  
BREAKER SIZES:NEC 240.6(A)  
WIRE AMPACITY TABLE:NEC 310.15(B)(16)  
MAX SYSTEM VOLTAGE CORRECTION: NEC 690.7(A) NUMBER OF  
CONDUCTORS NEC 690.7(A)CORRECTION: NEC 310.15(B)(3)(A)  
AMBIENT TEMPERATURE CORRECTION: NEC 310.15(B)(2)(A)  
AMBIENT TEMPERATURE ADJUSTMENT:NEC 310.15(B)(3)(C) DC  
GROUNDING ELECTRODE CONDUCTOR:NEC 250.166 AC  
GROUNDING ELECTRODE CONDUCTOR: NEC 250.50 RACK  
GROUNDING ELECTRODE CONDUCTOR: NEC 690.47(B) MAXIMUM  
OCPD (120% RULE):NEC 705.12



**VICINITY MAP**  
SCALE: NTS



**AERIAL MAP**  
SCALE: NTS



## SHEET INDEX

T1-TITLE PLAN, GENERAL NOTES PV SYSTEM SUMMARY  
A1-SITE PLAN / A1.1-SYSTEM INFORMATION  
A2-PANEL AND RACKING LAYOUT / A3-GENERAL DETAIL  
E1-SINGLE LINE DIAGRAM / E2-LABELS AND PLACARD  
MANUFACTURER SPEC SHEETS

## REVISIONS

DATE	REV.

PAPER SIZE: 11"X17"

DATE: 9/16/21

SHEET TITLE: COVER PAGE

HOMEOWNER: JOSE ANTONIO LOPEZ

ADDRESS: 45 SCOTTS CREEK RUN  
ANGIER NC 27501

CONTRACTOR: VON LOOR & SLOOF ENERGY LLC

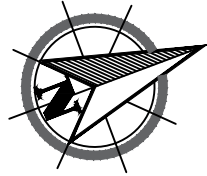
LICENSE # 85970 SIGNATURE: \_\_\_\_\_

JOB#: PM2441

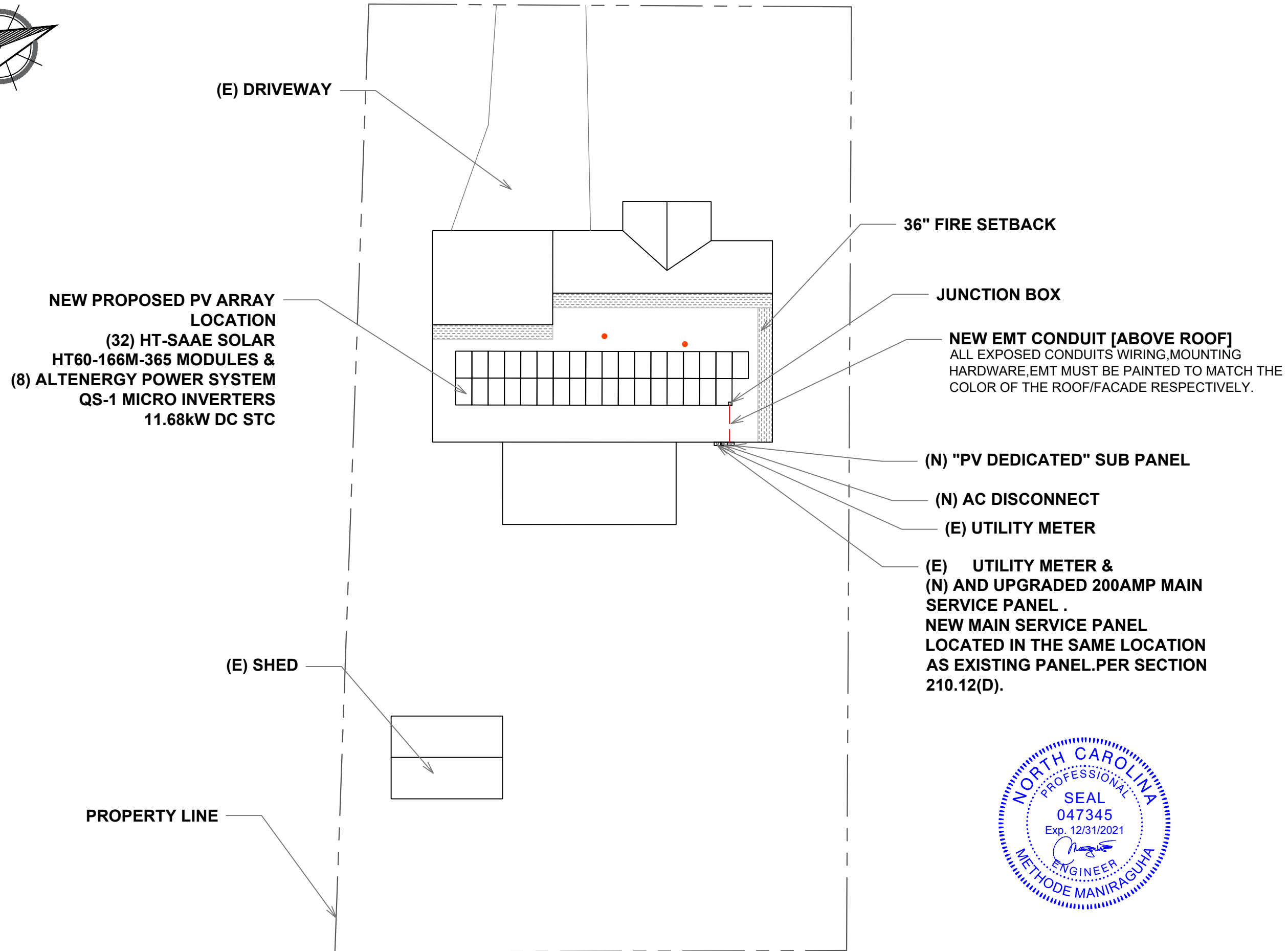
SCALE: NTS

SOLAR PERMIT PACKAGE

**T1**



# SCOTTS CREEK RUN



### REVISIONS

DATE	REV.

PAPER SIZE: 11"X17"

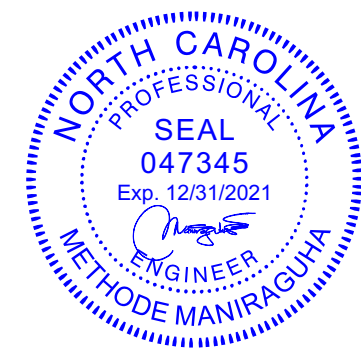
DATE: 9/16/21

<b>SHEET TITLE: SITE PLAN</b>	<b>HOMEOWNER: JOSE ANTONIO LOPEZ</b>	<b>ADDRESS: 45 SCOTTS CREEK RUN ANGIER NC 27501</b>	<b>CONTRACTOR: VON LOOR &amp; SLOOF ENERGY LLC LICENSE # 85970</b>	<b>SIGNATURE: _____</b>
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JOB#: PM2441

SCALE: 1" = 20'

SOLAR PERMIT PACKAGE



# A1



**1. Equipment Location**

Scale: N/A

- ALL EQUIPMENT SHALL MEET MINIMUM SETBACKS.
- WIRING SYSTEMS INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE.
- ADDITIONAL AC DISCONNECT(S) SHALL BE PROVIDED WHERE THE INVERTER IS NOT WITHIN SIGHT OF THE AC SERVICING DISCONNECT
- ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL.
- ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE

**2. Interconnection Notes**

Scale: N/A

- THE SUM OF THE UTILITY OCPD AND INVERTER CONTINUOUS INPUT MAY NOT EXCEED 120% OF BUSBAR RATING.
- WHEN SUM OF THE PV SOURCES EQUALS >100% OF BUSBAR RATING, PV DEDICATED BACKFED BREAKERS MUST BE LOCATED OPPOSITE END OF THE BUS FROM THE UTILITY SOURCE OCPD.
- AT MULTIPLE PV OUTPUT COMBINER PANEL, TOTAL RATING OF ALL OVER CURRENT DEVICES SHALL NOT EXCEED AMPACITY OF BUSBAR.
- SUPPLY SIDE TAP INTERCONNECTION WITH SERVICE ENTRANCE CONDUCTORS BACK FEEDING BREAKER FOR UTILITY-INTERACTIVE INVERTER OUTPUT IS EXEMPT FROM ADDITIONAL FASTENING.

**3. General Notes**

Scale: N/A

- MODULES ARE LISTED UNDER UL 1703 AND CONFORM TO THE STANDARDS.
- INVERTERS ARE LISTED UNDER UL 1741 AND CONFORM TO THE STANDARDS.
- DRAWINGS ARE DIAGRAMMATIC, INDICATING GENERAL ARRANGEMENT OF THE PV SYSTEM AND THE ACTUAL SITE CONDITION MIGHT VARY.
- WORKING CLEARANCES AROUND THE ELECTRICAL EQUIPMENT WILL BE MAINTAINED.
- ALL GROUND WIRING CONNECTED TO THE MAIN SERVICE GROUNDING IN MAIN SERVICE PANEL/ SERVICE EQUIPMENT.
- ALL CONDUCTORS SHALL BE 600V, 90°C STANDARD COPPER UNLESS OTHERWISE NOTED.
- WHEN REQUIRED, A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
- THE SYSTEM WILL NOT BE INTERCONNECTED BY THE CONTRACTOR UNTIL APPROVAL FROM THE LOCAL JURISDICTION AND/OR THE UTILITY.
- ROOF ACCESS POINT SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREES, WIRES OR SIGNS.
- PV ARRAY COMBINER/JUNCTION BOX PROVIDES TRANSITION FROM ARRAY WIRING TO CONDUIT WIRING

**4. Wiring & Conduit Notes**

Scale: N/A

- 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.
- DC WIRING LIMITED TO MODULE FOOTPRINT. MICRO INVERTER WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY WITH SUITABLE WIRING CLIPS.
- AC CONDUCTORS COLORED OR MARKED AS FOLLOWS:  
1-PHASE A OR L1- BLACK  
2-PHASE B OR L2- RED, OR OTHER CONVENTION IF THREE PHASE  
3-PHASE C OR L3- BLUE, YELLOW, ORANGE\*, OR OTHER CONVENTION  
4-NEUTRAL- WHITE OR GREY IN WIRE DELTA CONNECTED SYSTEMS THE

**5. Grounding Notes**

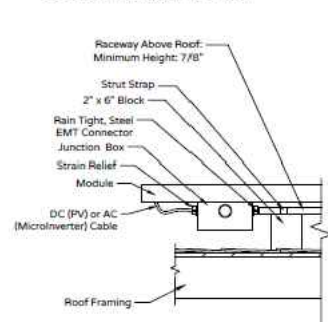
Scale: N/A

- GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVICES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR SUCH USE.
- PV EQUIPMENT SHALL BE GROUNDED METAL PARTS OF MODULE FRAMES, MODULE RACKING, AND ENCLOSURES.
- EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO MICRO INVERTER MANUFACTURER'S INSTRUCTIONS.
- 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.
- GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLORED GREEN OR MARKED GREEN IF #4 AWG OR LARGER.
- IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, A GROUNDING ELECTRODE SYSTEM PROVIDED.

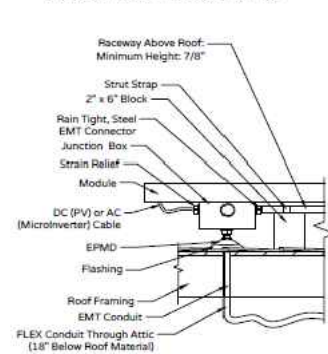
**6. Conduit Run Details**

Scale: N/A

CONDUIT RUN ABOVE ROOF



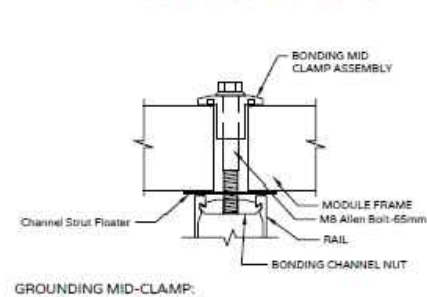
CONDUIT RUN THROUGH ATTIC



**7. Grounding Details**

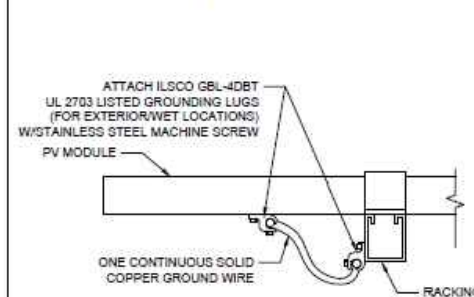
Scale: N/A

Module to Module



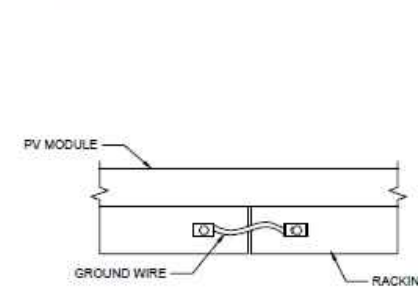
NTS REMOVAL OF ONE PIECE OF EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN ANY OTHER PIECES.

Module to Rail



NTS REMOVAL OF ONE PIECE OF EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN ANY OTHER PIECES.

Rail to Rail



NTS REMOVAL OF ONE PIECE OF EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN ANY OTHER PIECES.

**8. Structural Notes**

Scale: N/A

- RACKING SYSTEM & PV ARRAY WILL BE INSTALLED ACCORDING TO CODE-COMPLIANT INSTALLATION 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.
- JUNCTION BOX WILL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS. IF ROOF-PENETRATING TYPE, IT SHALL BE FLASHED & SEALED PER LOCAL REQUIREMENTS.
- ROOFTOP PENETRATIONS FOR PV RACEWAY WILL BE COMPLETED AND SEALED WITH APPROVED CHEMICAL SEALANT PER CODE BY A LICENSED CONTRACTOR.
- ALL PV RELATED ROOF ATTACHMENTS TO BE SPACED NO GREATER THAN THE SPAN DISTANCE SPECIFIED BY THE RACKING MANUFACTURER.

**9. Disconnection & OCPD Notes**

Scale: N/A

- 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).
- DISCONNECTS TO BE ACCESSIBLE TO QUALIFIED UTILITY PERSONNEL, BE LOCKABLE, AND BE A VISIBLE-BREAK SWITCH
- RAPID SHUTDOWN OF ENERGIZED CONDUCTORS BEYOND 10 FT OF PV ARRAY OR 5 FT INSIDE A BUILDING WITHIN 10 SECONDS. CONTROLLED CONDUCTORS ≤30V AND ≤240VA. LOCATION OF LABEL ACCORDING TO AHJ.
- IF REQUIRED BY AHJ, SYSTEM WILL INCLUDE ARC-FAULT CIRCUIT PROTECTION.



**REVISIONS**

DATE	REV.

**PAPER SIZE: 11"X17"**

**DATE: 9/16/21**

**SHEET TITLE: SYSTEM INFORMATION**

**HOMEOWNER: JOSE ANTONIO LOPEZ**

**ADDRESS: 45 SCOTTS CREEK RUN**

**ANGIER NC 27501**

**CONTRACTOR: VON LOOR & SLOOF ENERGY LLC**

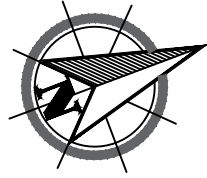
**LICENSE # 85970 SIGNATURE: \_\_\_\_\_**

**JOB#: PM2441**

**SCALE: 1" = 0'**

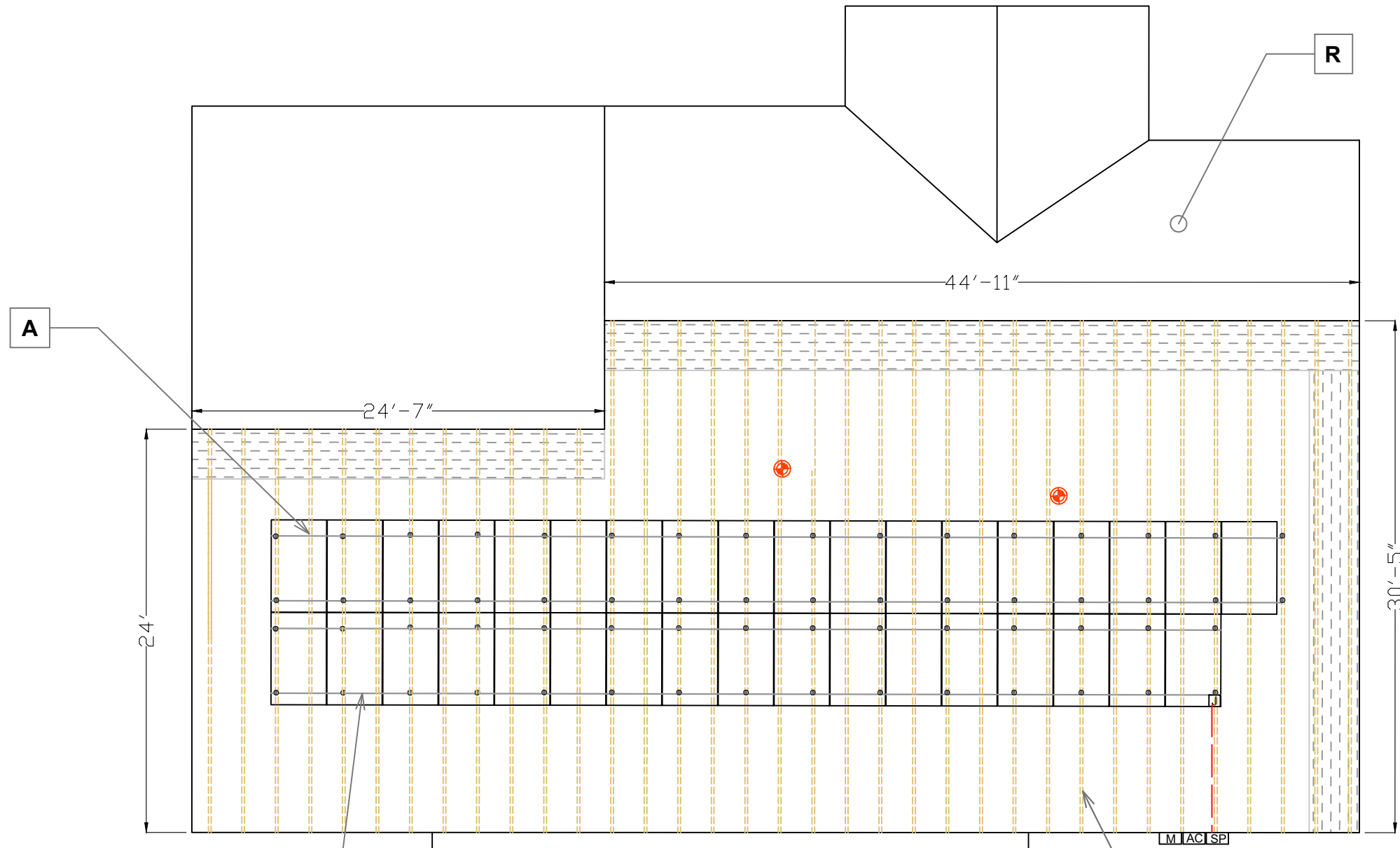
**SOLAR PERMIT PACKAGE**

**A1.1**



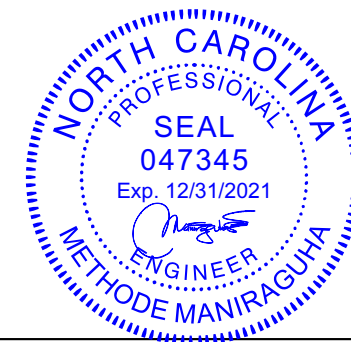
**A** DUAL RACK LITE FLASH L KIT  
ATTACHMENT SPACING TYP. @ [48" MAX.][MIN. 24"]

**R** ROOF MATERIAL: COMP. SHINGLE [TYP.] [01 LAYER]  
• 20% MAX. RAIL FREE SPAN [TYP.]



DUAL RACK RAIL

2X6 RAFTERS @ 24" O.C



**REVISIONS**

DATE	REV.

PAPER SIZE: 11"X17"

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SHEET TITLE: RACKING LAYOUT

HOMEOWNER: JOSE ANTONIO LOPEZ

ADDRESS: 45 SCOTTS CREEK RUN

ANGIER NC 27501

CONTRACTOR: VON LOOR & SLOOF ENERGY LLC

LICENSE # 85970

SIGNATURE: \_\_\_\_\_

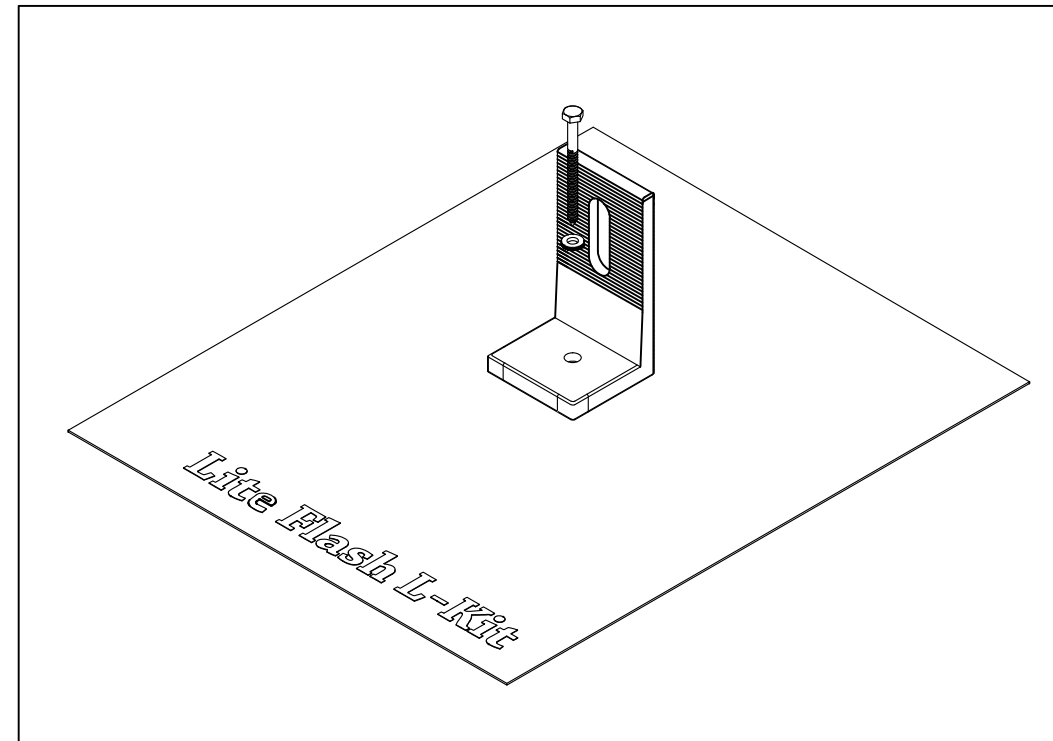
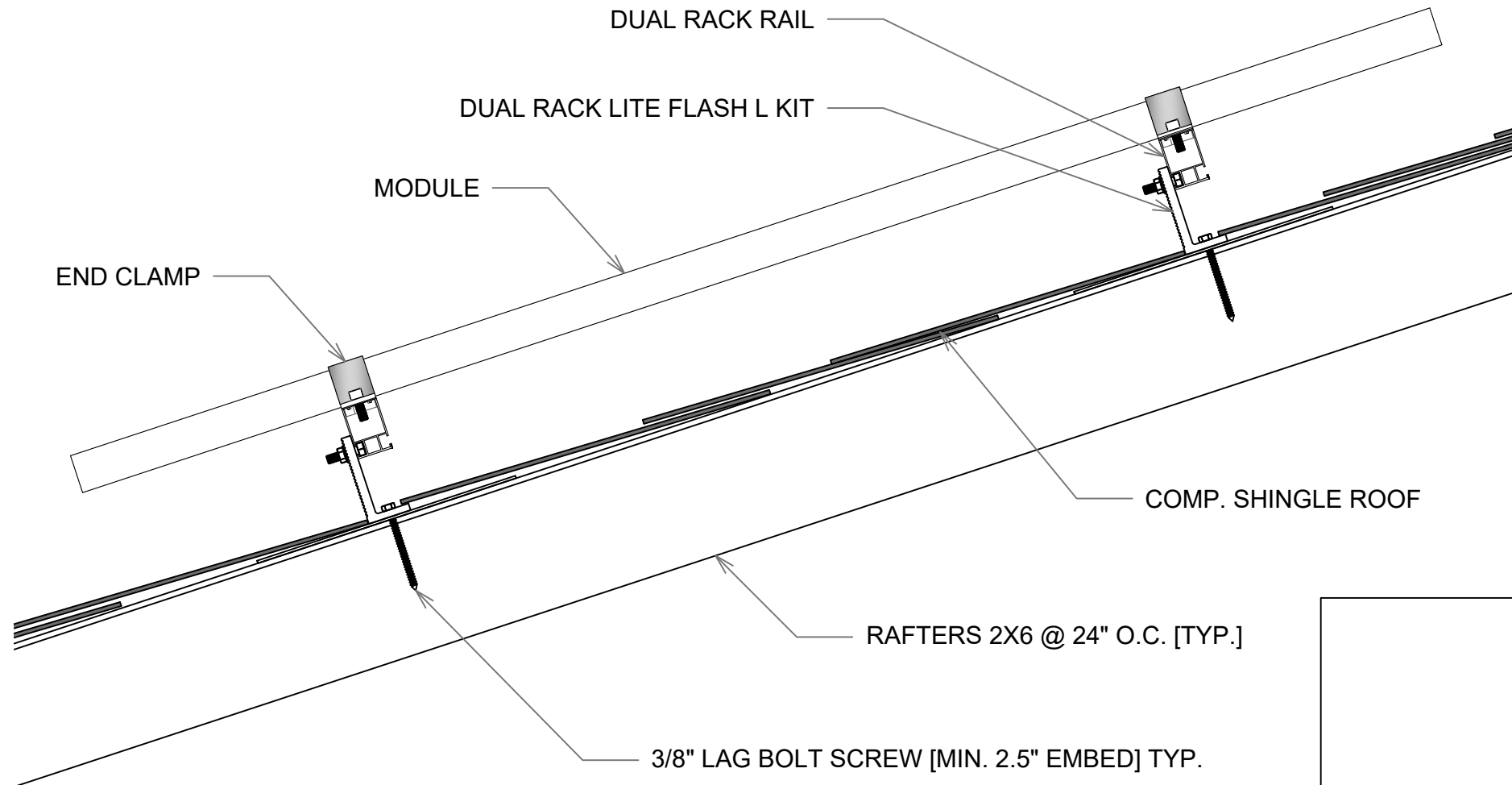
JOB#: PM2441

SCALE: 1" = 8'

SOLAR PERMIT PACKAGE

**A2**

- SUPPORT RAIL PLACEMENT SHALL NOT EXCEED 20% OF MODULE LENGTH FROM THE EDGE
- PV MODULES SHALL HAVE MIN. 3.5" ABOVE ROOF
- THE MAXIMUM DISTANCE FROM THE TOP OF THE MODULE TO THE ROOF PLANE IS LESS THAN 18 INCHES.



LITE FLASH L KIT

**REVISIONS**

DATE	REV.

PAPER SIZE: 11"X17"

DATE: 9/16/21

SHEET TITLE: ATTACHMENT DETAIL

HOMEOWNER: JOSE ANTONIO LOPEZ

ADDRESS: 45 SCOTTS CREEK RUN

ANGIER NC 27501

CONTRACTOR: VON LOOR & SLOOF ENERGY LLC

LICENSE # 85970

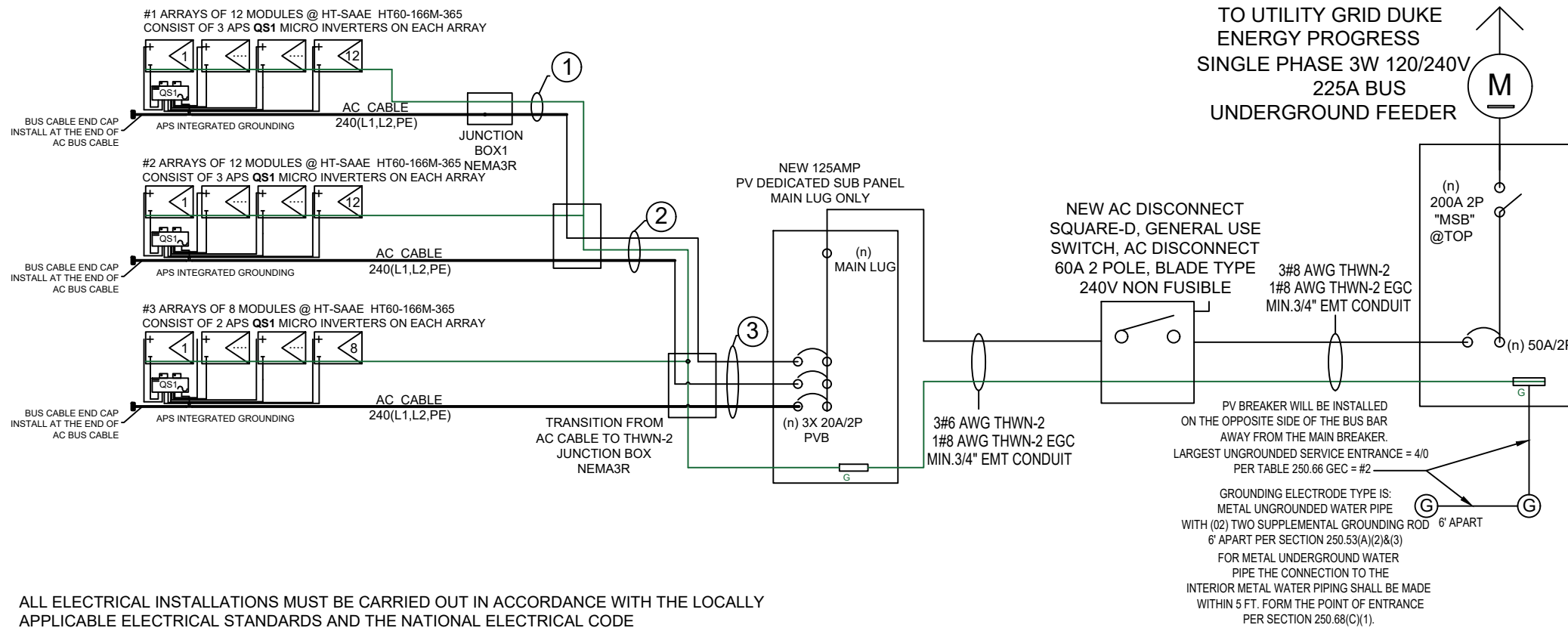
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JOB#: PM2441

SCALE: NTS

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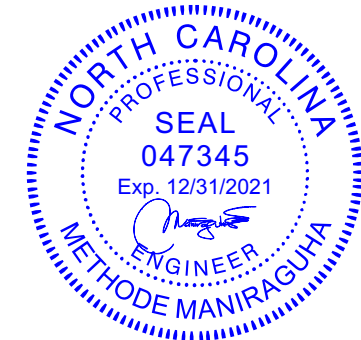
**A3**



PV BREAKER WILL BE INSTALLED ON THE OPPOSITE SIDE OF THE BUS BAR AWAY FROM THE MAIN BREAKER.  
NEW & UPGRADED MAIN SERVICE PANEL  
200A MAIN BREAKER TOP FED  
225A BUS BAR  
POINT OF CONNECTION LOAD SIDE  
120% RULE : 705.12(B)(2)(3)(d)

ALL ELECTRICAL INSTALLATIONS MUST BE CARRIED OUT IN ACCORDANCE WITH THE LOCALLY APPLICABLE ELECTRICAL STANDARDS AND THE NATIONAL ELECTRICAL CODE

<b>MODULE @ STC</b> MODULE MFR: HT-SAAE MODEL: HT60-166M-365 VOC = 41.3V VMP = 33.9V ISC = 11.63A IMP = 10.77A	<b>INVERTER</b> INVERTER MFR: APSYSTEMS INVERTER MODEL: QS1 DC VOLT RATING = 60V DC MAX INPUT CURRENT = 15A X4 DC MAX INPUT CURRENT = 15A X4 AC MAX OUTPUT POWER @ 240V = 1200W AC NOMINAL OUTPUT CURRENT = 5 A@240V MIN WIRE AMPACITY STRING = 5A * 1.25 * 3 [APS] = 18.75A MIN (OCPD) = 20A, TERMINALS RATED @ 75°C	<b>PV SUB-PANEL RATING</b> NEW 125A BUS, SPLIT PHASE 3W 120/240V MAX OUTPUT CURRENT = $INVERTER I_{MAX} * \# \text{ OF INVERTERS} * 125\%_{NEC}$ $= 5.0A * 8 * 1.25 = 50A$ MIN (OCPD) = 50A. AVAILABLE(OCPD) = 50A TERMINALS RATED @ 75°C IN: 3 * 20A PV BACKFED BREAKERS OUT: MAIN LUG CONNECTED TO 50A DISCONNECT @ MAIN DISTRIBUTION PANEL.	<b>120%RULE@MAIN SERVICE:</b> <b>705.12(B)(2)(3)(b)</b> NEW & UPGRADED BUS BAR RATING = 225A $= 1.2 * 225A \text{ BUS BAR} = 270A$ TOTAL FEED = 200A "MSB" + 50A = 250A < 270A MAX
<b>PV SYSTEM OUTPUT</b> MAX DC OUTPUT = 365W * 32 = 11.68kW 342.2 W PTC * 32 = 10.95kW 10.95kW * 0.965 INV. = 10.57kW AC ACTUAL OUTPUT = 1200VA * 8 = 9.60kW			



HI TEMP. = 43°C LOW TEMP. = -10°C

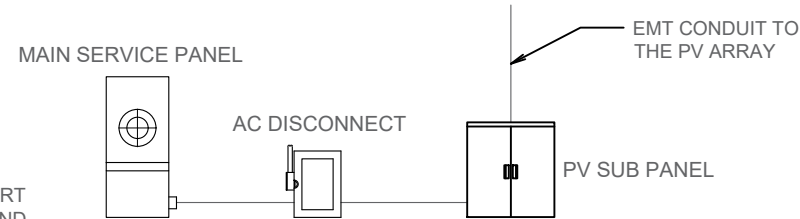
WIRE TAG#	WIRE TYPE-QTY-SIZE	GRD-SIZE	WIRE AMP.	TERMINAL RATING	CONDUIT	ABOVE ROOF	TEMP. CORRECTION	AMP.ADJ C.C.C	CURRENT
①	APS TO JUNCTION BOX (L1,L2,PE)#12	#6,BARE CU	30A	90°C	OPEN AIR	MIN.7/8"	0.71	N/A	21.3A > 18.75A
②	"THWN-2"-4-#10 (2*L1, 2*L2)	#8,EGC CU	40A	90°C	EMT.3/4"	MIN.7/8"	0.65	0.8	20.8A > 20A
③	"THWN-2"-6-#10 (3*L1, 3*L2)	#8,EGC CU	40A	90°C	EMT.3/4"	MIN.7/8"	0.65	0.8	20.8A > 20A
④	"THWN-2"-3-#6 (L1, L2, N)	#8,EGC CU	65A	75°C	MIN. EMT.3/4"	ALONG THE WALL	0.82	N/A	53.3A > 50A

ALL METALLIC RACEWAYS AND EQUIPMENT SHALL BE BONDED AND ELECTRICALLY CONTINUOUS(NEC 250.90,250.96)  
 GROUNDING BUSHINGS ARE REQUIRED AROUND PREPUNCHED CONCENTRIC KNOCKOUTS ON THE DC SIDE OF THE SYSTEM(NEC 250.97)  
 THE GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS,EXCEPT FOR SPLICES OR JOINTS AT BUSBAR WITHIN LISTED EQUIPMENT. (NEC250.64)  
 THE EQUIPMENT GROUNDING CONDUCTOR MAY BE USED AS A GROUNDING ELECTRODE CONDUCTOR.(NEC 250.121 EXCEPTION.INSTALLED PER 250.B(A),II,III,VI)

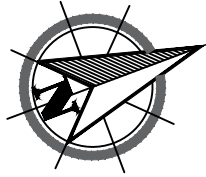
REVISIONS	
DATE	REV.
PAPER SIZE: 11"X17"	
DATE: 9/16/21	
SHEET TITLE: SINGLE LINE DIAGRAM	
HOMEOWNER: JOSE ANTONIO LOPEZ	
ADDRESS: 45 SCOTTS CREEK RUN	
ANGIER NC 27501	
CONTRACTOR: VON LOOR & SLOOF ENERGY LLC	
LICENSE # 85970	
SIGNATURE: _____	
JOB#: PM2441	
SCALE: NTS	
SOLAR PERMIT PACKAGE	
E1	



NOTE: PANEL DISTANCE APART  
10" MIN TO 5'-0" MAX AND  
4'-0" MIN TO 6'-0" MAX HIGH  
FROM GROUND.  
PERIMETER WORK SPACE SHALL  
BE MAINTAINED (NEC 110.26)



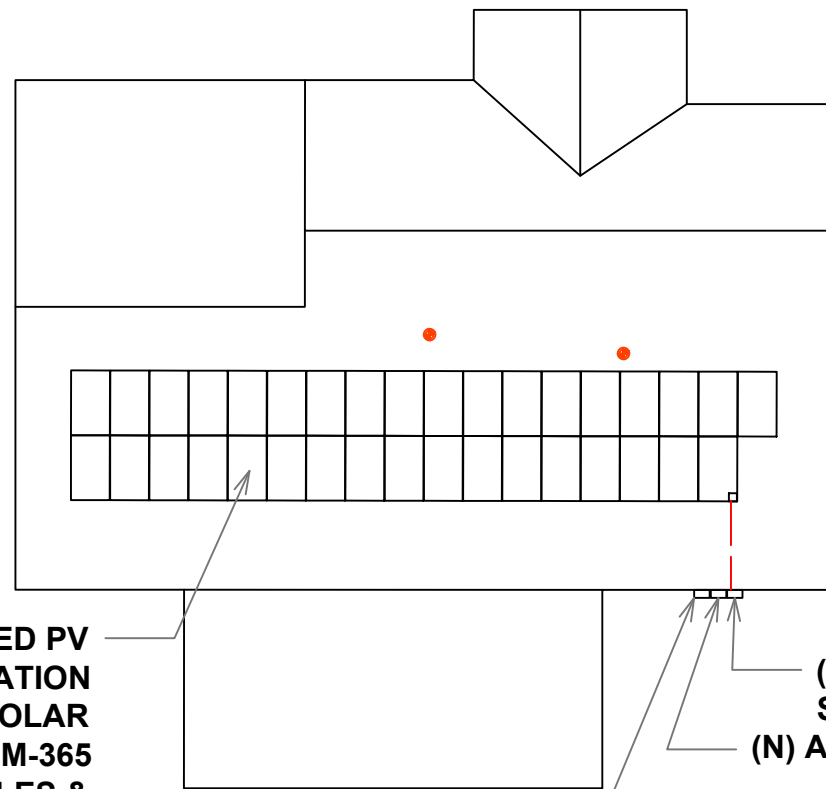
NORTH EAST SIDE OF THE WALL



**PLACARD CAUTION**

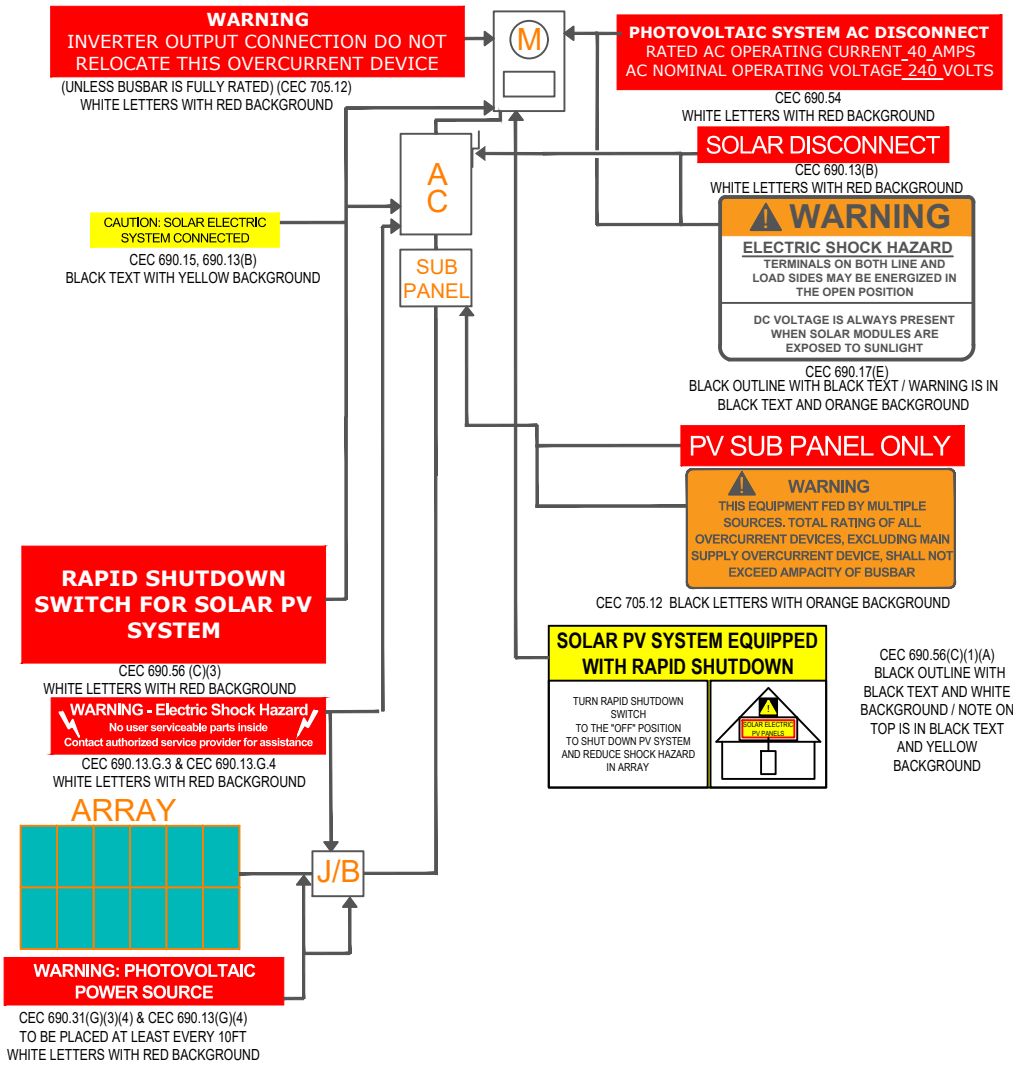
POWER TO THE BUILDING IS ALSO SUPPLIED  
FROM THE FOLLOWING SOURCES WITH  
DISCONNECTS LOCATED AS SHOWN

**SCOTTS CREEK RUN**



**NEW PROPOSED PV  
ARRAY LOCATION  
(32) HT-SAAE SOLAR  
HT60-166M-365  
MODULES &  
(8) ALTENERGY POWER  
SYSTEM QS-1 MICRO  
INVERTERS  
11.68kW DC STC**

**(N) "PV DEDICATED"  
SUB PANEL  
(N) AC DISCONNECT  
(E) UTILITY METER &  
(N) AND UPGRADED 200AMP MAIN  
SERVICE PANEL .  
NEW MAIN SERVICE PANEL  
LOCATED IN THE SAME LOCATION  
AS EXISTING PANEL.PER SECTION  
210.12(D).**



- NOTES:
- BACKGROUND RED AND BLK ON YELLOW MINIMUM HEIGHT: 3/8".
  - LETTERS: WHITE.
  - FONT: ARIAL OR SIMILAR NON-BOLD.
  - ALL LABELS SHALL HAVE CAPITAL LETTERS.
  - MINIMUM HEIGHT: 3/16" FOR REMAINING CHARACTERS.
  - ALL LABELS SHALL BE WEATHER RESISTANT MATERIAL AND MATERIAL SUITABLE FOR EXTERIOR USE.
  - ALL SYSTEMS LABELS AND WARNINGS TO BE INSTALLED AT THE SITE AND THEIR LOCATIONS IN ACCORDANCE WITH ARTICLE 690 OF THE 2017 NEC ,ARTICLE 110.21(B) ,AND THE OCFA GUIDELINES.
  - THE ABOVE LABELS SHALL BE PLACED EXACTLY AS NOTED.

**REVISIONS**

DATE	REV.

**PAPER SIZE: 11"X17"**

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**SHEET TITLE: LABELS AND PLACARD**

**HOMEOWNER: JOSE ANTONIO LOPEZ**

**ADDRESS: 45 SCOTTS CREEK RUN  
ANGIER NC 27501**

**CONTRACTOR: VON LOOR & SLOOF ENERGY LLC**

**LICENSE # 85970**

**SIGNATURE: \_\_\_\_\_**

**JOB#: PM2441**

**SCALE: NTS**

**SOLAR PERMIT PACKAGE**

**E2**





Leading the Industry in  
**Solar Microinverter Technology**

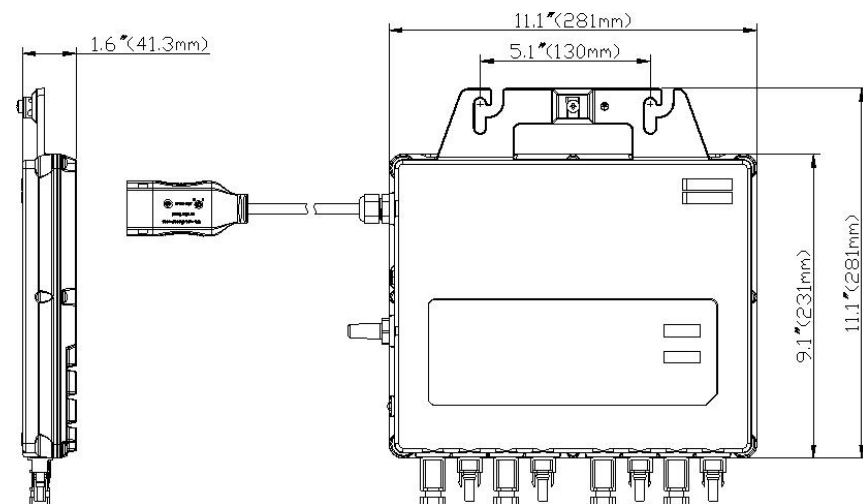
# QS1

- Quad module microinverter with independent MPPT
- Maximum continuous output power up to 1,200W
- Wide MPPT voltage range (22V-48V)
- Accommodates modules up to 440W
- Meets NEC 2014/2017 690.12 Rapid Shutdown requirements
- Zigbee communication and online monitoring

APsystems breaks new ground once again with the QS1, a cutting edge microinverter design accommodating up to four high-capacity PV modules up to 450W+ with independent MPPT. A single-phase, smart grid-compliant microinverter, the QS1 features Zigbee wireless communication over a mesh network with faster data speeds than PLC, and a wide MPPT voltage range results in a greater energy harvest for homeowners.

A true utility-interactive microinverter with Reactive Power Control (RPC) technology, the QS1 is inherently NEC 690.12 2014/2017 Rapid Shutdown compliant. The unit also builds on the successful APsystems line of multi-module microinverters, simplifying installation and reducing costs.

**DIMENSIONS:**



## APsystems QS1 Microinverter Datasheet

### INPUT DATA (DC) PER CHANNEL

Module Compatibility	60 + 72 Cell PV Modules
MPPT Voltage Range	22V-48V
Operation Voltage Range	16V-55V
Maximum Input Voltage	60V
Startup Voltage	20V
Maximum Input Current	12A
Maximum DC short circuit current	15A
Recommended PV Module Input Power	440W

### OUTPUT DATA (AC)

	240V	208V
Maximum Continuous Output Power	1,200W	1,100W
Nominal Output Voltage/Range	240V/211V-264V	208V/183V-229V
Nominal Output Current	5.00A	5.29A
Nominal Output Frequency/Range	60Hz/59.3Hz-60.5Hz	
Power Factor	>0.99	
Total Harmonic Distortion	<3%	
Maximum units per branch	3 (12 PV modules)	3 (12 PV modules)

### EFFICIENCY

Peak Efficiency	96.5%
Nominal MPPT Efficiency	99.5%
Night Power Consumption	30mW

### MECHANICAL DATA


Operating Ambient Temperature Range	-40°F to +149°F(-40°C to +65°C)
Storage Temperature Range	-40°F to +185°F(-40°C to +85°C)
Dimensions (W x H x D)	11.1" x 9.1" x 1.6"(281mm x 231mm x 41.3mm)
Weight	9.9lbs (4.5kg)
AC Trunk Cable Maximum Current	20A
Enclosure Rating	NEMA 6
Cooling	Natural Convection - No Fans

### FEATURES

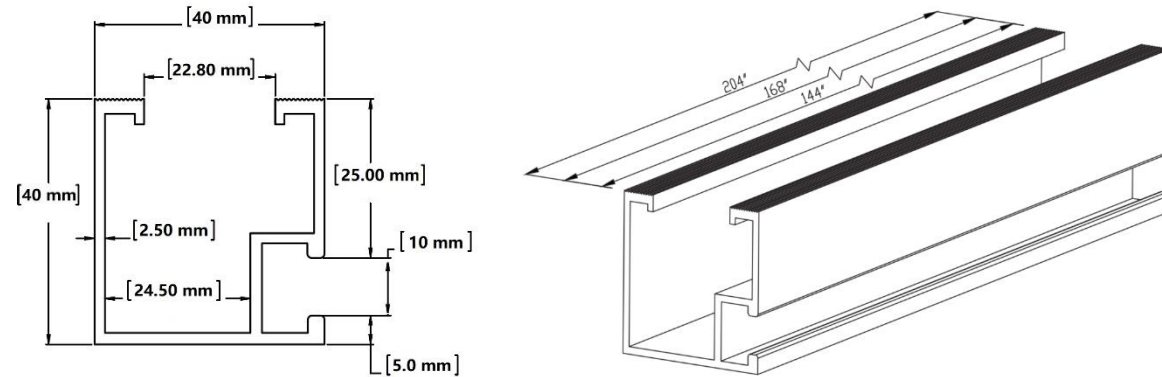
Communication	Wireless (Zigbee)
Transformer Design	High Frequency Transformers, Galvanically Isolated
Monitoring	Via EMA* Online Portal
Warranty	10 years standard, extendable to 25 years

### CERTIFICATE & COMPLIANCE

Safety and EMC Compliance	FCC Part15; ANSIC63.4; ICES-003
Certificate & Compliance	UL1741**, CSAC22.2No.107.1-01 UL 1741 SA/Rule 21 compliant (240V version only)
Grid Connection Compliance	IEEE1547
Rapid Shutdown	Meets NEC 2014/2017 690.12

 \*\* Meets the standard requirements for Distributed Energy Resources (UL 1741) and identified with the CSA Listed Mark.  
Specifications subject to change without notice - please ensure you are using the most recent update found at [www.APsistemas.com](http://www.APsistemas.com)

## Dual Rack Lite Rail



## Dual Rack Lite Rail – Span Calculation

Exposure B	Ultimate Wind Speed V (mph)	Rail Type	Maximum Span Length (in.)																							
			Roof Wind Pressure Zone 1							Roof Wind Pressure Zone 2							Roof Wind Pressure Zone 3									
			Roof Snow Load (psf)							Roof Snow Load (psf)							Roof Snow Load (psf)									
			0	10	20	30	40	50	60	70	0	10	20	30	40	50	60	70	0	10	20	30	40	50	60	70
ROOFS 0° TO 7°	110	HD	145	133	122	111	97	88	80	75	140	133	122	111	97	88	80	75	114	114	114	111	97	88	80	75
		STD	116	107	94	81	71	64	59	54	102	102	94	81	71	64	59	54	82	82	82	81	71	64	59	54
		LTE	95	86	76	67	59	53	48	45	79	79	76	67	59	53	48	45	69	69	69	67	59	53	48	45
	115	HD	145	133	122	111	97	88	80	75	135	133	122	111	97	88	80	75	109	109	109	109	97	88	80	75
		STD	116	107	94	81	71	64	59	54	98	94	81	71	64	59	54	79	79	79	79	71	64	59	54	
		LTE	93	86	76	67	59	53	48	45	77	77	76	67	59	53	48	45	67	67	67	67	59	53	48	45
	120	HD	145	133	122	111	97	88	80	75	129	129	122	111	97	88	80	75	104	104	104	104	97	88	80	75
		STD	116	107	94	81	71	64	59	54	93	93	93	81	71	64	59	54	75	75	75	75	71	64	59	54
		LTE	90	86	76	67	59	53	48	45	75	75	75	67	59	53	48	45	64	64	64	64	59	53	48	45
	130	HD	145	133	122	111	97	88	80	75	119	119	119	111	97	88	80	75	96	96	96	96	96	88	80	75
		STD	112	107	94	81	71	64	59	54	86	86	86	81	71	64	59	54	69	69	69	69	69	64	59	54
		LTE	85	85	76	67	59	53	48	45	71	71	71	67	59	53	48	45	59	59	59	59	59	53	48	45
	140	HD	142	133	122	111	97	88	80	75	110	110	110	110	97	88	80	75	89	89	89	89	89	88	80	75
		STD	104	104	94	81	71	64	59	54	79	79	79	79	71	64	59	54	64	64	64	64	64	64	59	54
		LTE	80	80	76	67	59	53	48	45	67	67	67	67	59	53	48	45	54	54	54	54	54	54	48	45
	150	HD	134	132	121	111	97	88	80	75	102	102	102	102	97	88	80	75	83	83	83	83	83	83	80	75
		STD	97	97	92	81	71	64	59	54	74	74	74	74	71	64	59	54	60	60	60	60	60	60	59	54
		LTE	77	77	76	67	59	53	48	45	63	63	63	63	59	53	48	45	51	51	51	51	51	51	48	45
	160	HD	125	125	120	110	97	88	80	75	96	96	96	96	96	88	80	75	78	78	78	78	78	78	78	75
		STD	90	90	90	80	71	64	59	54	69	69	69	69	69	64	59	54	56	56	56	56	56	56	54	
		LTE	73	73	73	66	59	53	48	45	59	59	59	59	59	53	48	45	47	47	47	47	47	47	47	45
	170	HD	118	118	118	108	97	88	80	75	90	90	90	90	90	88	80	75	73	73	73	73	73	73	73	73
		STD	85	85	85	79	71	64	59	54	65	65	65	65	65	64	59	54	53	53	53	53	53	53	53	53
		LTE	70	70	70	65	59	53	48	45	55	55	55	55	55	53	48	45	45	45	45	45	45	45	45	45
180	HD	111	111	111	106	97	88	80	75	85	85	85	85	85	85	80	75	69	69	69	69	69	69	69	69	
	STD	80	80	80	77	70	64	59	54	61	61	61	61	61	61	59	54	50	50	50	50	50	50	50	50	
	LTE	67	67	67	64	58	53	48	45	52	52	52	52	52	52	48	45	42	42	42	42	42	42	42	42	
200	HD	99	99	99	94	87	80	75	76	76	76	76	76	76	76	76	75	62	62	62	62	62	62	62	62	
	STD	72	72	72	72	68	63	59	54	55	55	55	55	55	55	55	55	45	45	45	45	45	45	45	45	
	LTE	61	61	61	61	57	53	48	45	47	47	47	47	47	47	47	47	45	45	45	45	45	45	45	45	

- A. The table above ONLY includes Dual Rack rail capacity. It does not include roof attachment of roof capacity check.
- B. Structural risk category II per ASCE7-10.
- C. Wind exposure: B, C, D. Roof wind pressure region: Zone 1, Zone 2 & Zone 3.
- D. Maximum mean roof height is 45 ft.
- E. Seismic design category: A through E.
- F. Roof pitch is between 0 degree and 55 degree.
- G. Maximum solar panel weight is 50 lbs. H. Height of solar panel is between 2" and 10" to roof.



\*See Exposure C and D, zone 1 & 2 & 3 span table calculation details in Installation Manual/P.E. certification.

# LITE RAIL

Dual Rack Lite Rail is designed to be customizable specifically for solar PV arrays on residential projects. It is engineered for strength and durability and tested for spans up to eight feet. Dual Rack Lite Rail is compatible with all Dual Rack roof attachment products. Installers prefer Dual Rack Lite Rail because it is strong, reliable, time saving and available at the best price in the marketplace.

## ADVANTAGES

- Advanced Dual Rack design
- 3 sizes rail: 12', 14' & 17' – Silver & Black
- 10 year limited warranty
- Conforms to UL STD 2703
- Class A Fire Rated – Type 1 & 2



## Product Line

Item #	Product Name
LT-144-C	Lite Rail 144" - Clear ( NEW )
LT-168-C	Lite Rail 168" - Clear ( NEW )
LT-204-C	Lite Rail 204" - Clear ( NEW )
LT-144-B	Lite Rail 144" - Black ( NEW )
LT-168-B	Lite Rail 168" - Black ( NEW )
LT-204-B	Lite Rail 204" - Black ( NEW )

## Material Specifications

Material Designation	6005-T5
Density (p)	168.56 lbs/ft <sup>3</sup>
Diffusivity (λ)	200.00 W/m <sup>2</sup> °K
Modulus of Elasticity (E)	10.152E06 Psi (7,000 kN/cm <sup>2</sup> )
Shear Modulus (G)	3.916E06 Psi (2,700 kN/cm <sup>2</sup> )

## Ordering Specifics

Standard Packaging:	6 pcs / Bundle
Dimension:	144" / 168" / 204"
Weight:	0.68 lbs / ft

## Installation Guide

### Install with Dual-Jack & L-foot



- After locating and securely installing standoff to rafter, attach L-foot with 3/8" bolt and nut to Lite Rail at desired height
- L-foot enables height adjustment up to 1.1 inches.

### Install with Flash L Kit



- After locating and securely installing Flash L-Kit to rafter attach 3/8" bolt and nut to Lite Rail at desired height





Product Line	
Item #	Product Name
DR-CLFLK-01	Lite Flash L Kit – 12.0" x 9.0" - clear
DR-CLFLK-02	Lite Flash L Kit – 12.0" x 12.0" - clear
DR-BLFLK-01	Lite Flash L Kit – 12.0" x 9.0" - black
DR-BLFLK-02	Lite Flash L Kit – 12.0" x 12.0" - black

Component List	
Material	QTY
Aluminum Flashing	01
L Base	01
5/16" x 4" S.S Lag Bolt	01
3/8" Sealing Washer	01
3/8" x 1.5" S.S T Bolt	01
3/8" Flange Nut	01
EPDM Washer	01

Ordering Specifics		
Product	DR-CLFLK-01 / DR-BLFLK-01	DR-CLFLK-02 / DR-BLFLK-02
Net Weight	0.85 lbs/ set	1.02 lbs/ set
Standard Pack	10 set/ box	10 set/ box
Standard Pack Dimension	14.0" (L) x 13.0" (W) x 3.5" (H)	14.0" (L) x 13.0" (W) x 3.5" (H)
Standard Pack Weight	8.5 lbs/ box	10.2 lbs/ box
Big Pack	4 Packs of 10 = Set of 40/Box	4 Packs of 10 = Set of 40/Box
Big Pack Weight	34.0 lbs/ box	40.8 lbs/ box





## LITE FLASH L-Kit

Dual Rack Lite Flash L-Kit is designed in both 12.0" x 12.0" and 9.0" x 12.0" sizes and comes complete with all necessary components for a quick and weatherproof installation. Standard packs include a kitted set of 10 in clear or black finish options. Our best-in-class design delivers an efficient and cost-effective solar attachment solution for composition/asphalt shingle roofs. It is compatible with all Dual Rack rails and there's no need to cut shingles on your install.


## ADVANTAGES

- Creates a weatherproofing seal every time.
- Install easily, quickly, and with confidence.
- All Aluminum 9.0" x 12.0" or 12.0" x 12.0" flashing.
- 10 Year Limited Warranty.
- Stainless steel hardware included.
- Meets or exceeds roofing industry best practices
- 100% IBC Compliant.
- No shingle cutting necessary.

Product Line	
Item #	Product Name
DR-CLFLK-01	Lite Flash L Kit - 12.0" x 9.0" - Clear
DR-CLFLK-02	Lite Flash L Kit - 12.0" x 12.0" - Clear
DR-BLFLK-01	Lite Flash L Kit - 12.0" x 9.0" - Black
DR-BLFLK-02	Lite Flash L Kit - 12.0" x 12.0" - Black

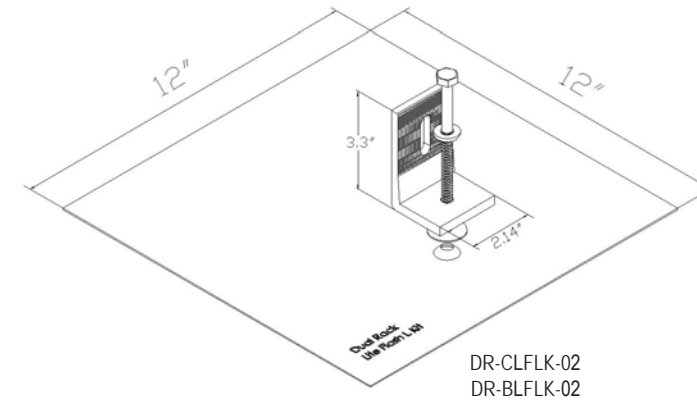





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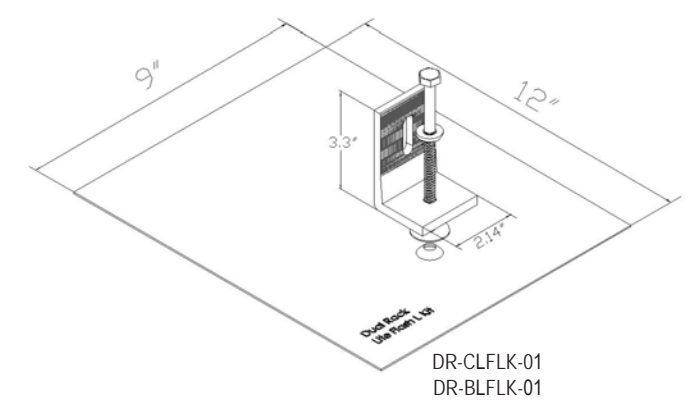


Conforms to UL SUB 2703

## LITE FLASH L-KIT



DR-CLFLK-02  
DR-BLFLK-02



DR-CLFLK-01  
DR-BLFLK-01

## Installation Guide

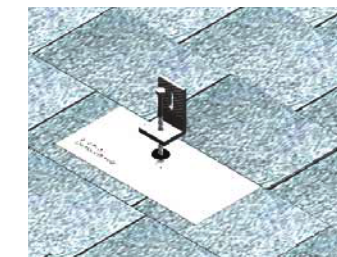
For detailed instructions please refer to the Dual Rack installation guide



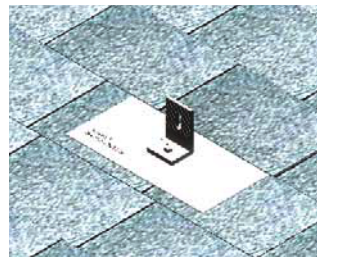
1. Locate, choose and mark center of the rafter for racking installation. Select the courses of shingles where mounts will be placed.



2. Gently break seal between shingles and remove any nails. Slide mount up under shingles, with flashing lined up with rafter center for drilling.



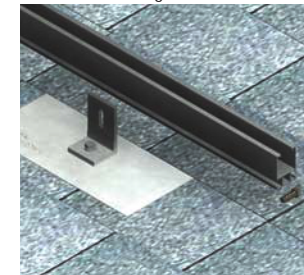
3. Put 5/16" x 4" lag bolt through L-foot. Next, slide the EPDM washer up onto the lag bolt.



4. Secure L-foot onto Flash L Base and rooftop. (Tightening torque of 14 lbs-ft).



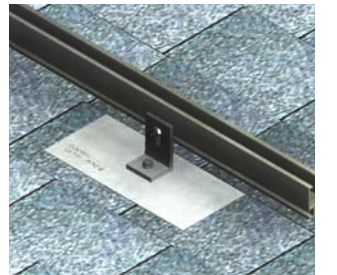
5. Screw the 5/16" lag bolt into the rafter embedded a min. of 2.5".  
\*(Tightening torque is dependent on the roofing material.)



6. You are now ready to attach the rail. Slide the 3/8" T bolt through the rail groove.



7. Attach the rail to the L-base using 3/8" T bolt and nut.



8. Secure the 3/8" T bolt with the nut. (Tightening torque 14 lbs-ft).

## Contact Info



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