

# HUGHES RESIDENCE

## 10.800 kW PV SYSTEM

### 191 SCOTLAND DR, SPRING LAKE, NC 28390



**CASTILLO ENGINEERING SERVICES, LLC**  
 COA # 28345  
 620 N. WYMORE ROAD, SUITE 250,  
 MAITLAND, NC 32751  
 TEL: (407) 289-2575  
 ERMOCRATES E. CASTILLO - NC PE 050478

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REVISIONS		
DESCRIPTION	DATE	REV

PROJECT INSTALLER



Digitally signed by:  
 Ermocrates E. Castillo  
 Date: 2022.07.27 13:32:08

PROJECT NAME

**HUGHES RESIDENCE**

191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME  
COVER SHEET

SHEET SIZE  
**ANSI B**  
11" X 17"

SHEET NUMBER  
**G-01**

PROJECT DESCRIPTION:

27x400 HANWHA: Q. PEAK DUO ML-G10+ (400W)  
 ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES

SYSTEM SIZE: 10.800 kW DC STC  
 ARRAY AREA #1: 380.18 SQ. FT.  
 ARRAY AREA #2: 126.73 SQ. FT.  
 ARRAY AREA #3: 63.36 SQ. FT.

EQUIPMENT SUMMARY

27 HANWHA: Q. PEAK DUO ML-G10+ (400W) MODULES  
 01 SOLAREDGE TECHNOLOGY: SE10000H-US INVERTER  
 27 SOLAREDGE POWER P401 OPTIMIZERS

RACKING: K2 CROSSRAIL 44-X - RAIL  
 ATTACHMENT: SPLICE FOOT X

DESIGN CRITERIA:  
 ULTIMATE WIND SPEED : 120 MPH  
 NOMINAL WIND SPEED : 93 MPH  
 SNOW LOAD: 20 PSF  
 SEISMIC LOADS: 32.55 LBS  
 RISK CATEGORY: II  
 EXPOSURE: B

CODES AND STANDARDS

THE INSTALLATION OF SOLAR ARRAYS AND PHOTOVOLTAIC POWER SYSTEMS SHALL COMPLY WITH THE FOLLOWING CODES:  
 NORTH CAROLINA RESIDENTIAL CODE, 2018  
 NORTH CAROLINA MECHANICAL CODE, 2018  
 NORTH CAROLINA PLUMBING CODE, 2018  
 NORTH CAROLINA RESIDENTIAL CODE, 2018  
 ALL LOCAL CITY AND COUNTY ORDINANCES,  
 NATIONAL ELECTRICAL CODE, 2017 (NEC)  
 ASCE, 7-16

OWNER

HUGHES, STEVEN WILLIAM

INSTALLER

TITAN SOLAR  
 525 W BASELINE RD,  
 MESA, AZ 85210  
 (855) 729-7652

ENGINEER

Castillo Engineering Services LLC  
 620 N. Wymore Road, Suite 250, Maitland, NC32751  
 TEL: (407) 289-2575  
 Ermocrates E. Castillo  
 License#: NC PE 050478

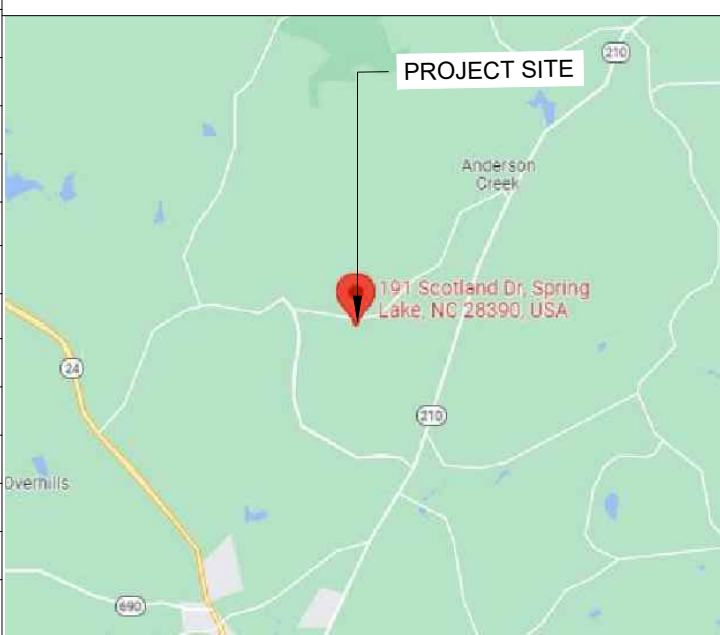
SHEET INDEX

SHEET #	SHEET DESCRIPTION
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A-01	ROOF PLAN
S-01	MODULE LAYOUT
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S-02	ATTACHMENT DETAIL
S-02.1	STRUCTURE CALCULATION
E-01	ELECTRICAL LINE DIAGRAM
E-02	WIRING CALCULATIONS
E-03	SYSTEM LABELING
E-03.1	RISER VIEW
DS-01-06	DATA SHEETS

HOUSE PHOTO



VICINITY MAP



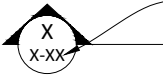
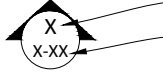
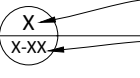
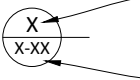


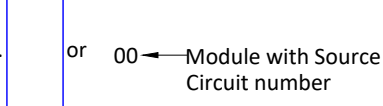









STRUCTURAL CERTIFICATION:

I ERMOCRATES CASTILLO PE# 050478 AN ENGINEER LICENSED PURSUANT TO GENERAL STATUTE 89C, CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH NCBC: RESIDENTIAL 2018, CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES, SEISMIC LOADS, SNOW LOADS, AND EQUIPMENT DEAD LOADS.

ELECTRICAL CERTIFICATION:

I ERMOCRATES CASTILLO PE# 050478 AN ENGINEER LICENSED PURSUANT TO GENERAL STATUTE 89C, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE NORTH CAROLINA RESIDENTIAL CODE, NCBC 107, AND THE NEC 2020.

**Symbols:**

- Section.....  Sheet where section is located
- Elevation .....  Detail ID Letter  
Sheet where section is located
- Detail .....  Detail ID Letter  
Sheet where section is located
- Detail .....  Detail ID Letter  
(Enlarged Plan) ← Area to be enlarged  
Sheet where section is located
- Keyed Notes ..... 1 Keyed note designation on applicable sheet
- Ground Terminal ..... 
- Grounding Point/rod.... 
- Solar Panel ..... 
- Combiner Box ..... CB
- AC Disconnect ..... ACD
- Main Distribution Panel ..... MDP
- Fuse ..... 
- Overcurrent Breaker .. 
- Inverter ..... 
- Transformer ..... 
- Automatic ..... ATS  
Transfer Switch
- Vent, Attic fan (Roof obstruction) 
- PV Roof Attachment 
- Trusses 
- Conduit 
- Fire Access 

**Abbreviations:**

- AC Alternating Current
- ACD AC Disconnect
- APPROX Approximate
- AWG American Wire Gauge
- BAT Battery
- CB Combiner Box
- DC Direct Current
- DISC Disconnect
- (E) Existing
- EL Elevation
- EQ Equal
- GP Generation Panel
- JB Junction Box
- MCB Main Combiner Box
- MFR Manufacturer
- MID Microgrid Interconnect Device
- MIN Minimum
- MISC Miscellaneous
- MDP Main Distribution Panel
- (N) New
- NAVD North American Vertical datum
- OCPD OverCurrent Protection Device
- POCC Point Of Common Coupling
- PV Photovoltaic
- SF Squarefoot/feet
- STC Standard Test Conditions
- SD Soladeck
- TBD To Be Determined
- TYP Typical
- UNO Unless Noted Otherwise
- UM Utility meter
- VIF Verify In Field
- WP Weather Proof

**System Description**

This system is a grid-tied, PV system, with PV generation consisting of 27x400 HANWHA: Q. PEAK DUO ML-G10+ (400W) Modules with a combined STC rated dc output power of 10,800W. The modules are connected into 01 SOLAREGE TECHNOLOGY: SE10000H-US Inverter. The inverter has electronic maximum power point tracking to maximize energy captured by the PV modules. The inverter also has an internal ground fault detection and interruption device that is set to disconnect the array in the event that a ground fault that exceeds one ampere should occur. The inverter has DC and AC disconnect integrated system and labels are provided as required by the *National Electrical Code*.

When the sun is shining, power from the PV array is fed into the inverter, where it is converted from DC to AC. The inverter output is then used to contribute to the power requirements of the occupancy. If PV power meets the requirements of the loads of the occupancy, any remaining PV power is sold back to the utility. When utility power is available, but PV power is not available, building loads are supplied by the utility.

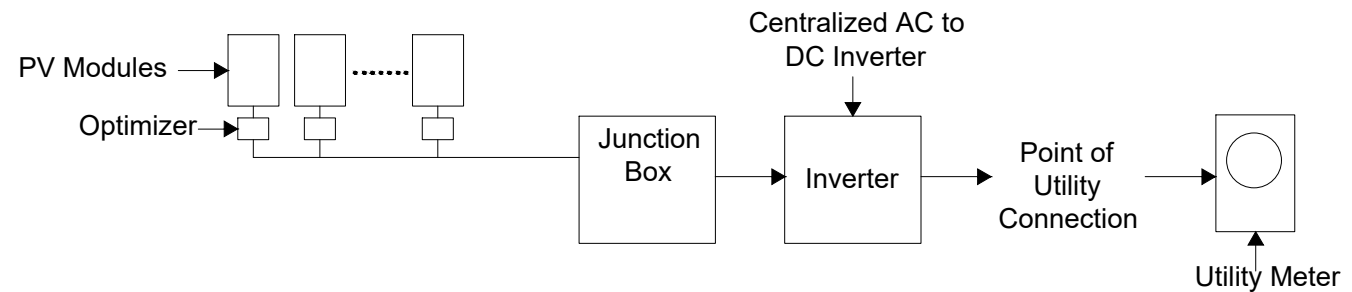


Figure 1: PV System Block Diagram

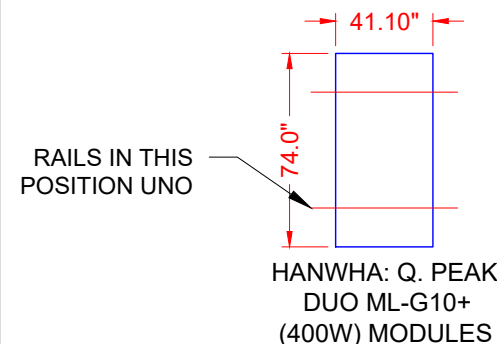
The inverter meets the requirements of IEEE 1547 and UL 1741.

**FALL PROTECTION:**  
 ANCHORAGES USED FOR ATTACHMENT OF PERSONAL FALL ARREST EQUIPMENT MUST BE INDEPENDENT OF ANY ANCHORAGE BEING USED TO SUPPORT OR SUSPEND PLATFORMS, AND CAPABLE OF SUPPORTING AT LEAST 5,000 POUNDS PER EMPLOYEE ATTACHED, OR MUST BE DESIGNED AND USED AS FOLLOWS:

- AS PART OF A COMPLETE PERSONAL FALL ARREST SYSTEM WHICH MAINTAINS A SAFETY FACTOR OF AT LEAST TWO.
- UNDER THE SUPERVISION OF A QUALIFIED PERSON

**ADDITIONAL INFORMATION**

- 29 CFR 1926 SUBPART M, FALL PROTECTION. OSHA STANDARD.
- 1926.502, FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES
- 1926.502(D)(15)



ALLOWABLE/DESIGN PRESSURE	PSF
DOWN PRESSURE	76
UPLIFT PRESSURE, 2 RAILS	56

**\*MODULE RAILING MAY BE INSTALLED IN LANDSCAPE ORIENTATION FOR MODULES WITH WEIGHTED PRESSURES BELOW 33 PSF\***

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 MAITLAND, NC 32751  
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**HUGHES RESIDENCE**

191 SCOTLAND DR,  
 SPRING LAKE, NC 28390

SHEET NAME

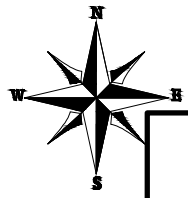
NOTES AND DESCRIPTION

SHEET SIZE

**ANSI B**  
 11" X 17"

SHEET NUMBER

**A-00**

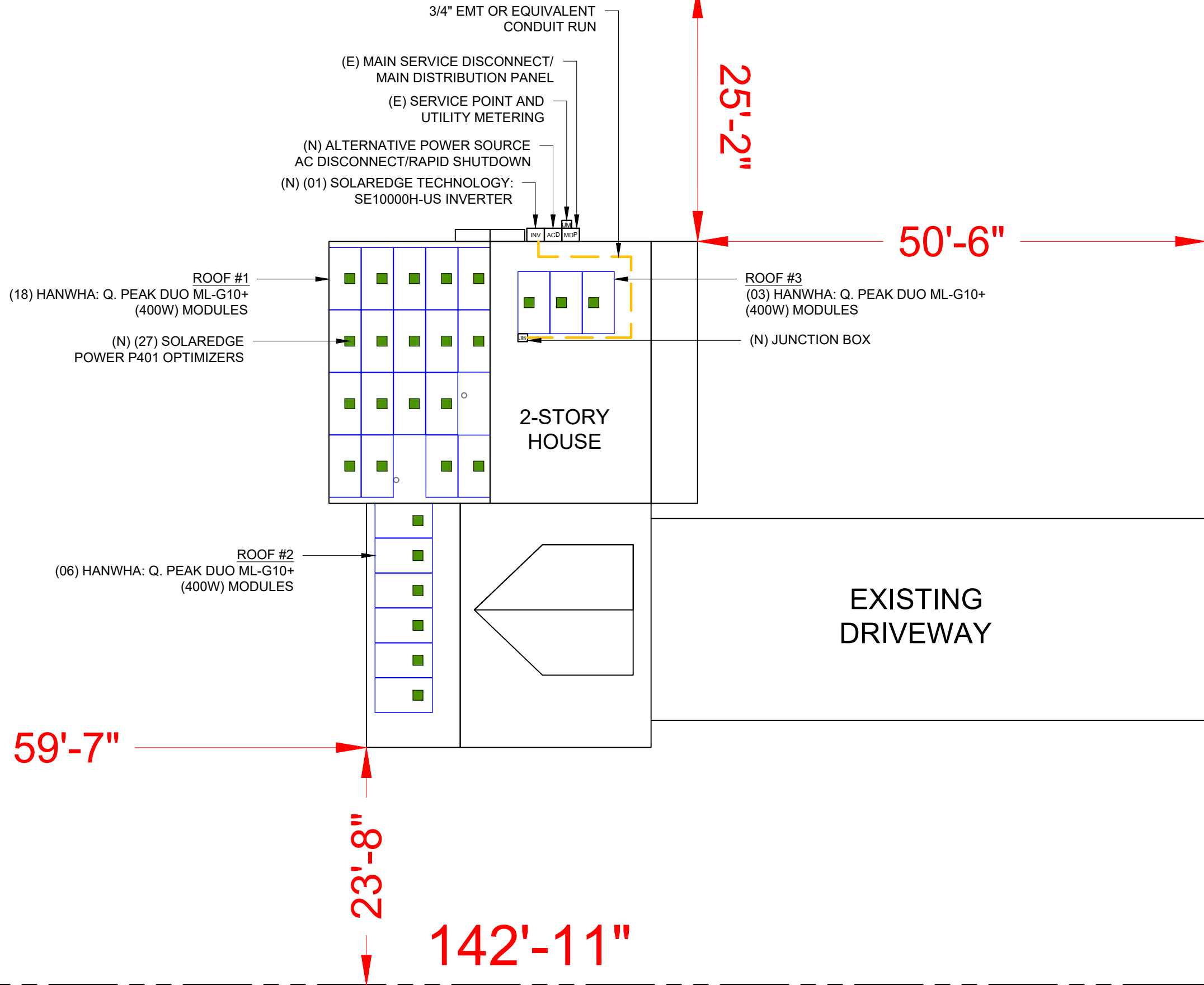


142'-11"

25'-2"

50'-6"

99'-1"



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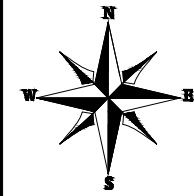
SHEET NAME  
 ROOF PLAN

SHEET SIZE  
 ANSI B  
 11" X 17"

SHEET NUMBER  
 A-01

**MODULE TYPE, DIMENSIONS & WEIGHT**

NUMBER OF MODULES = 27 MODULES  
 MODULE TYPE = HANWHA: Q. PEAK DUO ML-G10+ (400W) MODULES  
 MODULE WEIGHT = 48.50 LBS / 22 KG.  
 MODULE DIMENSIONS = 74.0" x 41.10" = 21.12 SF  
 UNIT WEIGHT OF ARRAY = 2.30 PSF



ARRAY AREA & ROOF AREA CALC'S								
ROOF	ROOF TYPE	ARRAY AREA (sq.Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)	TILT	AZIMUTH	TRUSS SIZE	TRUSS SPACING
#1	ASPHALT SHINGLE	380.18	415.84	91.42	22.6°	270°	2"X4"	24" O.C.
#2	ASPHALT SHINGLE	126.73	225.61	56.17	22.6°	270°	2"X4"	24" O.C.
#3	ASPHALT SHINGLE	63.36	415.84	15.24	22.6°	90°	2"X4"	24" O.C.
TOTAL PLAN VIEW		570.26	1644.61	34.67				

**GENERAL INSTALLATION PLAN NOTES:**

1) ROOF ATTACHMENTS TO SYP TRUSSES SHALL BE INSTALLED AS SHOWN IN SHEET S-02 AND AS FOLLOWS FOR EACH WIND ZONE:

WIND ZONES	NON-EXPOSED MODULES		EDGE / EXPOSED MODULES	
	SPAN	CANTILEVER	SPAN	CANTILEVER
ZONE 1	6' - 0"	1' - 4"	6' - 0"	1' - 4"
ZONE 1'	X	X	X	X
ZONE 2e	6' - 0"	1' - 4"	6' - 0"	1' - 4"
ZONE 2n	6' - 0"	1' - 4"	4' - 0"	1' - 4"
ZONE 2r	6' - 0"	1' - 4"	4' - 0"	1' - 4"
ZONE 3e	6' - 0"	1' - 4"	4' - 0"	1' - 4"
ZONE 3r	6' - 0"	1' - 4"	4' - 0"	1' - 4"

SEE SHEET S-02.1 FOR SUPPORTING CALCULATIONS.

2) EXISTING RESIDENTIAL BUILDING HAS AN ASPHALT SHINGLE ROOF WITH A MEAN ROOF HEIGHT OF 25 FT AND SYP 2"X4" ROOF TRUSSES SPACED 24" O.C. EXISTING ROOF SLOPE FOR SOLAR SYSTEM RETROFIT IS 22.6 DEGREES. CONTRACTOR TO FIELD VERIFY AND SHALL REPORT TO THE ENGINEER IF ANY DISCREPANCIES EXIST BETWEEN PLANS AND IN FIELD CONDITIONS.

3) THE EXISTING ROOF AND STRUCTURE WILL NOT BE ADVERSELY AFFECTED DUE TO THE ADDITIONAL LOADS IMPOSED BY THE SOLAR SYSTEM.

\* I CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH NCBC: RESIDENTIAL 2018, CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES, SEISMIC LOADS, SNOW LOADS, AND EQUIPMENT DEAD LOADS.\*

**\*MODULE RAILING MAY BE INSTALLED IN LANDSCAPE ORIENTATION FOR MODULES WITH WEIGHTED PRESSURES BELOW 33 PSF\***

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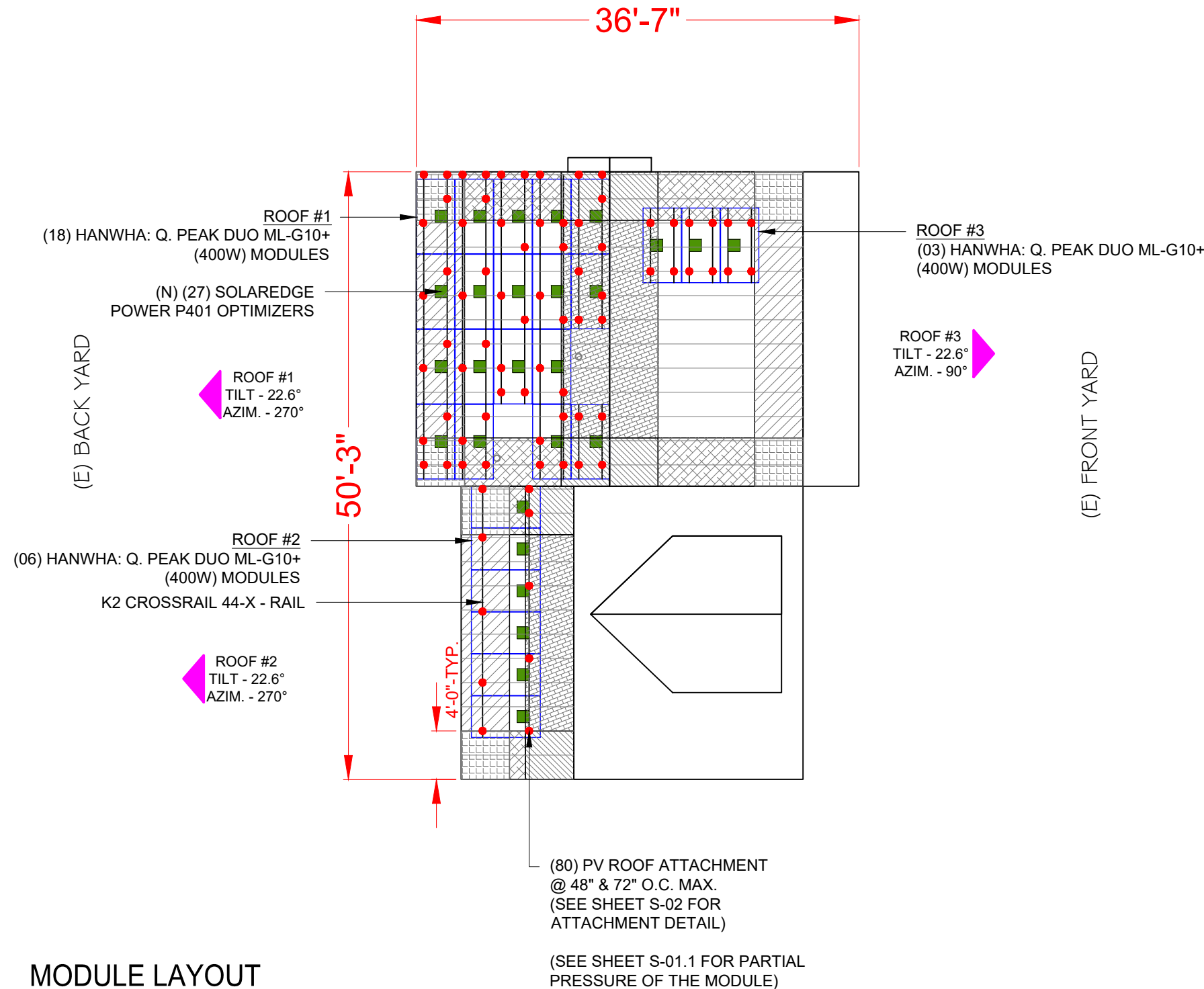
MODULE LAYOUT

SHEET SIZE

**ANSI B**  
 11" X 17"

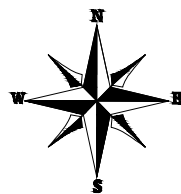
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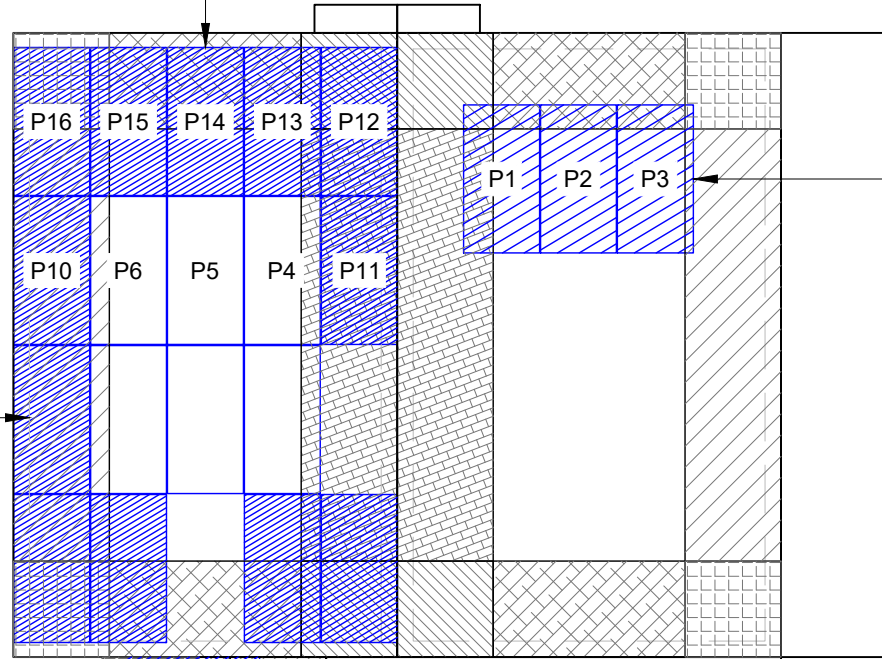


**LEGEND**

	- WIND ZONE 1 (TYP)
	- WIND ZONE 2e (TYP)
	- WIND ZONE 2n (TYP)
	- WIND ZONE 2r (TYP)
	- WIND ZONE 3r (TYP)
	- WIND ZONE 3e (TYP)

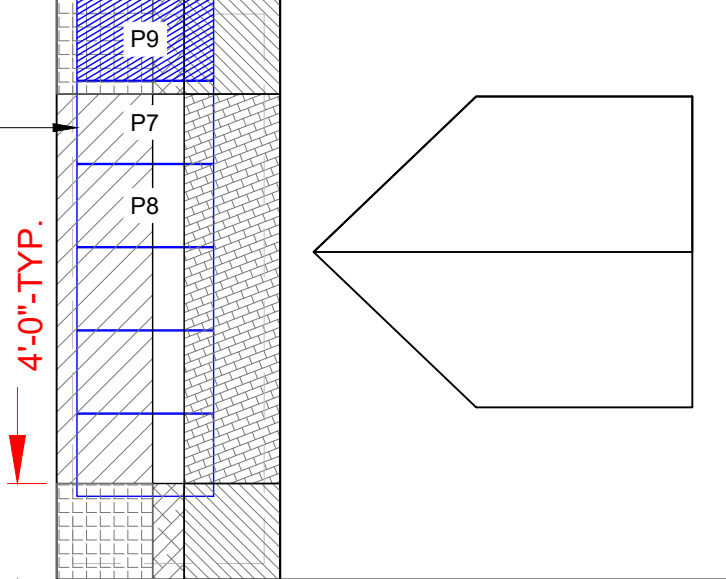


ROOF #1  
(18) HANWHA: Q. PEAK DUO ML-G10+  
(400W) MODULES



ROOF #3  
(03) HANWHA: Q. PEAK DUO ML-G10+  
(400W) MODULES

ROOF #2  
(06) HANWHA: Q. PEAK DUO ML-G10+  
(400W) MODULES



(E) BACK YARD

(E) FRONT YARD

FOR EXPOSED MODULES

1	1'	2e	2n	2r	3e	3r
18.5	0	18.5	26.6	26.6	26.6	30

Module Size 21.12 Sq. ft.

	Exposed modules							Partial Pressure
	1	1'	2e	2n	2r	3e	3r	
P1	10.81	0	0	2.09	6.88	0	1.34	22.67
P2	17.69	0	0	3.43	0	0	0	19.82
P3	15.75	0	1.94	3.04	0	0.39	0	19.82

FOR NON-EXPOSED MODULES

1	1'	2e	2n	2r	3e	3r
16	0	16	17.8	17.8	17.8	20

Module Size 21.12 Sq. ft.

	Non-Exposed modules							Partial Pressure
	1	1'	2e	2n	2r	3e	3r	
P4	15.79	0	0	0	5.33	0	0	16.45
P5	21.12	0	0	0	0	0	0	16.00
P6	15.89	0	5.23	0	0	0	0	16.00
P7	4.10	0	9.86	0.76	3.84	1.85	0.70	16.68
P8	4.86	0	11.70	0	4.56	0	0	16.39

FOR EDGE MODULES

1	1'	2e	2n	2r	3e	3r
18.5	0	18.5	26.6	26.6	26.6	30

Module Size 21.12 Sq. ft.

	Edge Modules							Partial Pressure
	1	1'	2e	2n	2r	3e	3r	
P9	0	0	11.70	4.86	0	0	4.56	22.85
P10	0	0	21.12	0	0	0	0	18.50
P11	0	0	0	0	21.12	0	0	26.60
P12	0	0	0	0	9.49	0	11.63	28.47
P13	7.10	0	0	8.69	2.38	0	2.95	24.35
P14	9.49	0	0	11.63	0	0	0.00	22.96
P15	7.15	0	2.34	8.74	0	2.89	0	22.96
P16	0	0	9.49	0	0	11.63	0	22.96

ALLOWABLE MODULE UPLIFT PRESSURE 2 RAILS: 56 PSF

LEGEND

- EXPOSED MODULE
- EDGE MODULE
- NON- EXPOSED MODULE
- MISSING MODULE
- MIN. MODULE EDGE DISTANCE LINE
- MODULE EXPOSURE LINE
- WIND ZONE 1 (TYP)
- WIND ZONE 2e (TYP)
- WIND ZONE 2n (TYP)
- WIND ZONE 2r (TYP)
- WIND ZONE 3r (TYP)
- WIND ZONE 3e (TYP)

**\*MODULE RAILING MAY BE INSTALLED IN LANDSCAPE ORIENTATION FOR MODULES WITH WEIGHTED PRESSURES BELOW 33 PSF\***

2h<sub>2</sub> DISTANCE : 0' - 10"  
0.5h DISTANCE : 12' - 6"

NOTE: PARTIAL PRESSURES OF THE WIND ZONES ON ALL MODULES HAVE BEEN VERIFIED AND ARE WITHIN THE ALLOWABLE PER THE MANUFACTURER SPECIFICATION, INSTALLER SHOULD FOLLOW THE LAYOUT TO AVOID HIGHER ZONAL PARTIAL PRESSURES. ANY CHANGES IN LAYOUT SHOULD BE REPORTED BACK TO THE ENGINEER OF RECORD.



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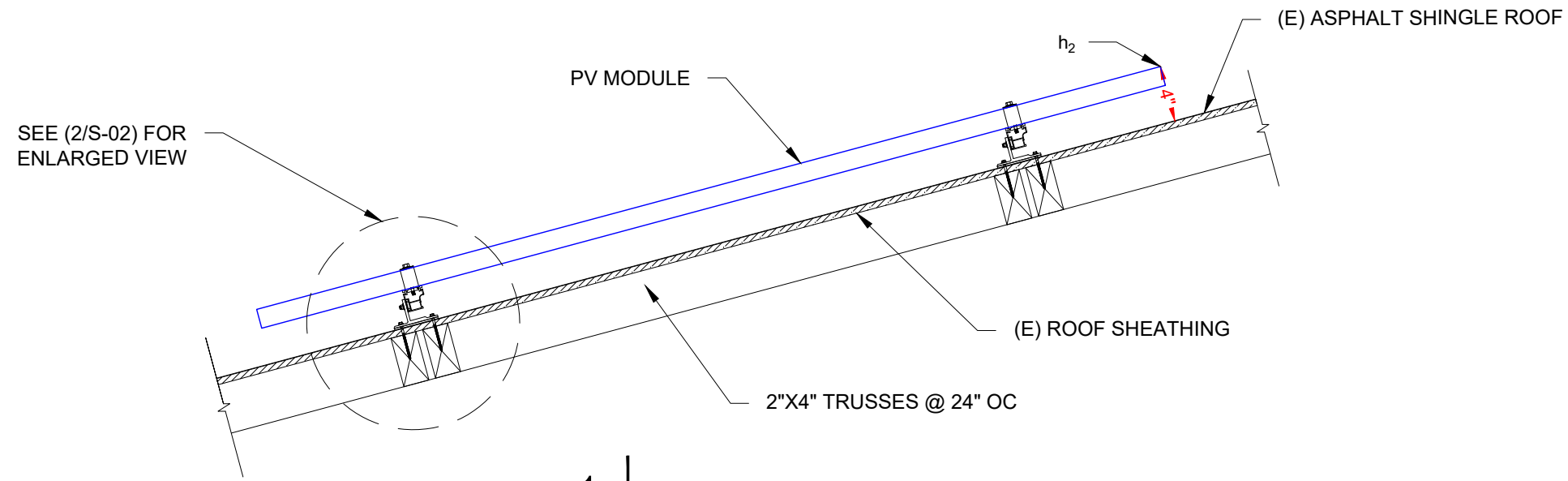
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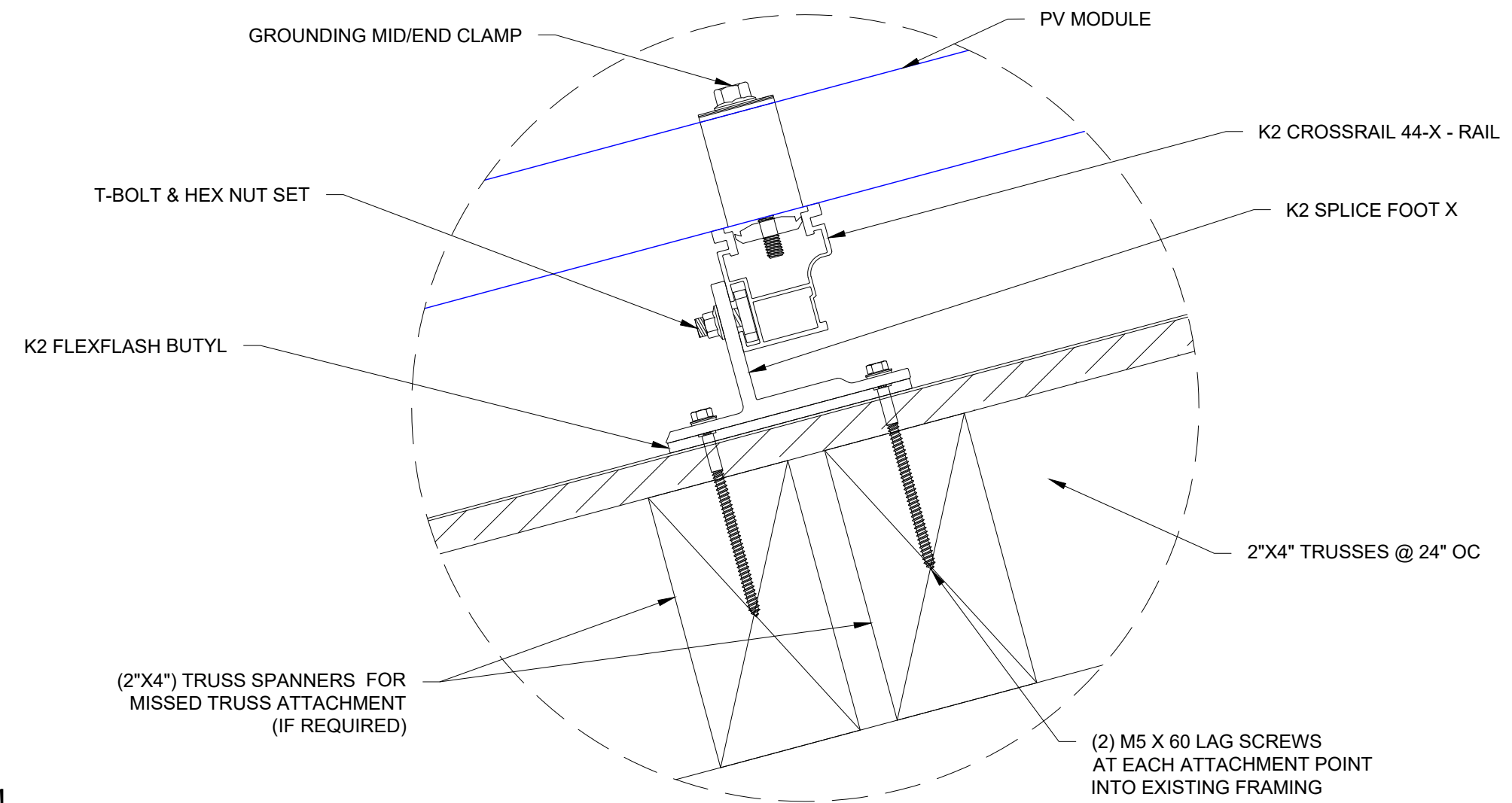
SHEET NAME  
PARTIAL PRESSURE AND  
MODULES EXPOSURE

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
S-01.1



**1** | ATTACHMENT DETAIL  
 S-02 | SCALE: 1" = 1'-0"



**2** | ATTACHMENT DETAIL (ENLARGED SECTION VIEW)  
 S-02 | SCALE: 6" = 1'-0"

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 ATTACHMENT DETAIL

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SHEET NUMBER  
**S-02**

# SNOW MAP

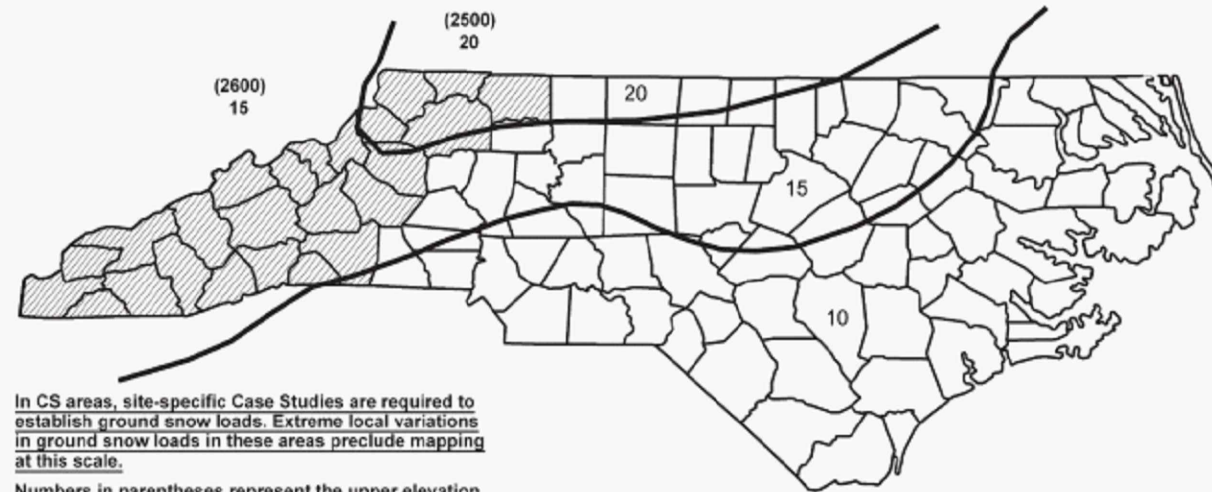
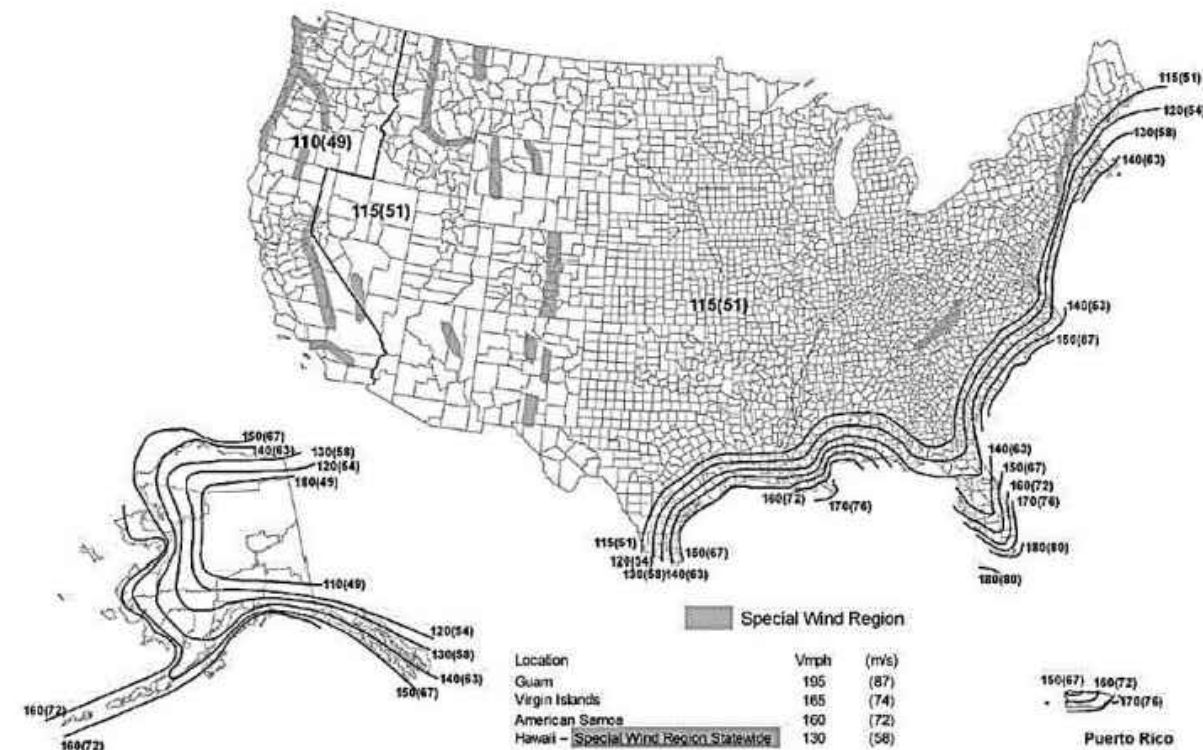


FIGURE 1608.2—continued  
GROUND SNOW LOADS, *Pg.* FOR THE STATE OF NORTH CAROLINA (psf)

# WIND MAP



## WIND LOAD CALCULATIONS FOR MODULES INSTALLED ON ROOFS WITH A HEIGHT LESS THAN 60'

SITE INFORMATION			
IRC	2018	RISK CATEGORY	II
MEAN ROOF HEIGHT (ft)	25.0	EXPOSURE CATEGORY	B
ROOF LENGTH (ft)	36.7	ROOF SLOPE	5 / 12
ROOF WIDTH (ft)	50.3	ROOF SLOPE (°)	22.6
PARAPET HEIGHT (ft)	0.0	ROOF TYPE	GABLE
MODULE LENGTH (in)	74	ULTIMATE WIND SPEED	120 mph
MODULE WIDTH (in)	41.1	NOMINAL WIND SPEED	93 mph
MODULE ORIENTATION	PORTRAIT	EXPOSURE FACTOR (C <sub>e</sub> )	1.000
MODULE AREA (sq. ft)	21.12	TEMPERATURE FACTOR (C <sub>t</sub> )	1.000
GROUND SNOW LOAD (psf)	10.00	IMPORTANCE FACTOR (I <sub>s</sub> )	1.000
COMPONENT AMPLIFICATION (a <sub>p</sub> )	1.00	h <sub>2</sub> (ROOF TO MODULE) ft	0.500
COMPONENT OPERATING WEIGHT	48.50	SPECTRAL ACCELERATION (S <sub>D,S</sub> )	1.172
COMPONENT RESPONSE FACTOR	1.50	TOTAL MODULES IN ARRAY	27.00
DEAD LOAD (psf)	3.00	SLOPE FACTOR (C <sub>s</sub> )	0.910
SLOPED ROOF SNOW LOAD (psf)	9.10	K <sub>D</sub>	0.850
EFFECTIVE WIND AREA (ft <sup>2</sup> )	21.12	K <sub>ZT</sub>	1.000
GROUND ELEVATION (ft)	282.0	K <sub>e</sub>	0.990
HVHZ	NO	K <sub>z</sub>	0.665

DESIGN CALCULATIONS			
VELOCITY PRESSURE (q) = .00256*K <sub>e</sub> K <sub>z</sub> K <sub>zT</sub> K <sub>d</sub> V <sup>2</sup>			
VELOCITY PRESSURE(ASD)	12.4 psf		
WIDTH OF PRESSURE COEFFICIENT	36.7' * 10% = 3.67'	ZONE WIDTH A	4 FT
	25' * 40% = 10'	ZONE 2 WIDTH	N/A (FOR (°) < 7°)
		ZONE 3 WIDTH	N/A (FOR (°) < 7°)
EXTERNAL PRESSURE COEFFICIENT	ZONE 1	0.459	-1.486
	ZONE 1'	0.459	X
	ZONE 2e	0.459	-1.486
	ZONE 2n	0.459	-2.141
	ZONE 2r	0.459	-2.141
	ZONE 3e	0.459	-2.141
	ZONE 3r	0.459	-2.414
INTERNAL PRESSURE COEFFICIENT (+/-)	0		

DESIGN PRESSURES			
ROOF ZONE	DOWN	UP	
1	16.0	-18.4	psf
1'	16.0	X	psf
2e	16.0	-18.4	psf
2n	16.0	-26.5	psf
2r	16.0	-26.5	psf
3e	16.0	-26.5	psf
3r	16.0	-29.9	psf
		Module allowable uplift pressure	56 psf
		Module allowable down pressure	76 psf

ARRAY FACTORS			
ARRAY EDGE FACTOR (EXPOSED)	1.5	SOLAR PANEL PRESSURE	
ARRAY EDGE FACTOR (NON-EXPOSED)	1	EQUALIZATION FACTOR	0.67012

ADJUSTED DESIGN PRESSURES				
ROOF ZONE	DOWN	UP (Exposed)	UP (N. Exposed)	
1	16.0	-18.5	-16.0	psf
1'	16.0	X	X	psf
2e	16.0	-18.5	-16.0	psf
2n	16.0	-26.6	-17.8	psf
2r	16.0	-26.6	-17.8	psf
3e	16.0	-26.6	-17.8	psf
3r	16.0	-30.0	-20.0	psf

ATTACHMENTS USED		
ATTACHMENT MODEL	K2 Splice Foot X	
ATTACHMENT STRENGTH	466 psf	

MAX SEISMIC LOAD FOR THE SYSTEM			
HORIZONTAL FORCE	15.76	Pounds	
VERTICAL FORCE	11.37	Pounds	
TOTAL SEISMIC LOAD (1.2D + E <sub>v</sub> + E <sub>h</sub> + 2S)	32.55	Pounds	
ATTACHMENT SHEAR	476	Pounds	

MAX DESIGN LOADS ALLOWABLE							
LIMIT MAX SPAN TO		N/A		in			
RAFTER/SEAM SPACING	24	in	NO. OF RAILS	Exposed	2	Non-Exposed	2
ZONE	DOWN	UP (Exposed)	UP (N. Exposed)	SPANS (E)		SPANS (N.E)	
1	296.0	342.0	296.0	72 in	72 in	72 in	72 in
1'	0.0	X	X	X in	X in	X in	X in
2e	296.0	342.0	296.0	72 in	72 in	72 in	72 in
2n	296.0	328.5	328.5	48 in	72 in	72 in	72 in
2r	296.0	328.5	328.5	48 in	72 in	72 in	72 in
3e	296.0	328.5	328.5	48 in	72 in	72 in	72 in
3r	296.0	370.4	370.4	48 in	72 in	72 in	72 in

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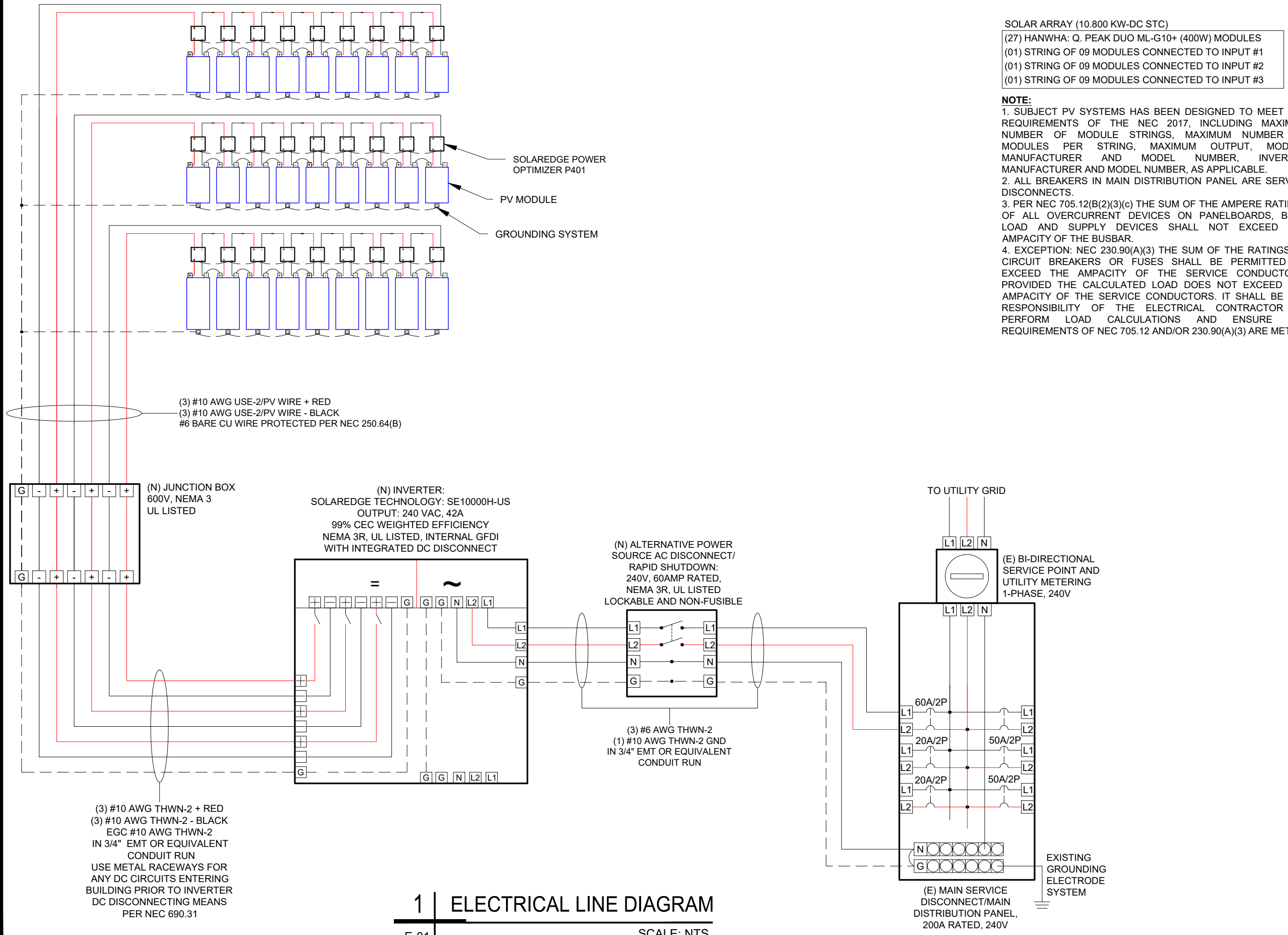
PROJECT NAME

HUGHES RESIDENCE  
191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME  
STRUCTURE CALCULATION

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
S-02.1



**1 | ELECTRICAL LINE DIAGRAM**  
 E-01 | SCALE: NTS

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PROJECT NAME

**HUGHES RESIDENCE**  
 191 SCOTLAND DR,  
 SPRING LAKE, NC 28390

SHEET NAME  
 ELECTRICAL LINE DIAGRAM  
 ELECTRICAL LINE DIAGRAM

SHEET SIZE  
 ANSI B  
 11" X 17"

SHEET NUMBER  
 E-01



## DC CONDUCTOR AMPACITY CALCULATIONS: ARRAY TO INVERTER

EXPECTED WIRE TEMP (In Celsius)	34°
TEMP. CORRECTION PER TABLE 310.15(B)(2)(a)	0.96
NO. OF CURRENT CARRYING CONDUCTORS	4
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	0.80
CIRCUIT CONDUCTOR SIZE	10 AWG
CIRCUIT CONDUCTOR AMPACITY	40A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	18.75
1.25 X OUTPUT OF OPTIMIZER	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	
TEMP. CORRECTION PER TABLE 310.15(B)(2)(a) X CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY	30.72A
Result should be greater than (18.75A) otherwise increase the size of the conductor and its ampacity	

## AC CONDUCTOR AMPACITY CALCULATIONS INVERTER TO MAIN SERVICE PANEL

No. OF INVERTER	1
EXPECTED WIRE TEMP (In Celsius)	34°
TEMP. CORRECTION PER TABLE 310.15(B)(2)(a)	0.96
NO. OF CURRENT CARRYING CONDUCTORS	3
CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a)	1
CIRCUIT CONDUCTOR SIZE	6AWG
CIRCUIT CONDUCTOR AMPACITY	75A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	52.50
1.25 X MAX INVERTER OUTPUT CURRENT	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	
TEMP. CORRECTION PER TABLE 310.15(B)(2)(a) X CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY	72.00
Result should be greater than (52.50A) otherwise increase the size of the conductor and its ampacity	

DC PHOTOVOLTAIC POWER SOURCE TO BE INSTALLED AT INVERTER PER NEC 690.53 & 690.54	
OPERATING CURRENT	15A
OPERATING VOLTAGE	400V
MAXIMUM SYSTEM VOLTAGE	480V
MAX INV INPUT CURRENT	27A

SOLAR MODULE SPECIFICATIONS	
MANUFACTURER	HANWHA
MODEL #	Q. PEAK DUO ML-G10+
PMAX	400W
VMP	37.13V
IMP	10.77A
VOC	45.30V
ISC	11.14A
MODULE DIMENSION	74.0"L x 41.10"W x 1.26"D (In Inch)

INVERTER SPECIFICATIONS	
MANUFACTURER	SOLAREGE TECHNOLOGY
MODEL #	SE10000H-US
NOMINAL AC POWER	10.0 KW
NOMINAL OUTPUT VOLTAGE	240V
NOMINAL OUTPUT CURRENT	42A

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

I ERMOCRATES CASTILLO PE# 050478 AN ENGINEER LICENSED PURSUANT TO GENERAL STATUTE 89C, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE NORTH CAROLINA BUILDING CODE, NCBC 107, AND THE NEC 2017.

- 1.) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- 2.) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT. THE TERMINALS ARE RATED FOR 75 DEGREES C.
- 3.) THE WIRES ARE SIZED ACCORDING TO NEC 110.14 .
- 4.) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
- 5.) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- 6.) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- 7.) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- 8.) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- 9.) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- 10.) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
- 11.) UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
- 12.) MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
- 13.) RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
- 14.) CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.10 (D).
- 15.) CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).
- 16.) ALL CONDUITS TO BE INSTALLED A MIN OF 7/8" ABOVE THE ROOF SURFACE.



CASTILLO ENGINEERING SERVICES, LLC  
COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
MAITLAND, NC32751  
TEL: (407) 289-2575  
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PROJECT NAME

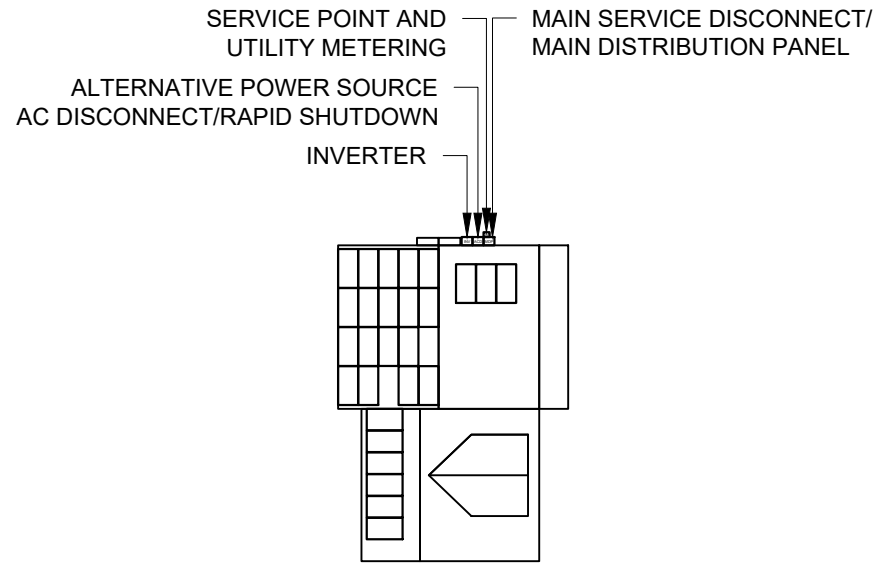
HUGHES RESIDENCE  
191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME  
WIRING CALCULATIONS

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
E-02

**CAUTION!**  
POWER TO THIS BUILDING  
SUPPLIED FROM MULTIPLE SOURCES



191 SCOTLAND DR, SPRING LAKE, NC 28390

LABEL LOCATION:  
MAIN SERVICE DISCONNECT / MAIN DISTRIBUTION PANEL, PV DISCONNECT  
LOCATED NO MORE THAN 3FT (1M) FROM THE SERVICE DISCONNECT  
(TEXT HEIGHT SHOULD BE A MINIMUM OF 3/8")  
PER CODE NEC 705.10

**PHOTOVOLTAIC SYSTEM AC DISCONNECT**  
RATED AC OPERATING CURRENT 42 AMPS  
AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC 690.54)

**WARNING:**  
POWER SOURCE OUTPUT CONNECTION DO  
NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:  
POINT OF INTERCONNECTION  
(PER CODE: NEC 705.12(B)(2)(3)(b))

INVERTER

<b>MAXIMUM SYSTEM VOLTAGE (VOC)</b>	<b>480</b>	<b>V</b>
<b>MAXIMUM CIRCUIT CURRENT (Isc)</b>	<b>27.0</b>	<b>A</b>
<b>MAXIMUM RATED OUTPUT OF DC TO DC CONVERTER (Idc)</b>	<b>15</b>	<b>A</b>

LABEL LOCATION:  
DC DISCONNECT, INVERTER  
(PER CODE: NEC 690.53)

**RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

LABEL LOCATION:  
AC DISCONNECT  
(PER CODE: NEC 690.56(C)(3))

**WARNING: PHOTOVOLTAIC POWER SOURCE**

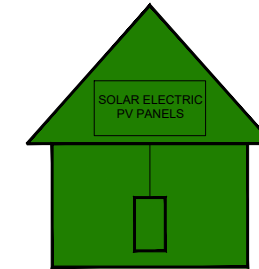
LABEL LOCATION:  
CONDUIT, COMBINER BOX  
(ADDITIONAL EQUIPMENT THAT CONTAINS PV SOURCE WIRES)  
(PER CODE: NEC 690.31(G)(3))

**EMERGENCY RESPONDER**  
THIS SOLAR PV SYSTEM IS EQUIPPED  
WITH RAPID SHUTDOWN.

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN ENTIRE PV SYSTEM

- SECTIONS OF THE PV SYSTEM THAT ARE SHUT DOWN WHEN THE RAPID SHUTDOWN SWITCH IS OPERATED.

- SECTIONS OF THE PV SYSTEM THAT ARE NOT SHUT DOWN WHEN THE RAPID SHUTDOWN SWITCH IS OPERATED.



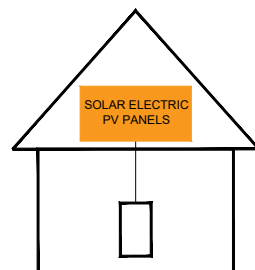
LABEL LOCATION:  
AC DISCONNECT  
(TEXT HEIGHT SHOULD BE A MINIMUM OF 3/8")  
(PER CODE: NFPA 1,11.12.2.1.1)

**TITAN SOLAR**  
EMERGENCY CONTACT:  
PH:(855) 729-7652

LABEL LOCATION:  
MAIN DISCONNECT  
(PER CODE: NFPA - 1, 11.12.2.1.5)

**SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

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



LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC 690.56(C)(1)(a), IFC 1204.5.1)

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

**WARNING DUAL POWER SOURCE**  
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:  
POINT OF INTERCONNECTION  
(PER CODE: NEC 705.12(B)(2)(3)(b))

LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC 690.13(B))



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COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
MAITLAND, NC 28751  
TEL: (407) 289-2575  
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PROJECT NAME

**HUGHES RESIDENCE**  
191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME

SYSTEM LABELING

SHEET SIZE

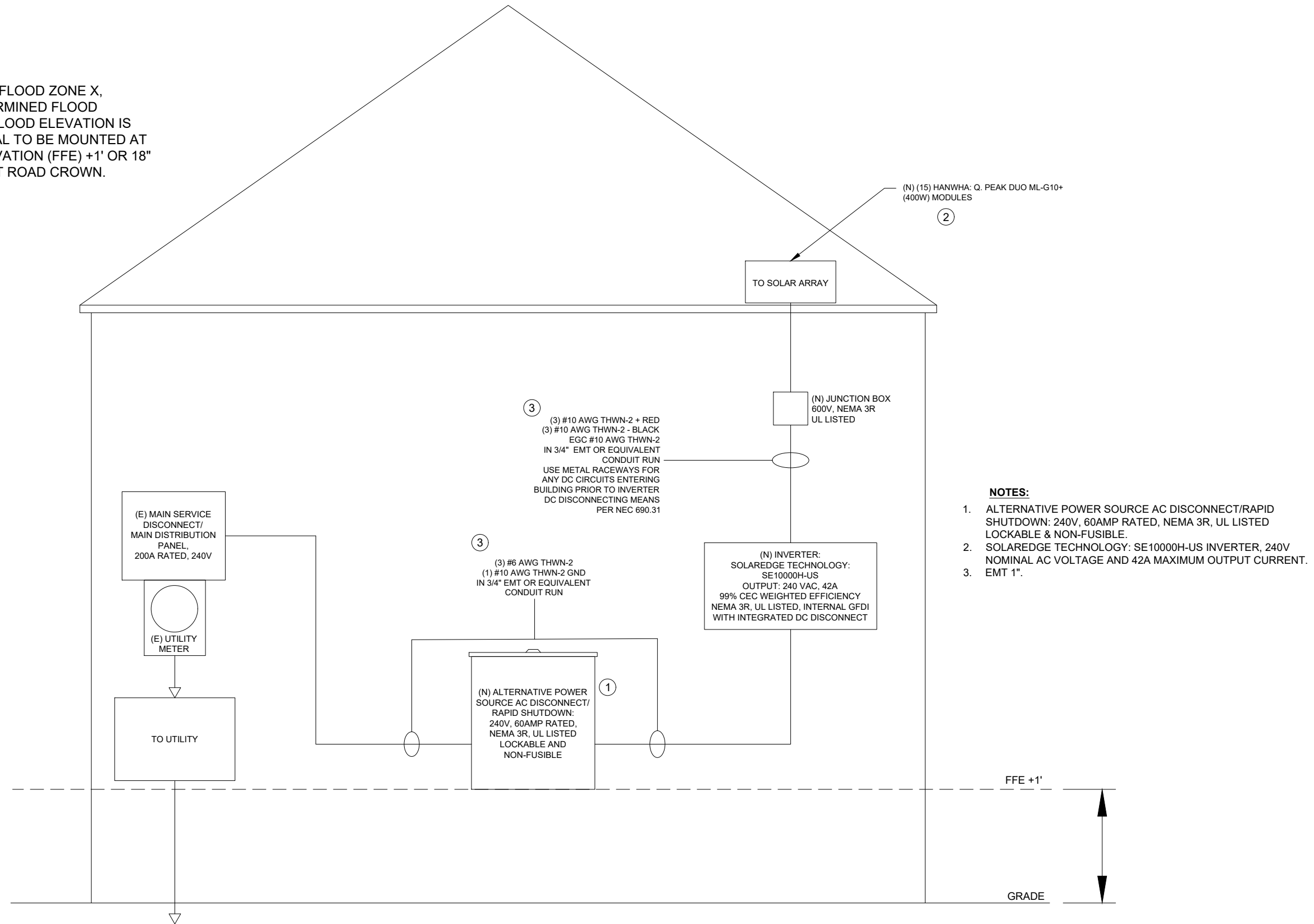
ANSI B  
11" X 17"

SHEET NUMBER

E-03

# 10.800 KW PHOTOVOLTAIC SYSTEM - RISER DIAGRAM

PER FEMA, THIS BUILDING IS IN FLOOD ZONE X, WHICH IS AN AREA OF UNDETERMINED FLOOD HAZARD. THEREFORE A BASE FLOOD ELEVATION IS NOT AVAILABLE. ALL ELECTRICAL TO BE MOUNTED AT MINIMUM FINISHED FLOOR ELEVATION (FFE) +1' OR 18" ABOVE THE HIGHEST ADJACENT ROAD CROWN.



**NOTES:**

1. ALTERNATIVE POWER SOURCE AC DISCONNECT/RAPID SHUTDOWN: 240V, 60AMP RATED, NEMA 3R, UL LISTED LOCKABLE & NON-FUSIBLE.
2. SOLAREEDGE TECHNOLOGY: SE10000H-US INVERTER, 240V NOMINAL AC VOLTAGE AND 42A MAXIMUM OUTPUT CURRENT.
3. EMT 1".

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SOLAR DONE RIGHT®  
CASTILLO ENGINEERING SERVICES, LLC  
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620 N. WYMORE ROAD, SUITE 250,  
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PROJECT NAME

**HUGHES RESIDENCE**  
191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME

RISER DIAGRAM

SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

E-03.1

1 RISER DAIGRAM

E-03.1

SCALE: NTS



# Q.PEAK DUO BLK ML-G10+ 385-405

ENDURING HIGH PERFORMANCE



**BREAKING THE 20% EFFICIENCY BARRIER**  
Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.

**THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY**  
Q CELLS is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.

**INNOVATIVE ALL-WEATHER TECHNOLOGY**  
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

**ENDURING HIGH PERFORMANCE**  
Long-term yield security with Anti LID Technology, Anti PID Technology<sup>1</sup>, Hot-Spot Protect and Traceable Quality Tra.Q™.

**EXTREME WEATHER RATING**  
High-tech aluminum alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa).

**A RELIABLE INVESTMENT**  
Inclusive 25-year product warranty and 25-year linear performance warranty<sup>2</sup>.

<sup>1</sup> APT test conditions according to IEC/TS 62804-1:2015, method A (-1500 V, 96h)  
<sup>2</sup> See data sheet on rear for further information.

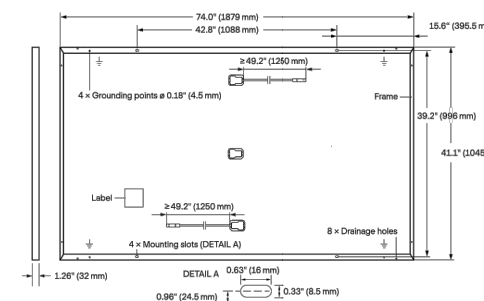
**THE IDEAL SOLUTION FOR:**  
Rooftop arrays on residential buildings

Engineered in Germany



## MECHANICAL SPECIFICATION

Format	74.0 in x 41.1 in x 1.26 in (including frame) (1879 mm x 1045 mm x 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 x 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in x 1.26-2.36 in x 0.59-0.71 in (53-101 mm x 32-60 mm x 15-18 mm), IP67, with bypass diodes
Cable	4 mm <sup>2</sup> Solar cable; (+) ≥ 49.2 in (1250 mm), (-) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

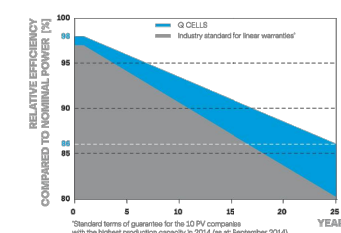


## ELECTRICAL CHARACTERISTICS

POWER CLASS		385	390	395	400	405	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5 W / -0 W)							
Minimum	Power at MPP <sup>1</sup>	P <sub>MPP</sub> [W]	385	390	395	400	405
	Short Circuit Current <sup>1</sup>	I <sub>SC</sub> [A]	11.04	11.07	11.10	11.14	11.17
	Open Circuit Voltage <sup>1</sup>	V <sub>OC</sub> [V]	45.19	45.23	45.27	45.30	45.34
	Current at MPP	I <sub>MPP</sub> [A]	10.59	10.65	10.71	10.77	10.83
	Voltage at MPP	V <sub>MPP</sub> [V]	36.36	36.62	36.88	37.13	37.39
	Efficiency <sup>1</sup>	η [%]	≥ 19.6	≥ 19.9	≥ 20.1	≥ 20.4	≥ 20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>2</sup>							
Minimum	Power at MPP	P <sub>MPP</sub> [W]	288.8	292.6	296.3	300.1	303.8
	Short Circuit Current	I <sub>SC</sub> [A]	8.90	8.92	8.95	8.97	9.00
	Open Circuit Voltage	V <sub>OC</sub> [V]	42.62	42.65	42.69	42.72	42.76
	Current at MPP	I <sub>MPP</sub> [A]	8.35	8.41	8.46	8.51	8.57
	Voltage at MPP	V <sub>MPP</sub> [V]	34.59	34.81	35.03	35.25	35.46

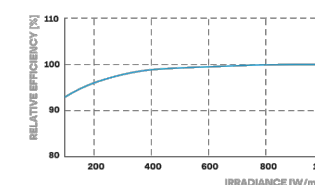
<sup>1</sup> Measurement tolerances P<sub>MPP</sub> ± 3%; I<sub>SC</sub>; V<sub>OC</sub> ± 5% at STC: 1000 W/m<sup>2</sup>, 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • 800 W/m<sup>2</sup>, NMOT, spectrum AM 1.5

## Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m<sup>2</sup>)

## TEMPERATURE COEFFICIENTS

Temperature Coefficient of I <sub>SC</sub>	α [%/K]	+0.04	Temperature Coefficient of V <sub>OC</sub>	β [%/K]	-0.27
Temperature Coefficient of P <sub>MPP</sub>	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3 °C)

## PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V <sub>sys</sub>	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	-40 °F up to +185 °F (-40 °C up to +85 °C)
Max. Test Load, Push / Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ]	113 (5400 Pa) / 84 (4000 Pa)		

<sup>3</sup> See Installation Manual

## QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells), GCPV Certification ongoing.



## PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules
----------------------	--------------------	--------------------	--------------------	--------------------	------------	------------	------------

**Note:** Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.  
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL inquiry@us.q-cells.com | WEB www.q-cells.us



CASTILLO ENGINEERING SERVICES, LLC  
COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
MAITLAND, NC 27251  
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## PROJECT INSTALLER



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## PROJECT NAME

HUGHES RESIDENCE  
191 SCOTLAND DR,  
SPRING LAKE, NC 28390

## SHEET NAME

DATA SHEET

## SHEET SIZE

ANSI B  
11" X 17"

## SHEET NUMBER

DS-01

Specifications subject to technical changes © Q CELLS Q.PEAK DUO BLK ML-G10+ 385-405\_2021-05\_Rev 01\_NA

# / Single Phase Inverter with HD-Wave Technology for North America

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

Model Number	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXBXX4							
<b>OUTPUT</b>								
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 <sup>1)</sup>							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
Power Factor	1, adjustable -0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
<b>INPUT</b>								
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			400				Vdc
Nominal DC Input Voltage	380			400				Vdc
Maximum Input Current @240V <sup>2)</sup>	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V <sup>2)</sup>	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600ka Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99			99 @ 240V 98.5 @ 208V				%
Nighttime Power Consumption	< 2.5							W

<sup>1)</sup> For other regional settings please contact SolarEdge support.  
<sup>2)</sup> A higher current source may be used, the inverter will limit its input current to the values stated.

# / Single Phase Inverter with HD-Wave Technology for North America

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

Model Number	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US		
<b>ADDITIONAL FEATURES</b>									
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)								
Revenue Grade Data, ANSI C12.20	Optional <sup>1)</sup>								
Inverter Commissioning	with the SetApp mobile application using built-in Wi-Fi Access Point for local connection								
Rapid Shutdown - NEC 2014 and 2017 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect								
<b>STANDARD COMPLIANCE</b>									
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 (H-I)								
Emissions	FCC Part 15 Class B								
<b>INSTALLATION SPECIFICATIONS</b>									
AC Output Conduit Size / AWG Range	1" Maximum / 14-6 AWG				1" Maximum /14-4 AWG				
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1-2 strings / 14-6 AWG				1" Maximum / 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 / -40 to +60 <sup>1)</sup>							°F / °C	
Protection Rating	NEMA 4X (Inverter with Safety Switch)								

<sup>1)</sup> Revenue grade inverter P/N: SExxxxH-US0008NC4  
<sup>2)</sup> Full power up to at least 50°C / 122°F; for power de-rating information refer to: <https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf>



**CASTILLO ENGINEERING SERVICES, LLC**  
 COA # 28345  
 620 N. WYMORE ROAD, SUITE 250,  
 MAITLAND, NC32751  
 TEL: (407) 289-2575  
 ERMOCRATES E. CASTILLO - NC PE 050478

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PROJECT NAME

HUGHES RESIDENCE  
 191 SCOTLAND DR,  
 SPRING LAKE, NC 28390

SHEET NAME  
 DATA SHEET

SHEET SIZE  
 ANSI B  
 11" X 17"

SHEET NUMBER  
 DS-02

# Power Optimizer

For North America

P370 / P400 / **P401** / P485 / 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



## Power Optimizer For North America

P370 / P400 / **P401** / P485 / P505

Optimizer model (typical module compatibility)	P370 (for higher-power 60 and 72-cell modules)	P400 (for 72 & 96-cell modules)	P401 (for high power 60 and 72 cell modules)	P485 (for high-voltage modules)	P505 (for higher current modules)	
<b>INPUT</b>						
Rated Input DC Power <sup>(1)</sup>	370		400	485	505	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	60	80	60	125 <sup>(2)</sup>	83 <sup>(2)</sup>	Vdc
MPPT Operating Range	8 - 60	8 - 80	8-60	12.5 - 105	12.5 - 83	Vdc
Maximum Short Circuit Current (Isc)	11	10.1	11.75	11	14	Adc
Maximum Efficiency			99.5			%
Weighted Efficiency			98.8			%
Overtolerance Category			II			
<b>OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREGE INVERTER)</b>						
Maximum Output Current			15			Adc
Maximum Output Voltage		60		85		Vdc
<b>OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREGE INVERTER OR SOLAREGE INVERTER OFF)</b>						
Safety Output Voltage per Power Optimizer			1 ± 0.1			Vdc
<b>STANDARD COMPLIANCE</b>						
Photovoltaic Rapid Shutdown System	NEC 2014, 2017 & 2020		NEC 2014, 2017 & 2020		NEC 2014, 2017 & 2020	
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3					
Safety	IEC62109-1 (class II safety), UL1741					
Material	UL94 V-0, UV Resistant					
RoHS	Yes					
<b>INSTALLATION SPECIFICATIONS</b>						
Maximum Allowed System Voltage	1000					Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters					
Dimensions (W x L x H)	129 x 153 x 27.5 / 5.1 x 6 x 1.1	129 x 153 x 33.5 / 5.1 x 6 x 1.3	129 x 153 x 29.5 / 5.1 x 6 x 1.6	129 x 153 x 33.5 / 5.1 x 6 x 1.3	129 x 162 x 59 / 5.1 x 6.4 x 2.3	mm / in
Weight (including cables)	655 / 1.4	750 / 1.7	655 / 1.4	845 / 1.9	1064 / 2.3	gr / lb
Input Connector	MC4 <sup>(3)</sup>			Single or dual MC4 <sup>(3)(4)</sup>	MC4 <sup>(3)</sup>	
Input Wire Length	0.16 / 0.52, 0.9 / 2.95 <sup>(4)</sup>	0.16 / 0.52	0.16 / 0.52, 0.9 / 2.95 <sup>(4)</sup>	0.16 / 0.52	0.16 / 0.52	m / ft
Output Wire Type / Connector	Double Insulated / MC4					
Output Wire Length	1.2 / 3.9					m / ft
Operating Temperature Range <sup>(5)</sup>	-40 to +85 / -40 to +185					°C / °F
Protection Rating	IP68 / NEMA6P					
Relative Humidity	0 - 100					%

(1) Rated power of the module at STC will not exceed the optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed.  
 (2) NEC 2017 requires max input voltage be not more than 80V.  
 (3) For other connector types please contact SolarEdge.  
 (4) For dual version for parallel connection of two modules use P485-4NMDMRM. In the case of an odd number of PV modules in one string, installing one P485 dual version power optimizer connected to one PV module. When connecting a single module seal the unused input connectors with the supplied pair of seals.  
 (5) For ambient temperature above +85°C / +185°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details.

PV System Design Using a SolarEdge Inverter <sup>(6)(7)</sup>	Single Phase HD-Wave	Single phase	Three Phase for 208V grid	Three Phase for 277/480V grid	
Minimum String Length (Power Optimizers)	P370, P400, P401 P485, P505	8	10	18	
Maximum String Length (Power Optimizers)		6	8	14	
Maximum Nominal Power per String		25	25	50	
Maximum Nominal Power per String		5700 <sup>(8)</sup> (6000 with SE7600-US - SE11400-US)	5250 <sup>(8)</sup>	6000 <sup>(9)</sup>	12750 <sup>(10)</sup> W
Parallel Strings of Different Lengths or Orientations					Yes

(6) For detailed string sizing information refer to: [http://www.solaredge.com/sites/default/files/string\\_sizing\\_na.pdf](http://www.solaredge.com/sites/default/files/string_sizing_na.pdf)  
 (7) It is not allowed to mix P485/P505 with P370/P400/P401 in one string.  
 (8) If the inverters rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverters maximum input DC power. Refer to: <https://www.solaredge.com/sites/default/files/se-power-optimizer-single-string-design-application-note.pdf>  
 (9) For 208V grid: it is allowed to install up to 7,200W per string when the maximum power difference between each string is 1,000W  
 (10) For 277/480V grid: it is allowed to install up to 15,000W per string when the maximum power difference between each string is 2,000W

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COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
MAITLAND, NC 32751  
TEL: (407) 289-2575  
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PROJECT NAME

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191 SCOTLAND DR,  
SPRING LAKE, NC 28390

SHEET NAME  
DATA SHEET

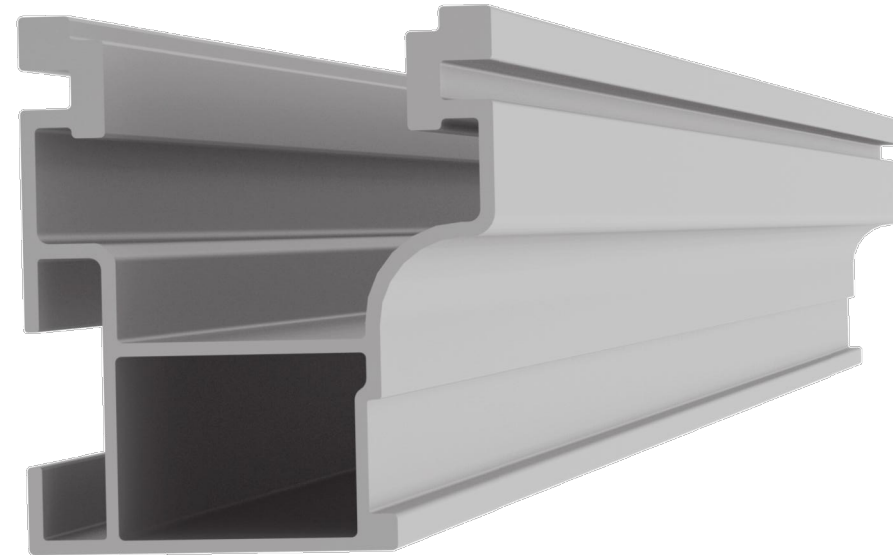
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ANSI B  
11" X 17"

SHEET NUMBER  
DS-03

# Mounting systems for solar technology



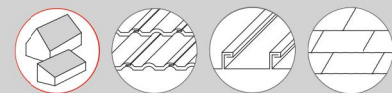
**NEW!**



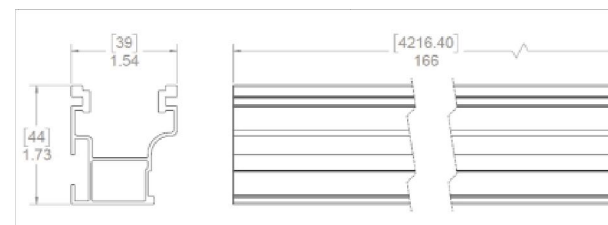
## NEW PRODUCT

# CrossRail 44-X

- ▶ Optimized rail profile
- ▶ One rail for all markets
- ▶ Built-in wire management
- ▶ Maintains same structural integrity as 48-X
- ▶ Tested up to 200 mph winds
- ▶ Tested up to 100 PSF snow loads



Part Number	Description
4000019	CrossRail 44-X 166", Mill
4000020	CrossRail 44-X 166", Dark
4000021	CrossRail 44-X 180", Mill
4000022	CrossRail 44-X 180", Dark
4000051	RailConn Set, CR 44-X, Mill
4000052	RailConn Set, CR 44-X, Dark
4000067	End Cap, Black, CR 44-X



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# Everest Ground Lug

## PRODUCT SHEET

Part Number	Description
4000006-H	Everest Ground Lug Set, 13mm Hex

- ▶ Top mount configuration
- ▶ No copper wire bending makes for simple installation
- ▶ MK3 technology provides highest rail engagement
- ▶ UL 2703 Listed
- ▶ Compatible with 8AWG and 6AWG solid copper wire
- ▶ Works with all CrossRail profiles.

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## Bonding and Grounding

Appropriate means of bonding and grounding are required by regulation. The information provided in this manual shall always be verified with local and national building codes.

Everest Solar Systems has obtained a UL 2703 system listing from Underwriter's Laboratories (UL).

A sample bonding path diagram is shown in Figure 1 below. Your specific installation may vary, based upon site conditions and your AHJ's requirements.

Each electrical connection has been evaluated to a maximum fuse rating of 30A. At least one ground lug per sub array must be used to ground all strings, although additional may be used for redundancy. When installed per these installation instructions, all connections meet the requirements of NEC 690.43.

This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

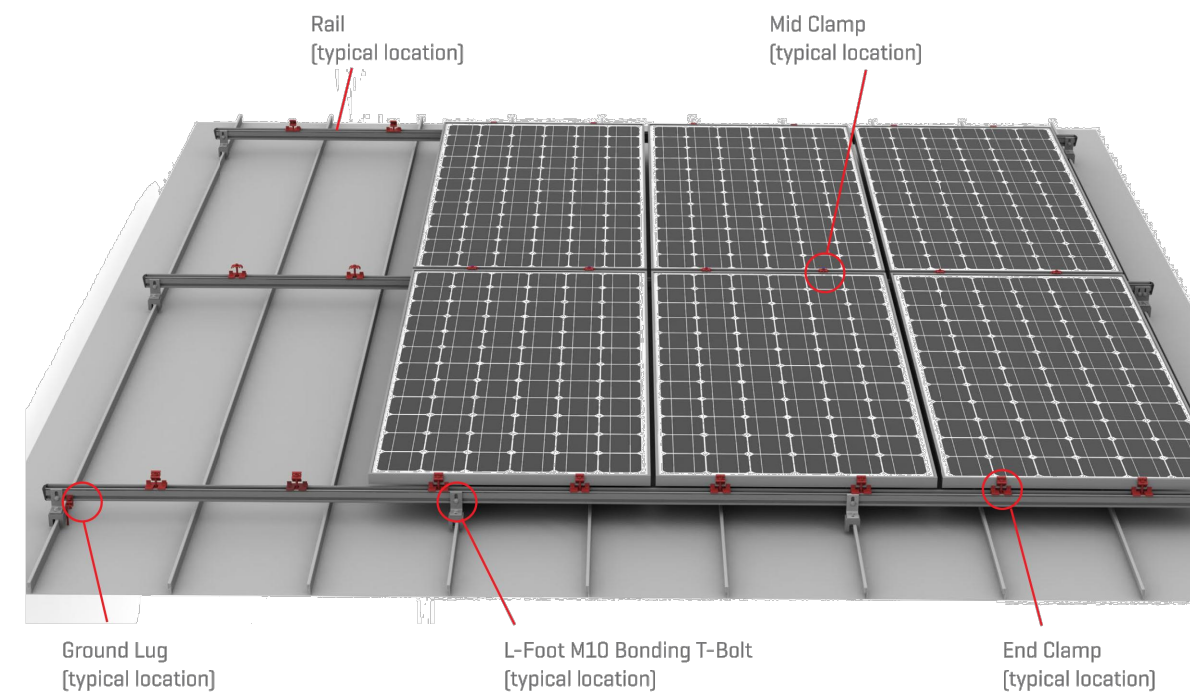


Figure 1: Bonding connections shown in red. For certain jurisdictions, bonding and grounding connections are identified at typical locations.



**CASTILLO ENGINEERING SERVICES, LLC**  
COA # 28345  
620 N. WYMORE ROAD,  
SUITE 250,  
MAITLAND, NC 27251  
TEL: (407) 289-2575  
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SHEET SIZE

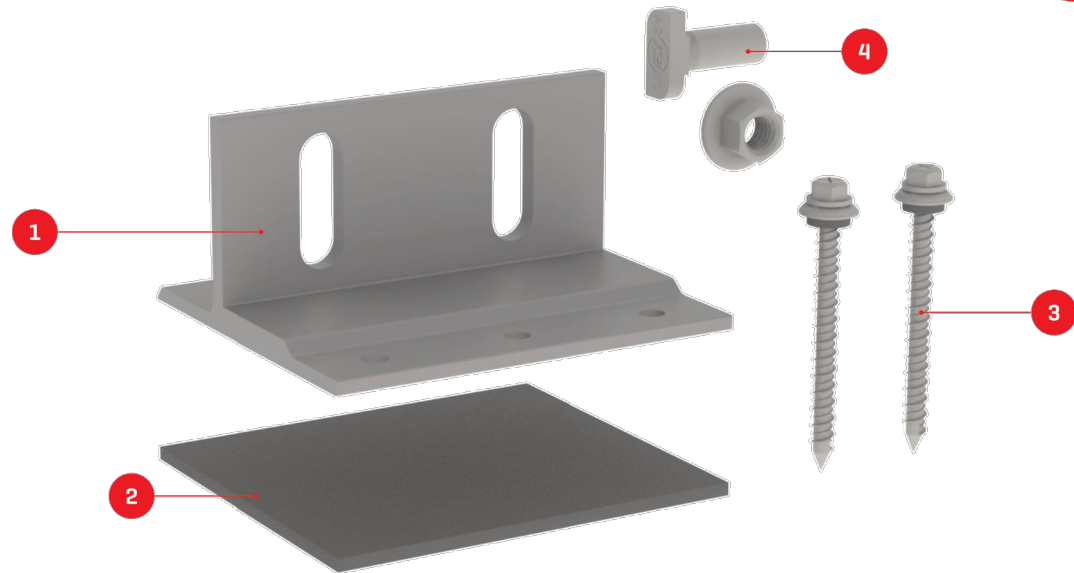
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# Splice Foot X

Patent Pending

## TECHNICAL SHEET

Item Number	Description	Part Number
1	Splice Foot X	4000113   Splice Foot X Kit, Mill
2	K2 FlexFlash Butyl	
3	M5 x 60 lag screws	
4	T-Bolt & Hex Nut Set	

### Technical Data

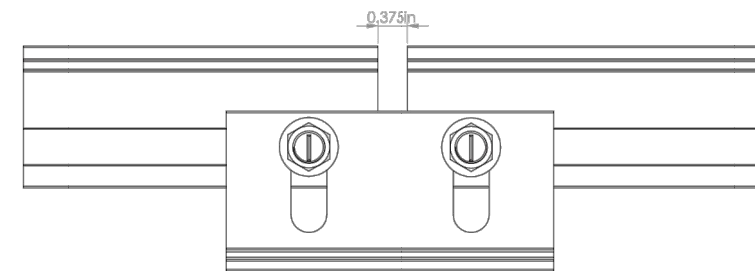
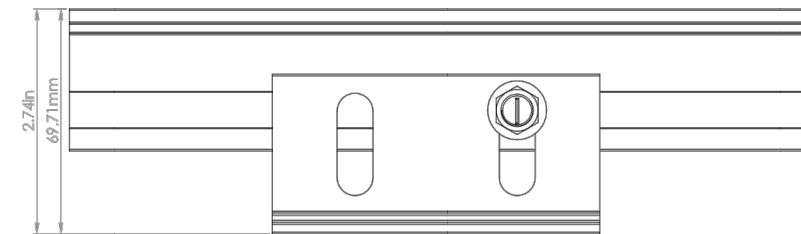
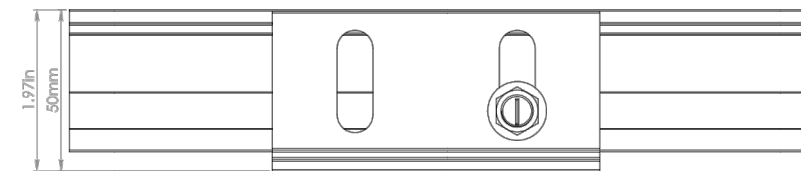
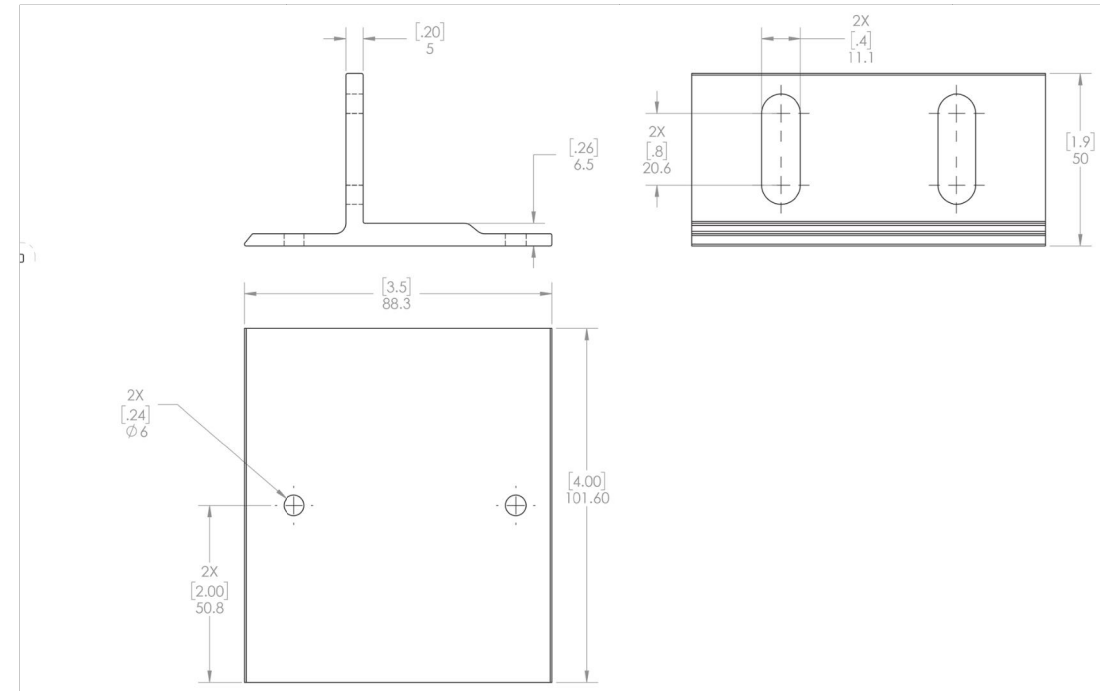
	Splice Foot X
Roof Type	Composition shingle
Material	Aluminum with stainless steel hardware
Finish	Mill
Roof Connection	M5 x 60 lag screws
Code Compliance	UL 2703
Compatibility	CrossRail 44-X, 48-X, 48-XL, 80

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Units: [in] mm



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COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
MAITLAND, NC32751  
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DS-06