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.

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°

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.

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

ELECTRIC UTILITY COMPANY: DEP
MAIN SERVICE AMPERAGE: 125AMP BUS BAR

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

NORTH CAROLINA PROFESSIONAL SEAL 047345 Exp. 12/31/2021 ENGINEER METHODE MANIRAGUHA

VICINITY MAP
SCALE: NTS

AERIAL MAP
SCALE: NTS

SHEET INDEX

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:_____

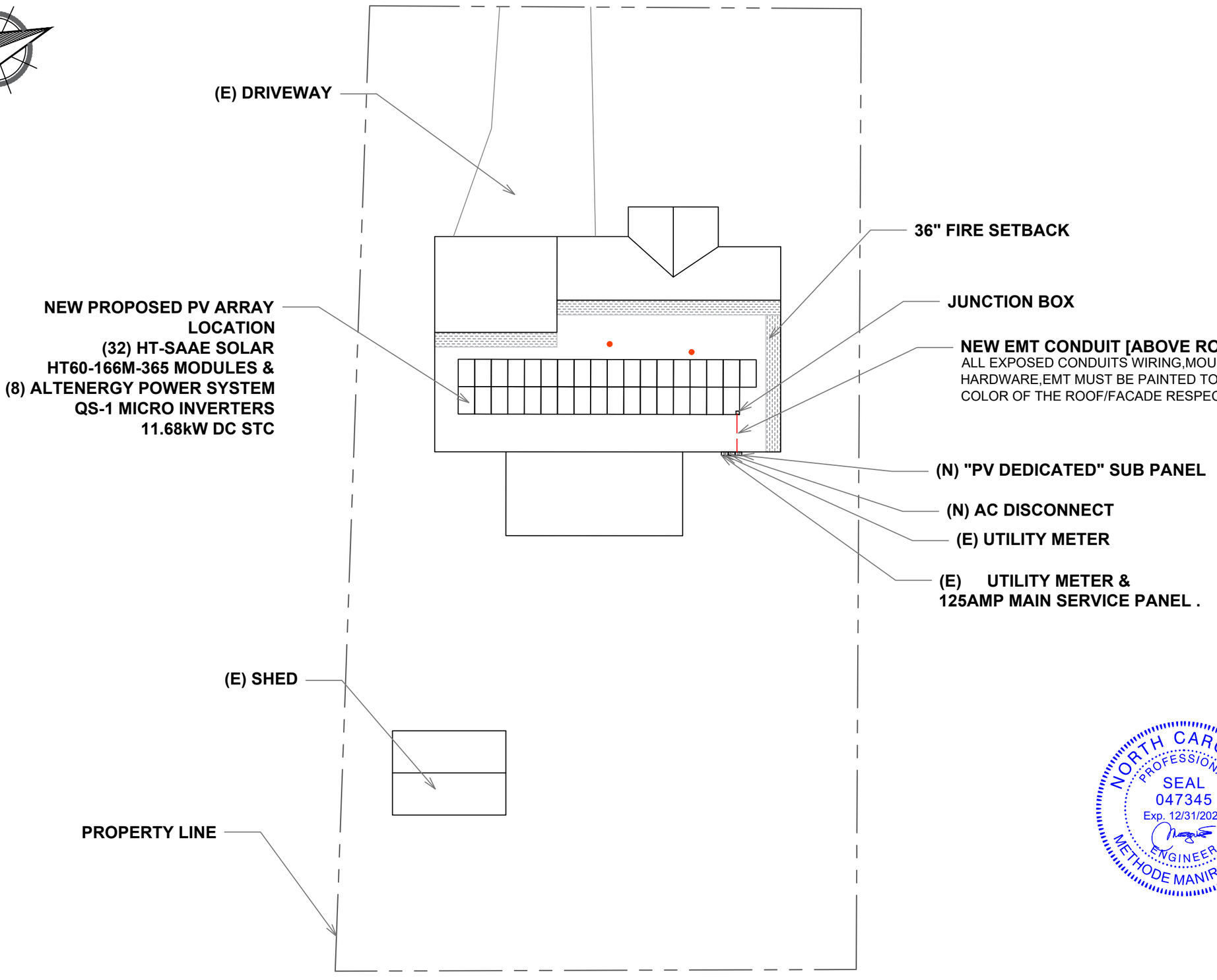
JOB#: PM2441

SCALE: NTS

SOLAR PERMIT PACKAGE

T1

SCOTTS CREEK RUN



NORTH CAROLINA PROFESSIONAL SEAL 047345 Exp. 12/31/2021 ENGINEER METHODE MANIRAGUHA

REVISIONS	
DATE	REV.

PAPER SIZE: 11"X17"

DATE: 9/16/21

SHEET TITLE: SITE PLAN

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" = 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 BACKFFED 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

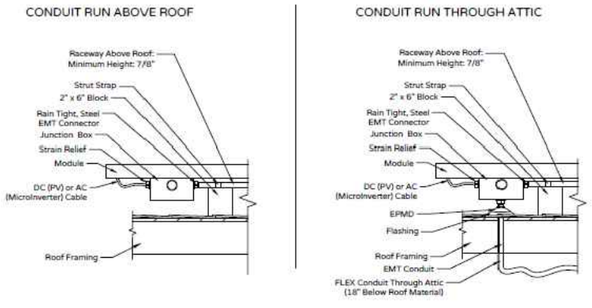
5. Grounding Notes

Scale: N/A

- GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVISES 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.

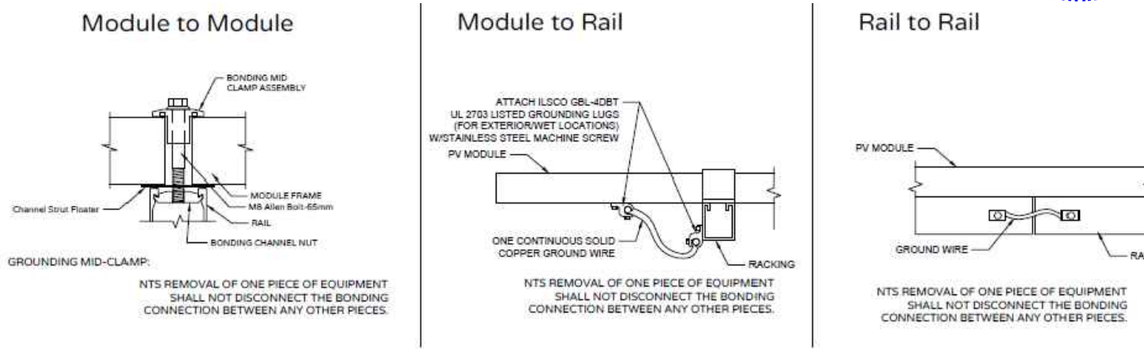
6. Conduit Run Details

Scale: N/A



7. Grounding Details

Scale: N/A



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'

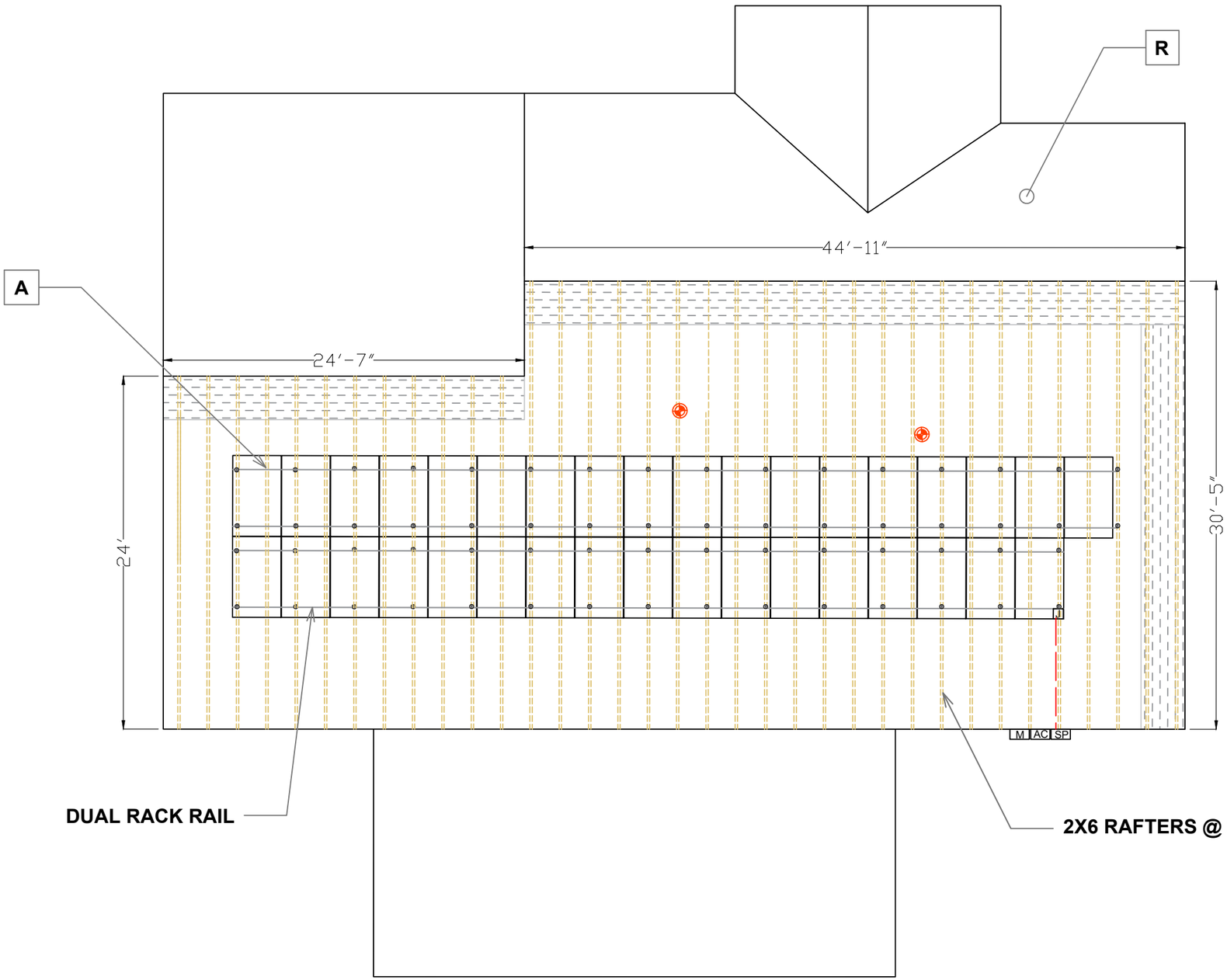
SOLAR PERMIT PACKAGE

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.]



NORTH CAROLINA PROFESSIONAL SEAL 047345 Exp. 12/31/2021 ENGINEER METHODE MANIRAGUHA

REVISIONS	
DATE	REV.

PAPER SIZE: 11"X17"

DATE: 9/16/21

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:

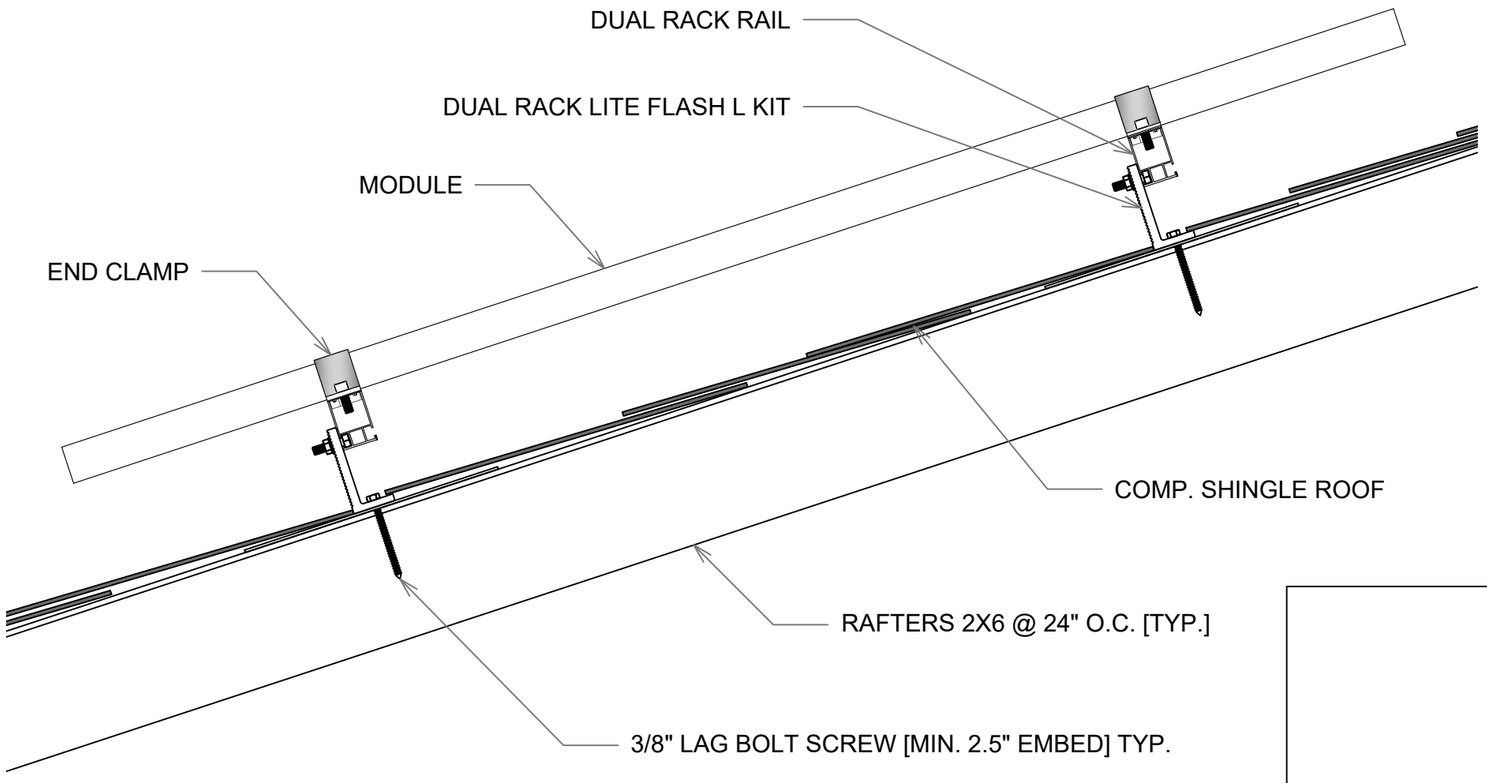
JOB#: PM2441

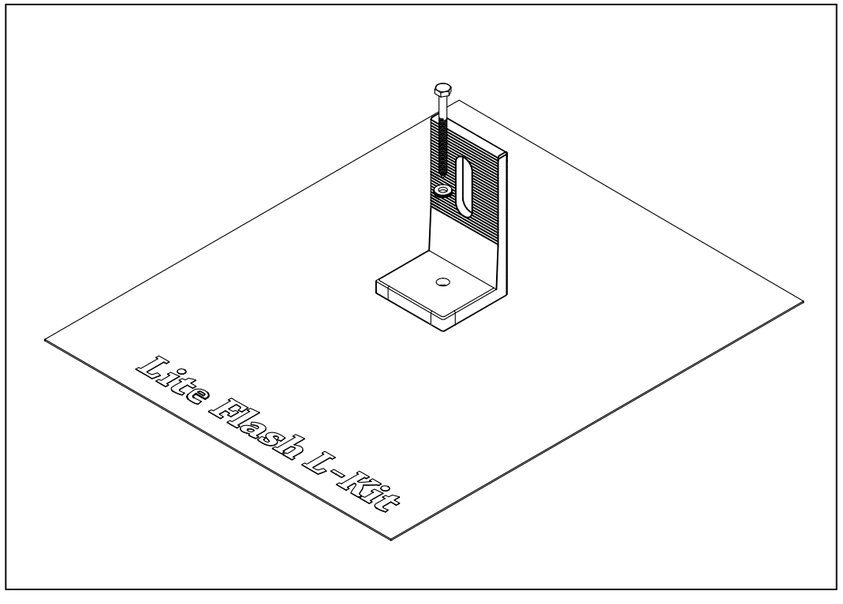
SCALE: 1" = 8'

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

NORTH CAROLINA PROFESSIONAL SEAL 047345 Exp. 12/31/2021 ENGINEER METHODE MANIRAGUHA

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

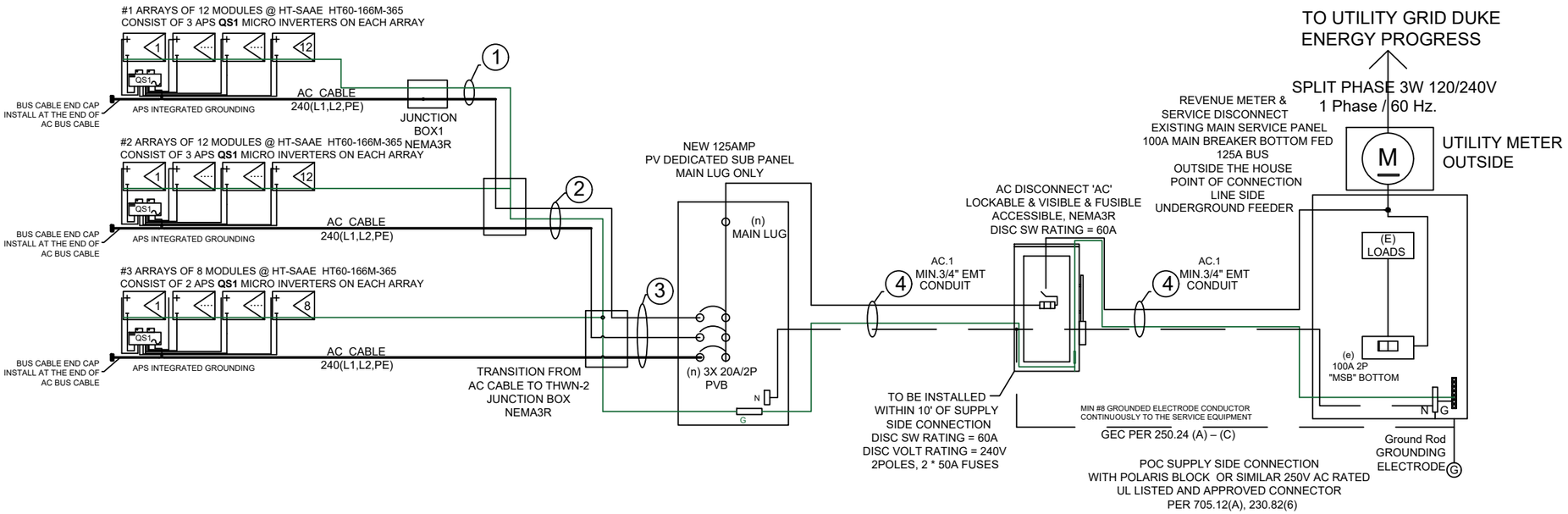
SIGNATURE:_____

JOB#: PM2441

SCALE: NTS

SOLAR PERMIT PACKAGE

A3



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

MODULE @ STC

MODULE MFR: HT-SAAE
MODEL:HT60-166M-365
VOC = 41.3V
VMP = 33.9V
ISC = 11.63A
IMP = 10.77A

PV SYSTEM OUTPUT

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

INVERTER

INVERTER MFR: APSYSTEMS
INVERTER MODEL: **QS1**
DC VOLT RATING = 60V
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

PV SUB-PANEL RATING

NEW 125A BUS , SPLIT PHASE 3W 120/240V
MAX OUTPUT CURRENT =
INVERTER I_{MAX} * # 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 FUSED DISCONNECT @MAIN DISTRIBUTION PANEL .

POINT OF INTERCONNECTION

SUPPLY SIDE PER 705.12(A), 230.82(6)
AC DISCONNECT WITH FUSES RECOMMENDED:
(2) POLARIS BLOCK CONNECTORS IPLDS

MAIN PANEL RATING

EXISTING SPLIT PHASE 3W 120/240V
BUS BAR RATING = 125A
MAIN SERVICE BREAKER = 100A BOTTOM FED

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,EXPECT 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

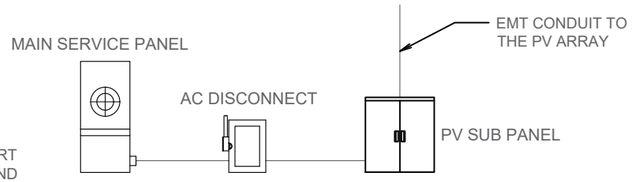
SIGNATURE:

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.

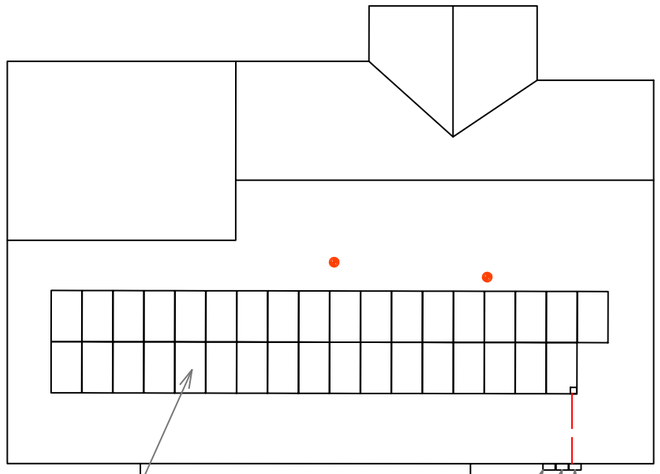
PERIMETER WORK SPACE SHALL
BE MAINTAINED (NEC 110.26)

NORTH EAST SIDE OF THE WALL

PLACARD CAUTION

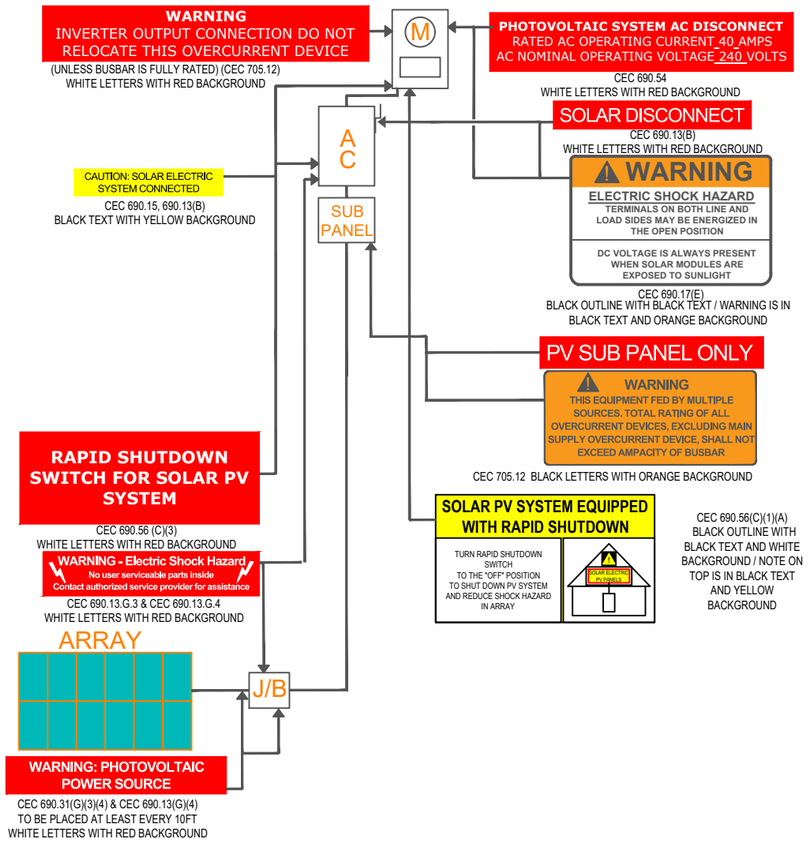
POWER TO THE BUILDING IS ALSO SUPPLIED
FROM THE FOLLOWING SOURCES WITH
DISCONNECTS LOCATED AS SHOWN

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 & 125AMP MAIN SERVICE PANEL .



NOTES:
1. BACKGROUND RED AND BLK ON YELLOW MINIMUM HEIGHT: 3/8".
2. LETTERS: WHITE.
3. FONT: ARIAL OR SIMILAR NON-BOLD.
4. ALL LABELS SHALL HAVE CAPITAL LETTERS.
5. MINIMUM HEIGHT: 3/16" FOR REMAINING CHARACTERS.
6. ALL LABELS SHALL BE WEATHER RESISTANT MATERIAL AND MATERIAL SUITABLE FOR EXTERIOR USE.
7. 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.
8. THE ABOVE LABELS SHALL BE PLACED EXACTLY AS NOTED.

REVISIONS

DATE	REV.

PAPER SIZE: 11"X17"

DATE: 9/16/21

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

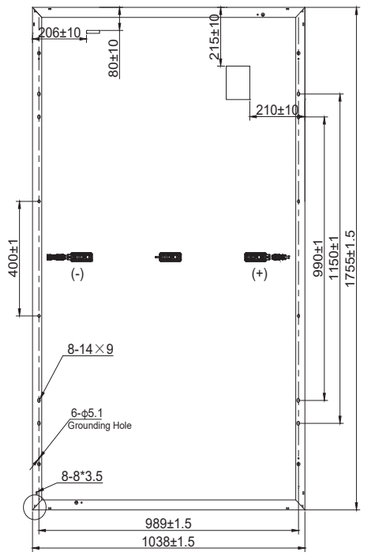
MULTIWAY+

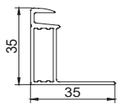
Better Choice For Higher Efficiency!

1500V module HT60-166M

360W/365W/370W/375W/380W

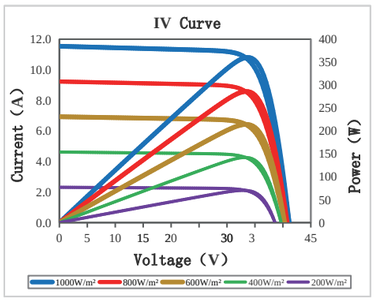
Engineering Drawing





I-V Curves

Current-Voltage & Power-Voltage Curve



Electrical Characteristics

Module	HT60-166M				
Maximum Power at STC(Pmax)	360W	365W	370W	375W	380W
Open-Circuit Voltage(Voc)	41.1V	41.3V	41.5V	41.6V	41.7V
Short-Circuit Current(Isc)	11.53A	11.63A	11.72A	11.85A	11.98A
Optimum Operating Voltage (Vmp)	33.7V	33.9V	34.1V	34.2V	34.6V
Optimum Operating Current(Imp)	10.69A	10.77A	10.86A	10.98A	10.99A
Module Efficiency	19.8%	20.0%	20.3%	20.6%	20.9%
Power Tolerance	0 ~ +5W				
Maximum System Voltage	1500V DC(UL/IEC)				
Maximum Series Fuse Rating	20A				
Operating Temperature	-40 ℃ to + 85℃				

*STC:Irradiance 1000W/m², module temperature 25, AM=1.5
Optional black frame or white frame module according to customer requirements

NMOT

Module	HT60-166M				
Maximum Power	267W	271W	275W	279W	283W
Open Circuit Voltage （Voc）	38.8V	39.0V	39.2V	39.4V	39.6V
Short Circuit Current (Isc)	9.30A	9.39A	9.48A	9.58A	9.65A
Maximum Power Voltage (Vmp)	31.8V	32.0V	32.2V	32.4V	32.6V
Maximum Circuit Current (Imp)	8.40A	8.47A	8.54A	8.61A	8.68A
NMOT	45℃±2℃				

Mechanical Characteristics

Solar Cells	Monocrystalline 166 × 83 mm
No.of Cells	120 (6 × 20)
Dimensions	1755mm×1038mm×35mm
Weight	19.5 kg
Front Glass	High transmission tempered glass
Frame	Anodized aluminium alloy
Junction Box	IP68
Cable	4mm² (UL/IEC) Length:1200mm
Connectors	MC4 / MC4 Compatible
Packaging Configuration	31pcs / box, 858pcs / 40'HQ Container

*NMOT:Irradiance 800W/m², ambient temperature 20℃, wind speed 1 m/s

Temperature Characteristics

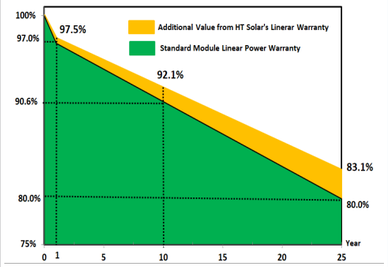
Temperature Coefficient of Pmax	γ (Pm)	-0.39%/℃
Temperature Coefficient of Voc	β (Voc)	-0.29%/℃
Temperature Coefficient of Isc	α (Isc)	0.049%/℃

Warranty

12-year product warranty

25-year warranty on power output

Specific information is referred to the product quality guarantee



Information Box

The module recycling should be carried out by the professional institutions at the the end of module life cycle

MULTIWAY+

MULTIWAY+

Reliable State-owned Enterprise Deliver Solar Power since 1960s

HT-SAAE

Shanghai Aerospace Automobile Electromechanical Co., Ltd. website: www.htsolar.com.tr

Factory :
Turkey HT Solar Energy Joint Stock Company
Lianyungang ShenZhou New Energy Co., Ltd.

HT60-166M

High Efficiency Low LID with Half-cut Technology

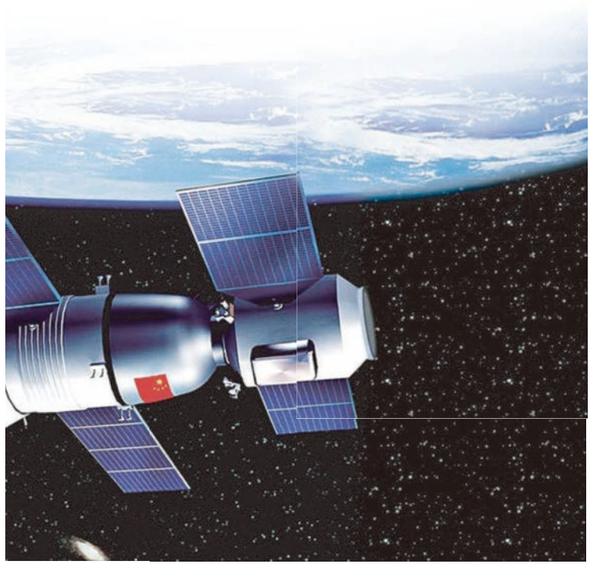
NEW

Big Size: Cell 166*83 Monocrystalline

360W / 365W
370W / 375W / 380W

Full Black Backsheet Type

- **Module Efficiency: 20.9%**
- **No.of Cells: 120 (6 × 20)**
- **Weight: 19.5kg**
- **Dimensions: 1755mm×1038mm×35mm**



Half cut cell technology can reduce the internal power loss and improve component overall power. Excellent heat dissipation avoids hot spot production.

9BB The optimized number and width of main gate lines, Maximize the light receiving area of components and Reduce component power consumption

12 Ys

Products Warranty

Designed for high voltage systems of up to 1500 VDC, increas-ing the string length of solar systems and saving on BOS costs

25 Ys

Warranty on power output

2%

All the modules are sorted and packaged by amperage, reducing mismatch losses and maximizing system output.

EL

Microcrack resistant high performance black backsheet structure enhance reliability, triple EL tested of high quality control.

5W

Positive tolerance 0/+5W guaranteed

Entire module certified to with stand extreme wind (2400 Pa) and snow loads (5400 Pa)

PID

PID Resistant

Comprehensive and first-rate certification system

IEC61215: 2016.IEC61730: 2016 Latest Standard

and UL 61730 Latest Standard, IS09001 ვ IS014001 and ISO45001, meeting the highest international standards Strict quality control

C US

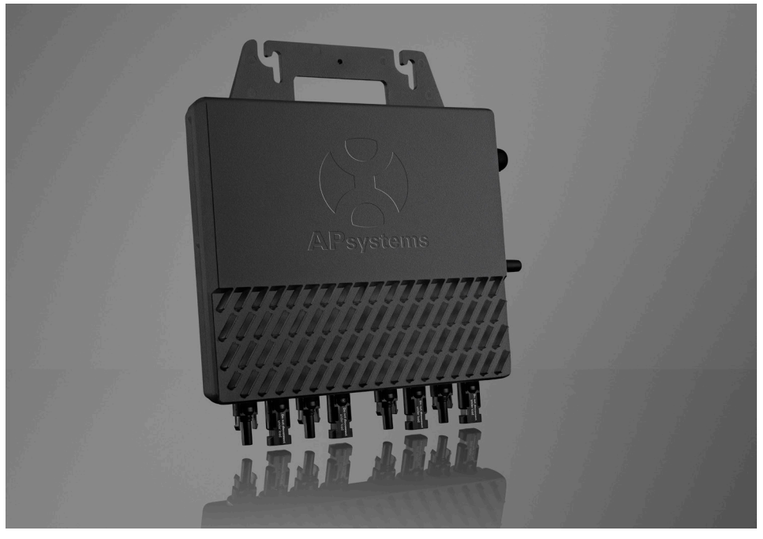
TÜVRheinland CERTIFIED

IEC 61215
IEC 61730
Regular Production Surveillance

www.tuv.com
ID 1419053360

APsystems
ALTENERGY POWER

Leading the Industry in
Solar Microinverter Technology



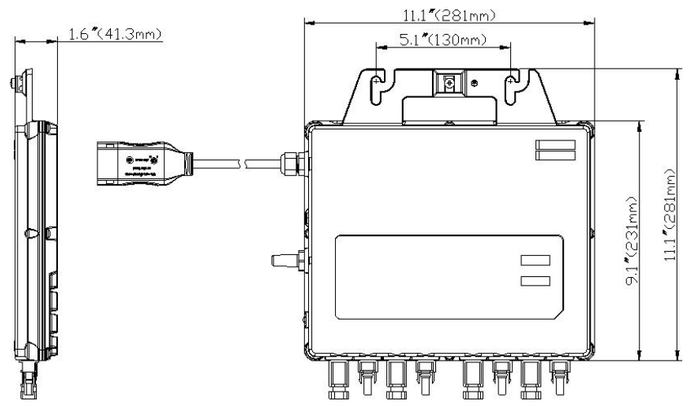
QS1

- 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

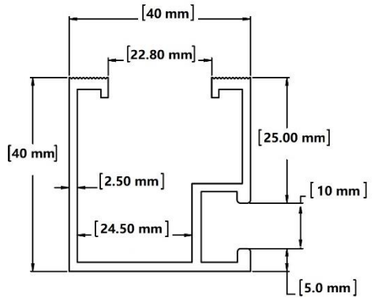
C US ** Meets the standard requirements for Distributed Energy Resources (UL 1741) and identified with the CSA Listed Mark.

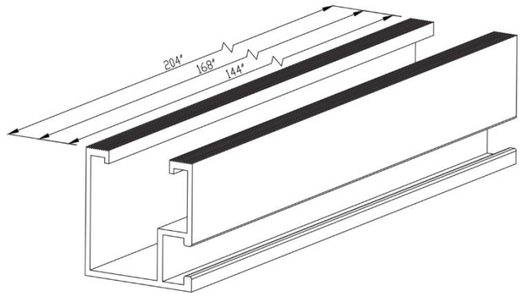
Specifications subject to change without notice – please ensure you are using the most recent update found at www.APsystems.com

600 Ericksen Ave NE, Suite 200, Seattle, WA 98110 | 844.666.7035 | APsystems.com

APsystems
ALTENERGY POWER

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	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	53	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	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	99	94	87	80	75	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	54	45	45	45	45	45	45	45	45
		LTE	61	61	61	61	57	53	48	45	47	47	47	47	47	47	47	45	38	38	38	38	38	38	38	38

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.

REGISTERED PROFESSIONAL ENGINEER
SHAWN PATRICK KELLEY
No. C80695
Exp. 12-31-20
CIVIL
STATE OF CALIFORNIA

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

Dual Rack PV MOUNTING SYSTEMS
■ RESIDENTIAL ■ COMMERCIAL ■ UTILITY

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

ETL CLASSIFIED
Intertek
5000799
Conforms to UL SUB 2703

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/ft³
Diffusivity (λ)	200.00 W/m-°K
Modulus of Elasticity (E)	10.152E06 Psi (7,000 kN/cm²)
Shear Modulus (G)	3.916E06 Psi (2,700 kN/cm²)

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

2290 Agate Ct., Unit A-B, Simi Valley, CA 93065 www.DualRack.net

Dual Rack
PV MOUNTING SYSTEMS

■ RESIDENTIAL ■ COMMERCIAL ■ UTILITY

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.

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

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

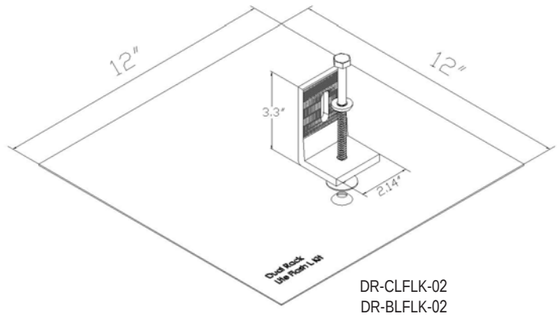
Item #	Product Name
DR-CLFLK-01	Lite Flash L Kit - 12.0" x 9.0" - Clear
DR-CLFLK-02	Lite Flash L Kit - 12.0" x 12.0" - Clear
DR-BLFLK-01	Lite Flash L Kit - 12.0" x 9.0" - Black
DR-BLFLK-02	Lite Flash L Kit - 12.0" x 12.0" - Black

ETL CLASSIFIED
Intertek
5000799
Conforms to UL SUB 2703

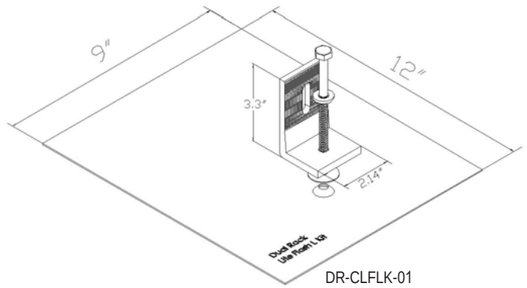
Dual Rack
PV MOUNTING SYSTEMS

■ RESIDENTIAL ■ COMMERCIAL ■ UTILITY

LITE FLASH L-KIT



DR-CLFLK-02
DR-BLFLK-02



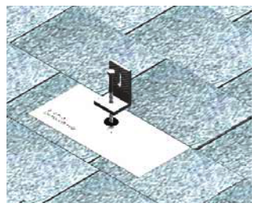
DR-CLFLK-01
DR-BLFLK-01

Installation Guide

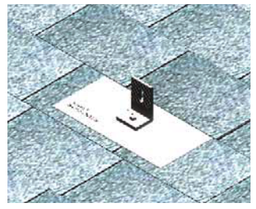
For detailed instructions please refer to the Dual Rack installation guide

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.

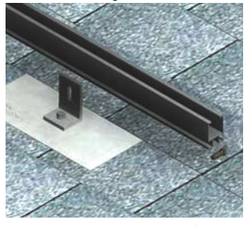


3. Put 5/16" x 4" lag bolt through L-foot. Next, slide the EPDM washer up onto the lag bolt.

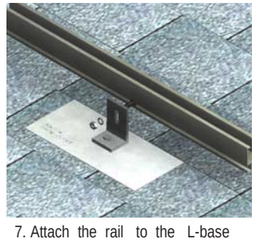


4. Secure L-foot onto Flash L Base and rooftop. (Tightening torque of 14 lbs-ft).

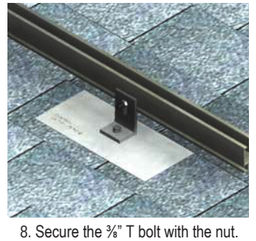
5. Screw the 5/16" lag bolt into the rafter embedded a min.of 2.5". *(Tightening torque is dependent on the roofing material.)



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 ⅜" T bolt with the nut. (Tightening torque 14.lbs-ft).

Contact Info

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www.DualRack.net
Email: info@DualRack.net
Phone:+1 (805) 254 - 2250

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