# HUGHES RESIDENCE

## 10.800 kW PV SYSTEM

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

NOTICE TO CONTRACTOR
All construction must comply with current NC Building Codes and is subject to field inspection and verification.
APPROVED
Limited building only review
Permit holder responsible for full compliance with the code
08/09/2022
Harnett COUNTY NORTH CAROLINA

## 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

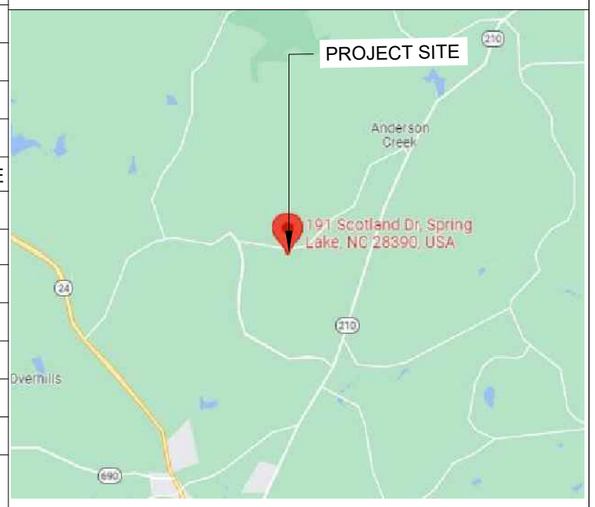
TITAN SOLAR
525 W BASELINE RD,
MESA, AZ 85210
(855) 729-7652

## ENGINEER

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

## HOUSE PHOTO


## VICINITY MAP




## SHEET INDEX



## 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.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ERMOCRATES E. CASTILLO - NC PE 050478




REVISIONS

| DESCRIPTION | DATE | REV |
|---|---|---|
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO
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

## Symbols:

Section..... X / X-XX — Sheet where section is located

Elevation ..... X / X-XX — Detail ID Letter; Sheet where section is located

Detail ..... X / X-XX — Detail ID Letter; Sheet where section is located

Detail ..... (Enlarged Plan) X / X-XX — Detail ID Letter; 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 ..... or 00 — Module with Source Circuit number

Combiner Box ..... CB

AC Disconnect ..... ACD

Main Distribution Panel ..... MDP

Fuse .....

Overcurrent Breaker ..

Inverter .....

Transformer .....

Automatic ..... Transfer Switch ATS

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 SOLAREDGE 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.

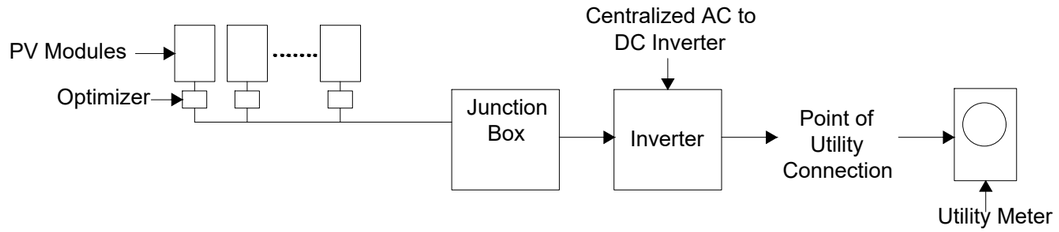



Figure 1: PV System Block Diagram

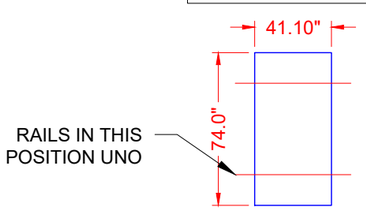
The inverter meets the requirements of IEEE 1547 and UL 1741.

**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)




HANWHA: Q. PEAK DUO ML-G10+ (400W) MODULES

| 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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REVISIONS

| DESCRIPTION | DATE | REV |
|---|---|---|
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

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

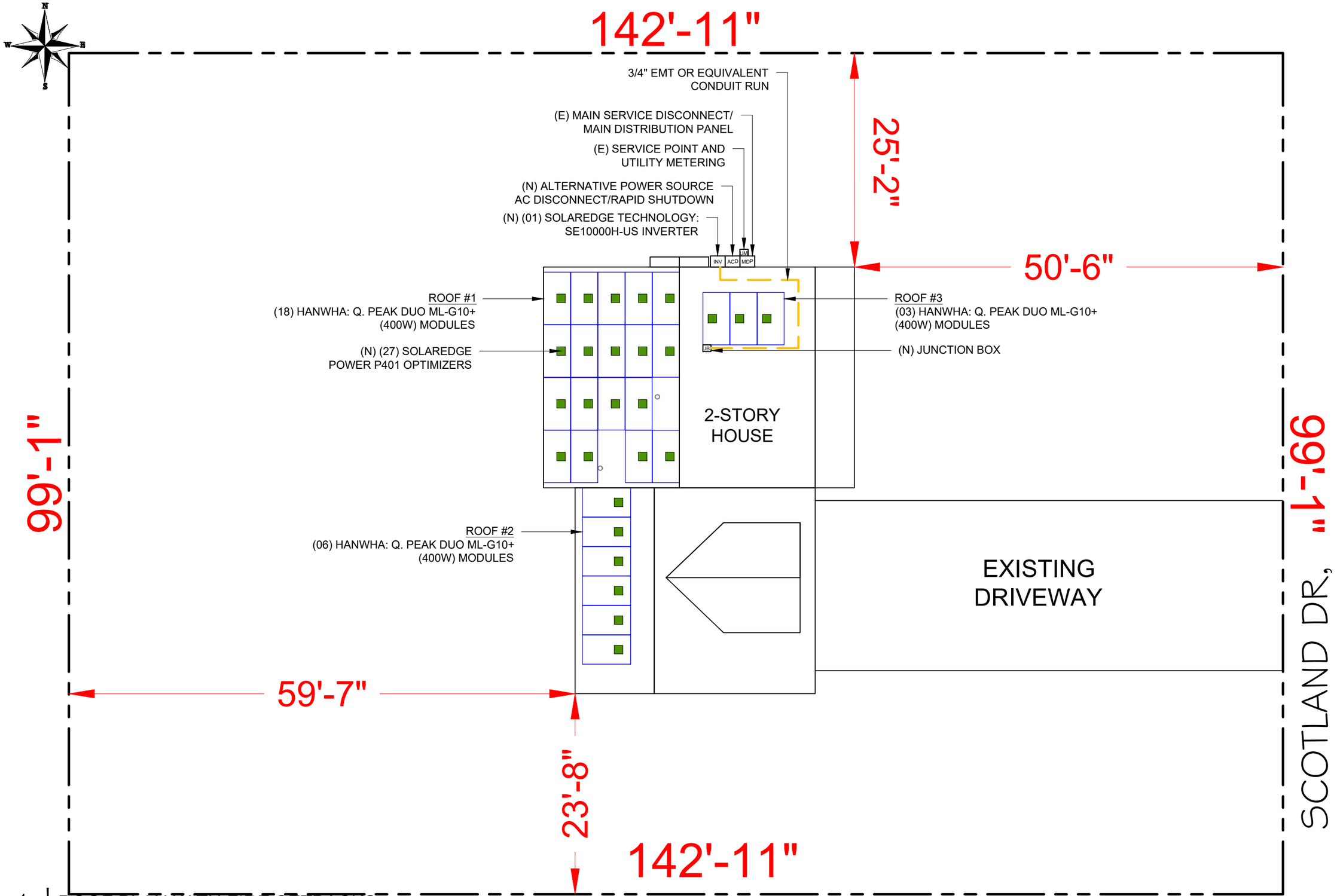
PROJECT NAME

HUGHES RESIDENCE
191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME
NOTES AND DESCRIPTION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
A-00




1 A-01 ROOF PLAN WITH FIRE SETBACKS AND PROPERTY LINES SCALE: 3/32" = 1'-0"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PROJECT INSTALLER

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PROJECT NAME

HUGHES RESIDENCE

191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME

ROOF PLAN

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

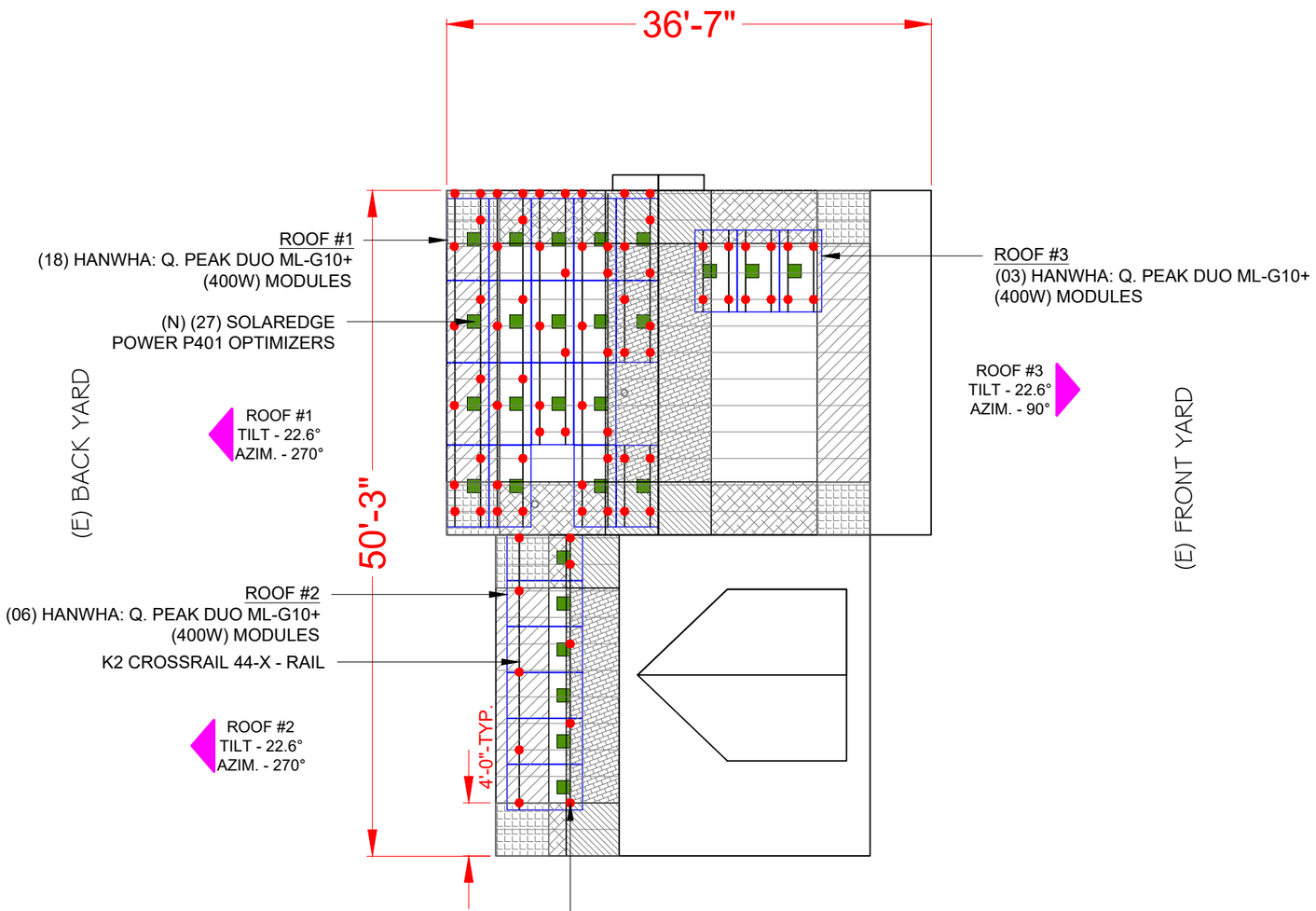
A-01

## 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 | | | | |




1 MODULE LAYOUT
S-01 SCALE: 3/32" = 1'-0"

### 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***

### 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)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REVISIONS

| DESCRIPTION | DATE | REV |
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:09

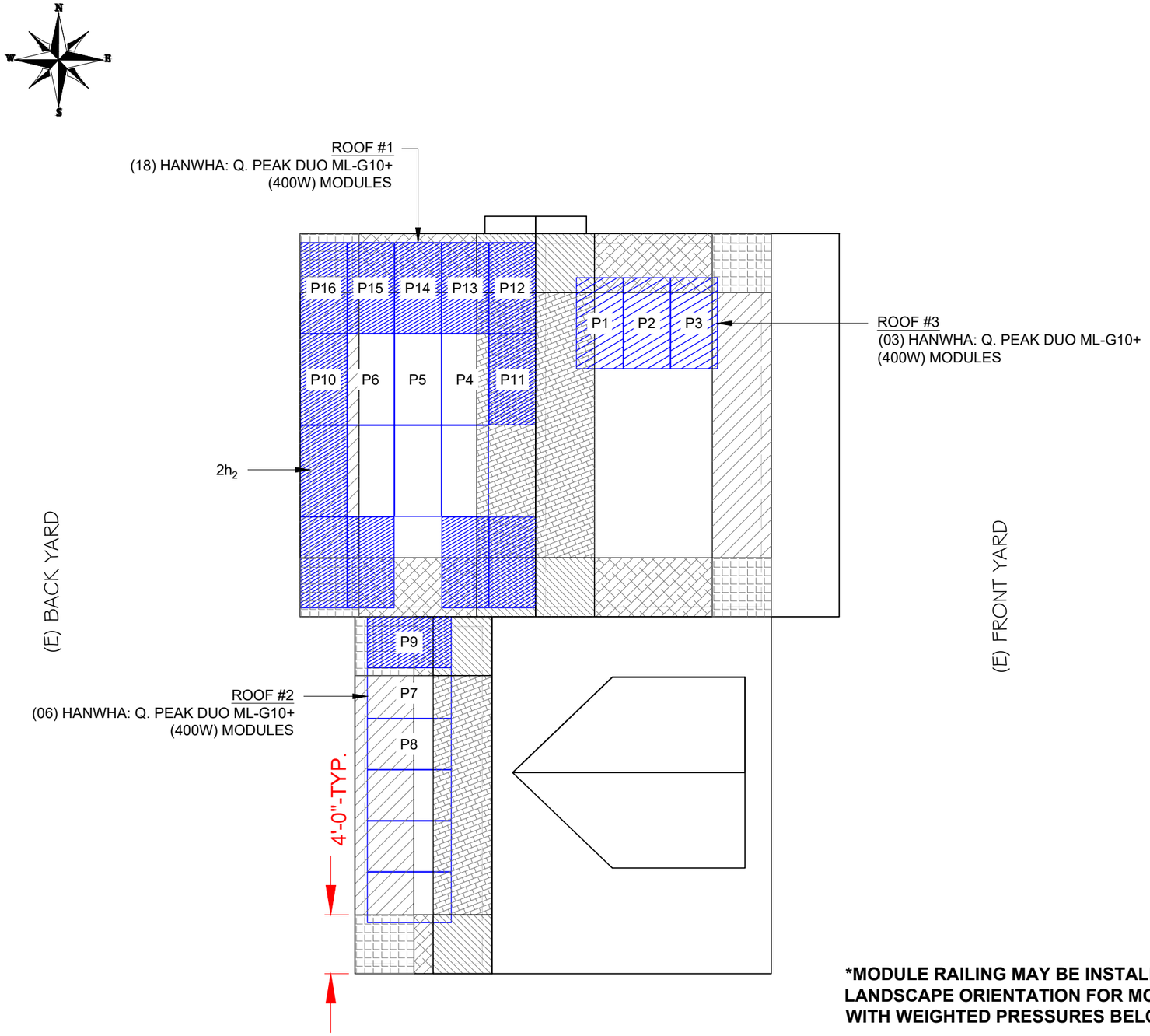
PROJECT NAME

HUGHES RESIDENCE
191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME
MODULE LAYOUT

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
S-01




## 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 |
|---|---|---|---|---|---|---|---|---|
| | 1 | 1' | 2e | 2n | 2r | 3e | 3r | Pressure |
| 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 |
|---|---|---|---|---|---|---|---|---|
| | 1 | 1' | 2e | 2n | 2r | 3e | 3r | Pressure |
| 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 |
|---|---|---|---|---|---|---|---|---|
| | 1 | 1' | 2e | 2n | 2r | 3e | 3r | Pressure |
| 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

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

$2h_2$ 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.

### 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)

1 PARTIAL PRESSURE AND MODULES EXPOSURE

S-01.1 SCALE: 3/32" = 1'-0"

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REVISIONS

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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:09

PROJECT NAME

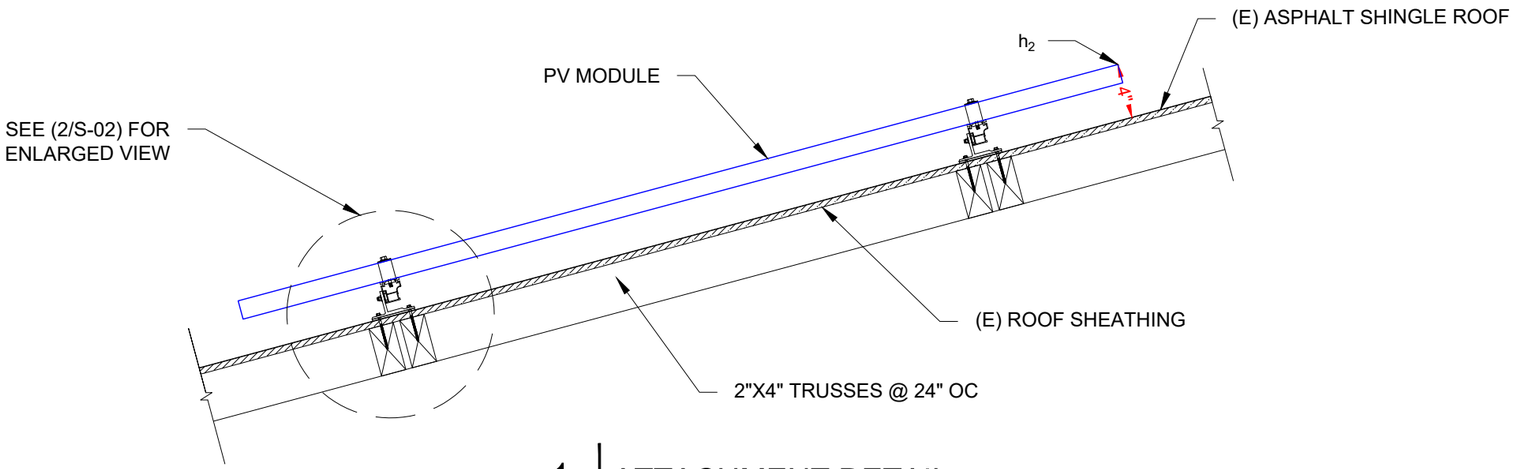
HUGHES RESIDENCE

191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME
PARTIAL PRESSURE AND MODULES EXPOSURE

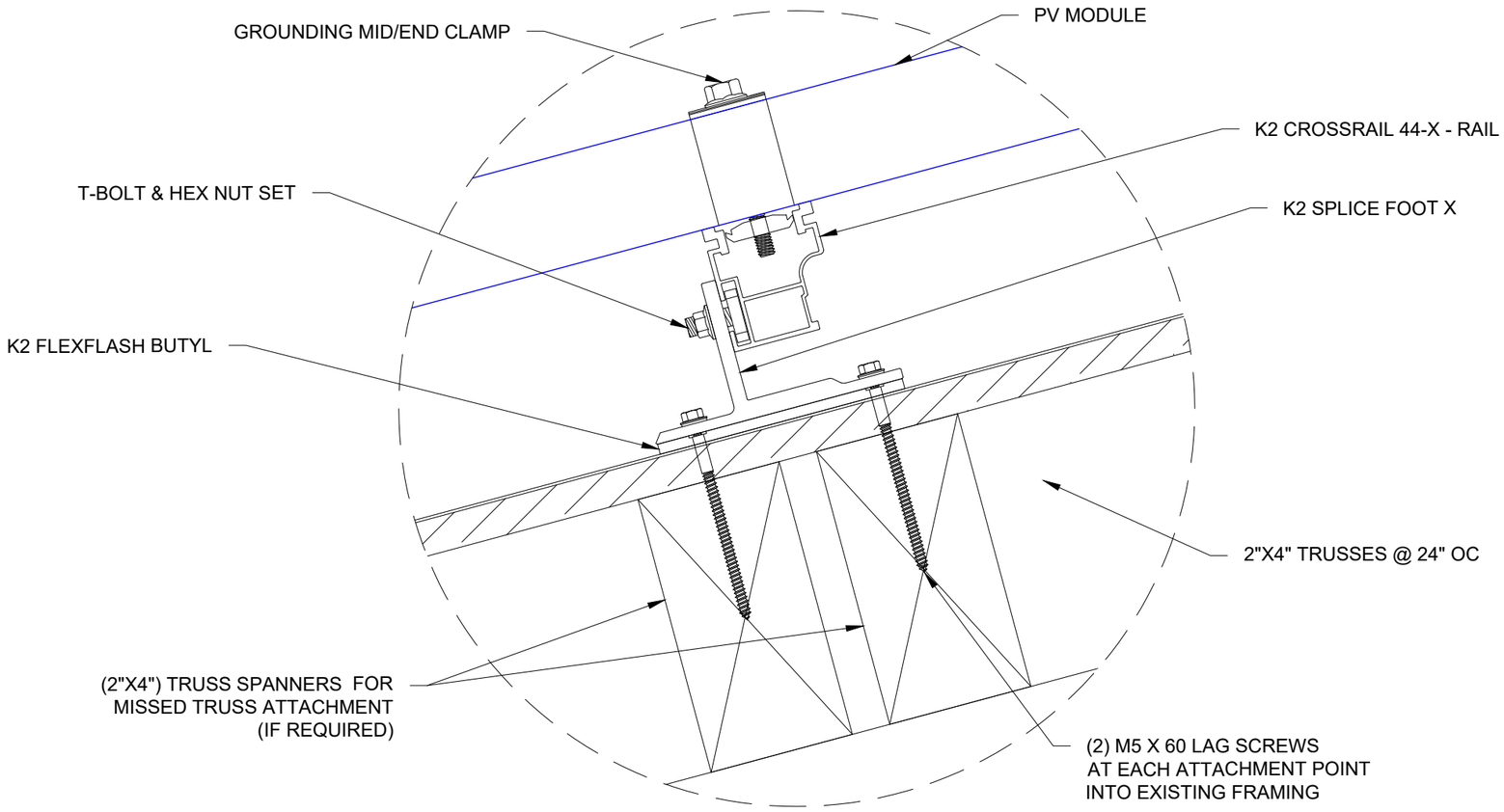
SHEET SIZE
ANSI B
11" X 17"

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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HUGHES RESIDENCE

191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME

ATTACHMENT DETAIL

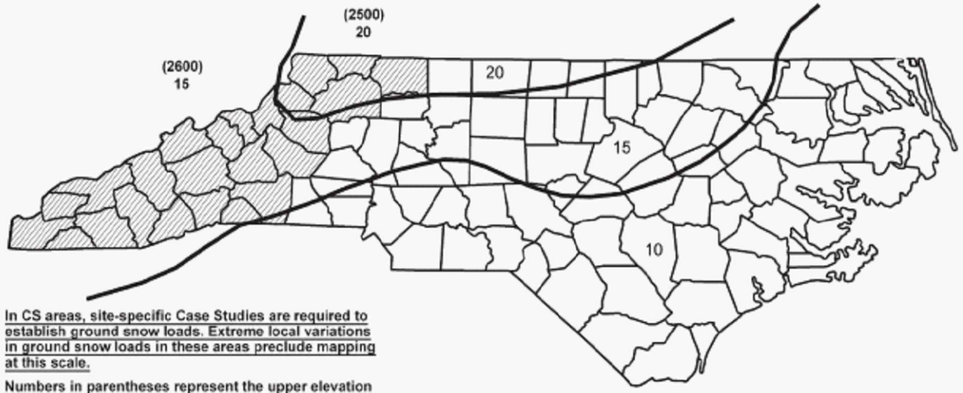
SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

S-02

## SNOW MAP




In CS areas, site-specific Case Studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

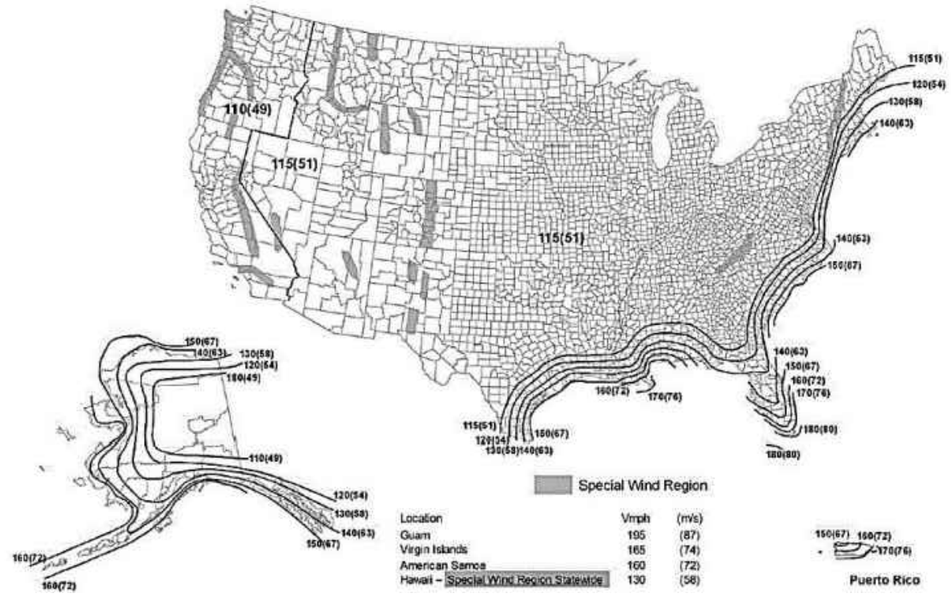
Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.

To convert lb/sq ft to kNm$^2$, multiply by 0.0479.

To convert feet to meters, multiply by 0.3048.

**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 ($C_e$) | 1.000 | |
| MODULE AREA (sq. ft.) | 21.12 | TEMPERATURE FACTOR ($C_t$) | 1.000 | |
| GROUND SNOW LOAD (psf) | 10.00 | IMPORTANCE FACTOR ($I_s$) | 1.000 | |
| COMPONENT AMPLIFICATION ($a_p$) | 1.00 | $h_2$ (ROOF TO MODULE) ft | 0.500 | |
| COMPONENT OPERATING WEIGHT | 48.50 | SPECTRAL ACCELERATION ($S_{DS}$) | 1.172 | |
| COMPONENT RESPONSE FACTOR | 1.50 | TOTAL MODULES IN ARRAY | 27.00 | |
| DEAD LOAD (psf) | 3.00 | SLOPE FACTOR ($C_s$) | 0.910 | |
| SLOPED ROOF SNOW LOAD (psf) | 9.10 | $K_D$ | 0.850 | |
| EFFECTIVE WIND AREA (ft$^2$) | 21.12 | $K_{ZT}$ | 1.000 | |
| GROUND ELEVATION (ft) | 282.0 | $K_e$ | 0.990 | |
| HVHZ | NO | $K_z$ | 0.665 | |

**DESIGN CALCULATIONS**

VELOCITY PRESSURE (q) = $.00256*K_E K_Z K_{ZT} K_D V^2$
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 | Module allowable uplift pressure | 56 | psf |
| 2n | 16.0 | -26.5 | psf | Module allowable down pressure | 76 | psf |
| 2r | 16.0 | -26.5 | psf | | | |
| 3e | 16.0 | -26.5 | psf | | | |
| 3r | 16.0 | -29.9 | psf | | | |

**ARRAY FACTORS**

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

**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 + $E_v$ + $E_h$+ .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 | lbs | | 72 in | 72 in | |
| 1' | 0.0 | X | X | lbs | | X in | X in | |
| 2e | 296.0 | 342.0 | 296.0 | lbs | | 72 in | 72 in | |
| 2n | 296.0 | 328.5 | 328.5 | lbs | | 48 in | 72 in | |
| 2r | 296.0 | 328.5 | 328.5 | lbs | | 48 in | 72 in | |
| 3e | 296.0 | 328.5 | 328.5 | lbs | | 48 in | 72 in | |
| 3r | 296.0 | 370.4 | 370.4 | lbs | | 48 in | 72 in | |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TEL: (407) 289-2575
ERMOCRATES E. CASTILLO - NC PE 050478




REVISIONS

| DESCRIPTION | DATE | REV |
|---|---|---|
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:10

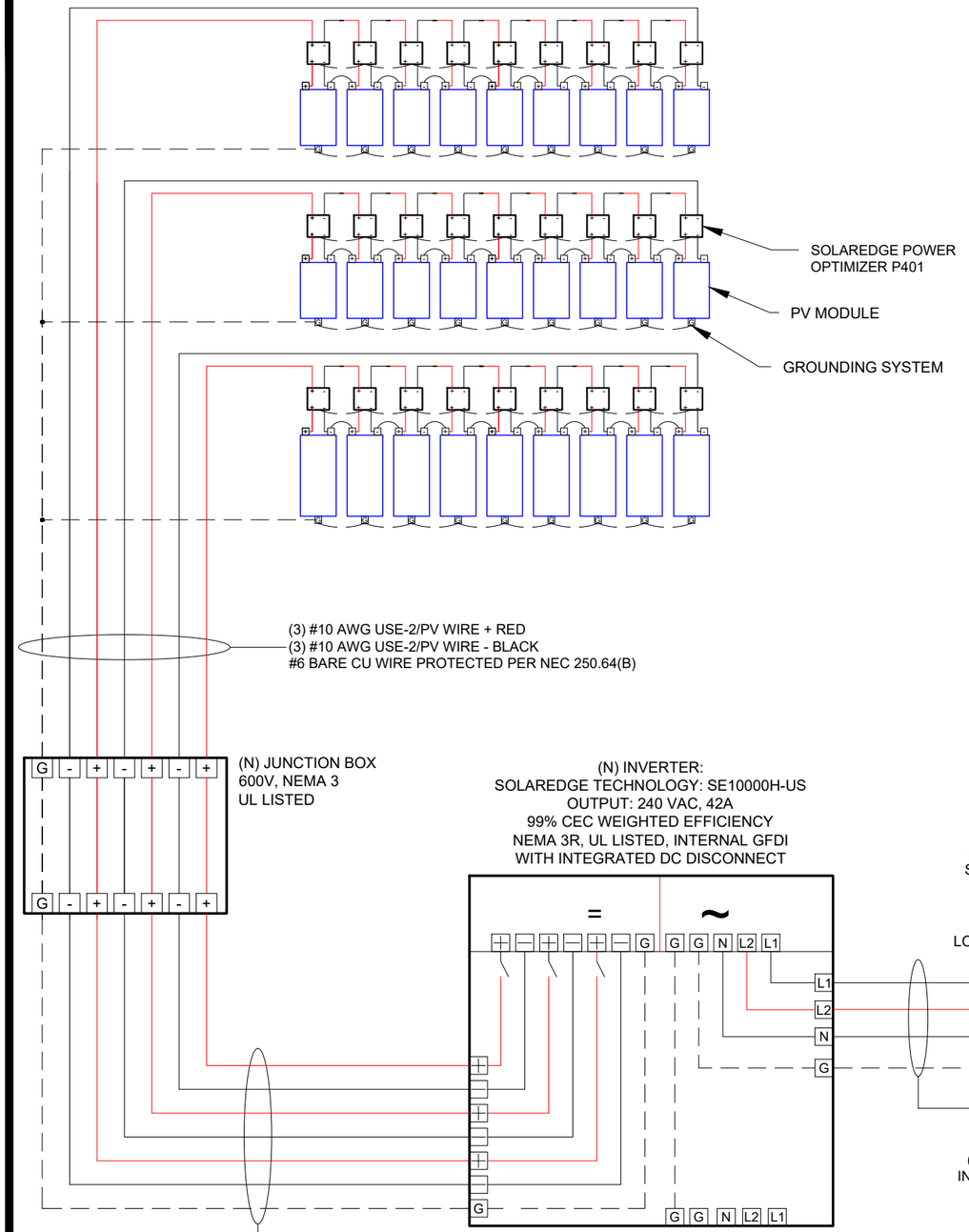
PROJECT NAME

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

SOLAR ARRAY (10.800 KW-DC STC)

| |
|---|
| (27) HANWHA: Q. PEAK DUO ML-G10+ (400W) MODULES |
| (01) STRING OF 09 MODULES CONNECTED TO INPUT #1 |
| (01) STRING OF 09 MODULES CONNECTED TO INPUT #2 |
| (01) STRING OF 09 MODULES CONNECTED TO INPUT #3 |

**NOTE:**

1. SUBJECT PV SYSTEMS HAS BEEN DESIGNED TO MEET THE REQUIREMENTS OF THE NEC 2017, INCLUDING MAXIMUM NUMBER OF MODULE STRINGS, MAXIMUM NUMBER OF MODULES PER STRING, MAXIMUM OUTPUT, MODULE MANUFACTURER AND MODEL NUMBER, INVERTER MANUFACTURER AND MODEL NUMBER, AS APPLICABLE.
2. ALL BREAKERS IN MAIN DISTRIBUTION PANEL ARE SERVICE DISCONNECTS.
3. PER NEC 705.12(B(2)(3)(c) THE SUM OF THE AMPERE RATINGS OF ALL OVERCURRENT DEVICES ON PANELBOARDS, BOTH LOAD AND SUPPLY DEVICES SHALL NOT EXCEED THE AMPACITY OF THE BUSBAR.
4. EXCEPTION: NEC 230.90(A)(3) THE SUM OF THE RATINGS OF CIRCUIT BREAKERS OR FUSES SHALL BE PERMITTED TO EXCEED THE AMPACITY OF THE SERVICE CONDUCTORS, PROVIDED THE CALCULATED LOAD DOES NOT EXCEED THE AMPACITY OF THE SERVICE CONDUCTORS. IT SHALL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO PERFORM LOAD CALCULATIONS AND ENSURE THE REQUIREMENTS OF NEC 705.12 AND/OR 230.90(A)(3) ARE MET.

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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 | 30.72A |
| 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 | |
| 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 | 72.00 |
| 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 | |
| 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 | SOLAREDGE 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.

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ERMOCRATES E. CASTILLO - NC PE 050478



REVISIONS

| DESCRIPTION | DATE | REV |
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:11

PROJECT NAME

HUGHES RESIDENCE
191 SCOTLAND DR,
SPRING LAKE, NC 28390

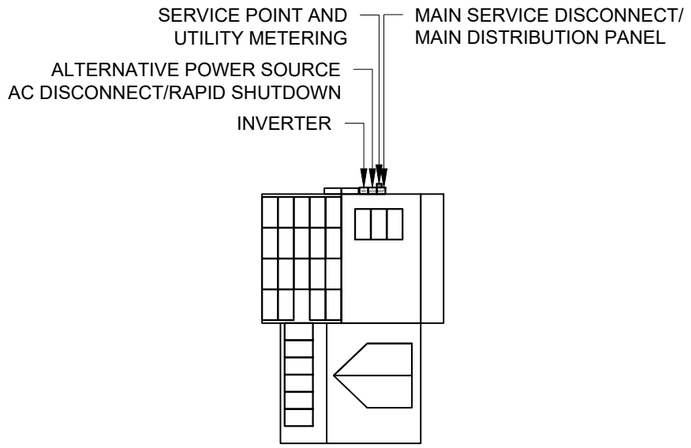
SHEET NAME
WIRING CALCULATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
E-02

# CAUTION!

POWER TO THIS BUILDING
SUPPLIED FROM MULTIPLE SOURCES

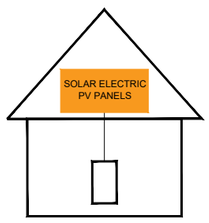



191 SCOTLAND DR, SPRING LAKE, NC 28390

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

## 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**

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

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

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

## 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

| | | |
|---|---|---|
| **MAXIMUM SYSTEM VOLTAGE (VOC)** | 480 | V |
| **MAXIMUM CIRCUIT CURRENT (Isc)** | 27.0 | A |
| **MAXIMUM RATED OUTPUT OF DC TO DC CONVERTER (Idc)** | 15 | A |

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**

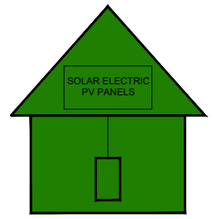
LABEL LOCATION:
CONDUIT, COMBINER BOX
(ADDITIONAL EQUIPMENT THAT
CONTAINS PV SOURCE WIRES
(PER CODE: NEC 690.31(G)(3))

## 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)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620 N. WYMORE ROAD,
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ERMOCRATES E. CASTILLO - NC PE 050478




REVISIONS

| DESCRIPTION | DATE | REV |
|---|---|---|
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:11

PROJECT NAME

HUGHES RESIDENCE

191 SCOTLAND DR,
SPRING LAKE, NC 28390

SHEET NAME

SYSTEM LABELING

SHEET SIZE

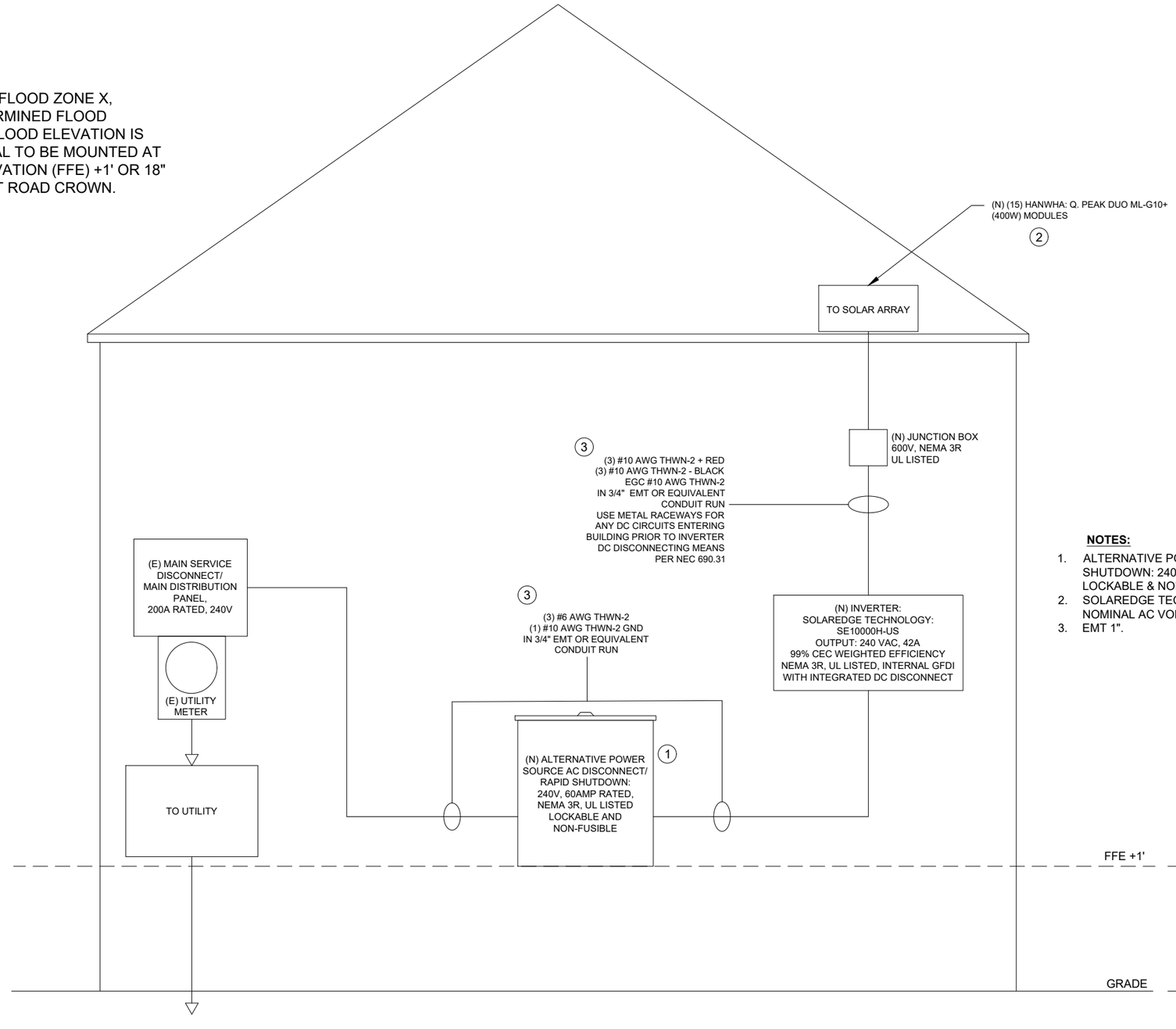
ANSI B
11" X 17"

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. SOLAREDGE TECHNOLOGY: SE10000H-US INVERTER, 240V NOMINAL AC VOLTAGE AND 42A MAXIMUM OUTPUT CURRENT.
3. EMT 1".

1 RISER DAIGRAM
E-03.1 SCALE: NTS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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


# Q.PEAK DUO BLK ML-G10+

## 385-405

ENDURING HIGH PERFORMANCE

25 YR Warranty
Product & Performance

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2021

Q CELLS
Yield Security

### 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[1], 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[2].

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

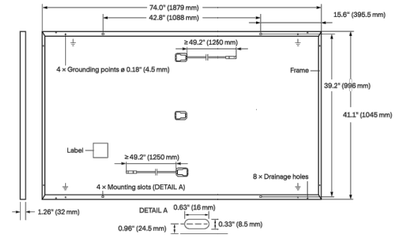
### THE IDEAL SOLUTION FOR:

Rooftop arrays on residential buildings

Engineered in Germany

## MECHANICAL SPECIFICATION

| | |
|---|---|
| Format | 74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 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 × 22 monocrystalline Q.ANTUM solar half cells |
| Junction Box | 2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes |
| Cable | 4 mm² Solar cable; (+) ≥ 49.2 in (1250 mm), (–) ≥ 49.2 in (1250 mm) |
| Connector | Stäubli MC4; IP68 |

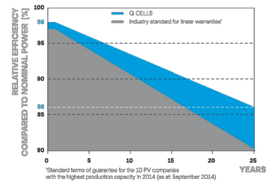



## ELECTRICAL CHARACTERISTICS

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

[1] Measurement tolerances $P_{MPP}$ ±3%; $I_{SC}$; $V_{OC}$ ±5% at STC: 1000 W/m², 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • [2] 800 W/m², NMOT, spectrum AM 1.5

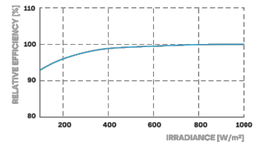
### Q CELLS PERFORMANCE WARRANTY




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.

### PERFORMANCE AT LOW IRRADIANCE




Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

| TEMPERATURE COEFFICIENTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature Coefficient of $I_{SC}$ | α | [%/K] | +0.04 | Temperature Coefficient of $V_{OC}$ | β | [%/K] | –0.27 |
| Temperature Coefficient of $P_{MPP}$ | γ | [%/K] | –0.34 | Nominal Module Operating Temperature | NMOT | [°F] | 109 ± 5.4 (43 ± 3 °C) |

## PROPERTIES FOR SYSTEM DESIGN

| | | | |
|---|---|---|---|
| Maximum System Voltage $V_{SYS}$ | [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[3] | [lbs/ft²] | 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[3] | [lbs/ft²] | 113 (5400 Pa) / 84 (4000 Pa) | | |

[3] 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), QCPV Certification ongoing.

CSA Certified US UL 61730 · CE · TÜVRheinland CERTIFIED www.tuv.com ID 1111220277

## 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.

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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



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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

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Date: 2022.07.27 13:32:12

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

# 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-XXXXXBXX4 | | | | | | | |
| **OUTPUT** | | | | | | | | |
| Rated AC Power Output | 3000 | 3800 @ 240V<br>3300 @ 208V | 5000 | 6000 @ 240V<br>5000 @ 208V | 7600 | 10000 | 11400 @ 240V<br>10000 @ 208V | VA |
| Maximum AC Power Output | 3000 | 3800 @ 240V<br>3300 @ 208V | 5000 | 6000 @ 240V<br>5000 @ 208V | 7600 | 10000 | 11400 @ 240V<br>10000 @ 208V | VA |
| AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Vac |
| AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229) | - | ✓ | - | ✓ | - | - | ✓ | Vac |
| AC Frequency (Nominal) | 59.3 - 60 - 60.5[1] | | | | | | | Hz |
| Maximum Continuous Output Current @240V | 12.5 | 16 | 21 | 25 | 32 | 42 | 47.5 | A |
| Maximum Continuous Output Current @208V | - | 16 | - | 24 | - | - | 48.5 | A |
| Power Factor | 1, adjustable -0.85 to 0.85 | | | | | | | |
| GFDI Threshold | 1 | | | | | | | A |
| Utility Monitoring, Islanding Protection, Country Configurable Thresholds | Yes | | | | | | | |
| **INPUT** | | | | | | | | |
| Maximum DC Power @240V | 4650 | 5900 | 7750 | 9300 | 11800 | 15500 | 17650 | W |
| Maximum DC Power @208V | - | 5100 | - | 7750 | - | - | 15500 | W |
| Transformer-less, Ungrounded | Yes | | | | | | | |
| Maximum Input Voltage | 480 | | | | | | | Vdc |
| Nominal DC Input Voltage | 380 | | | | 400 | | | Vdc |
| Maximum Input Current @240V[2] | 8.5 | 10.5 | 13.5 | 16.5 | 20 | 27 | 30.5 | Adc |
| Maximum Input Current @208V[2] | - | 9 | - | 13.5 | - | - | 27 | Adc |
| Max. Input Short Circuit Current | 45 | | | | | | | Adc |
| Reverse-Polarity Protection | Yes | | | | | | | |
| Ground-Fault Isolation Detection | 600kΩ Sensitivity | | | | | | | |
| Maximum Inverter Efficiency | 99 | 99.2 | | | | | | % |
| CEC Weighted Efficiency | 99 | | | | | | 99 @ 240V<br>98.5 @ 208V | % |
| Nighttime Power Consumption | < 2.5 | | | | | | | W |

[1] For other regional settings please contact SolarEdge support
[2] A higher current source may be used; the inverter will limit its input current to the values stated

# 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 | |
|---|---|---|---|---|---|---|---|---|
| **ADDITIONAL FEATURES** | | | | | | | | |
| Supported Communication Interfaces | RS485, Ethernet, ZigBee (optional), Cellular (optional) | | | | | | | |
| Revenue Grade Data, ANSI C12.20 | Optional[3] | | | | | | | |
| 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 | | | | | | | |
| **STANDARD COMPLIANCE** | | | | | | | | |
| Safety | UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07 | | | | | | | |
| Grid Connection Standards | IEEE1547, Rule 21, Rule 14 (HI) | | | | | | | |
| Emissions | FCC Part 15 Class B | | | | | | | |
| **INSTALLATION SPECIFICATIONS** | | | | | | | | |
| AC Output Conduit Size / AWG Range | 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[4] | | | | | | | °F / °C |
| Protection Rating | NEMA 4X (Inverter with Safety Switch) | | | | | | | |

[3] Revenue grade inverter P/N: SExxxxH-US000BNC4
[4] 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



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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

solaredge


# 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) | |
|---|---|---|---|---|---|---|
| **INPUT** | | | | | | |
| Rated Input DC Power(1) | 370 | 400 | | 485 | 505 | W |
| Absolute Maximum Input Voltage (Voc at lowest temperature) | 60 | 80 | 60 | 125(2) | 83(2) | 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 | | | | | % |
| Overvoltage Category | II | | | | | |
| **OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)** | | | | | | |
| Maximum Output Current | 15 | | | | | Adc |
| Maximum Output Voltage | 60 | | | 85 | | Vdc |
| **OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)** | | | | | | |
| Safety Output Voltage per Power Optimizer | 1 ± 0.1 | | | | | Vdc |
| **STANDARD COMPLIANCE** | | | | | | |
| 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 | | | | | |
| **INSTALLATION SPECIFICATIONS** | | | | | | |
| 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 1.16 | 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(3) | | | Single or dual MC4(3)(4) | MC4(3) | |
| Input Wire Length | 0.16 / 0.52, 0.9 / 2.95(4) | 0.16 / 0.52 | 0.16 / 0.52, 0.9 / 2.95(4) | 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(5) | -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(6)(7) | | 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 | 8 | | 10 | 18 | |
| | P485, P505 | 6 | | 8 | 14 | |
| Maximum String Length (Power Optimizers) | | 25 | | 25 | 50 | |
| Maximum Nominal Power per String | | 5700(8) (6000 with SE7600-US - SE11400-US) | 5250(8) | 6000(9) | 12750(10) | 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
(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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HUGHES RESIDENCE

191 SCOTLAND DR,
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SHEET NAME

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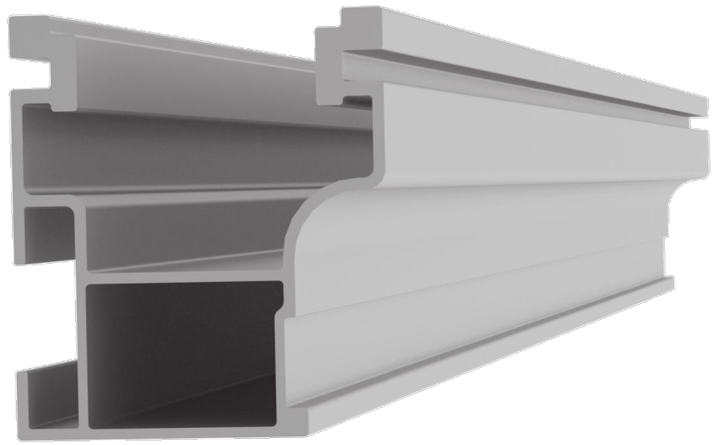
DS-03

Mounting systems for solar technology

EVEREST solar systems

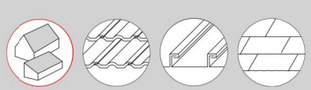
NEW!



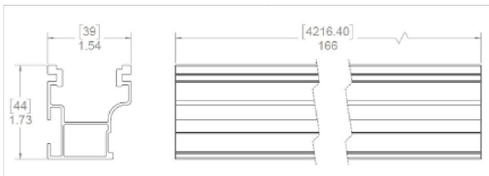
NEW PRODUCT

# 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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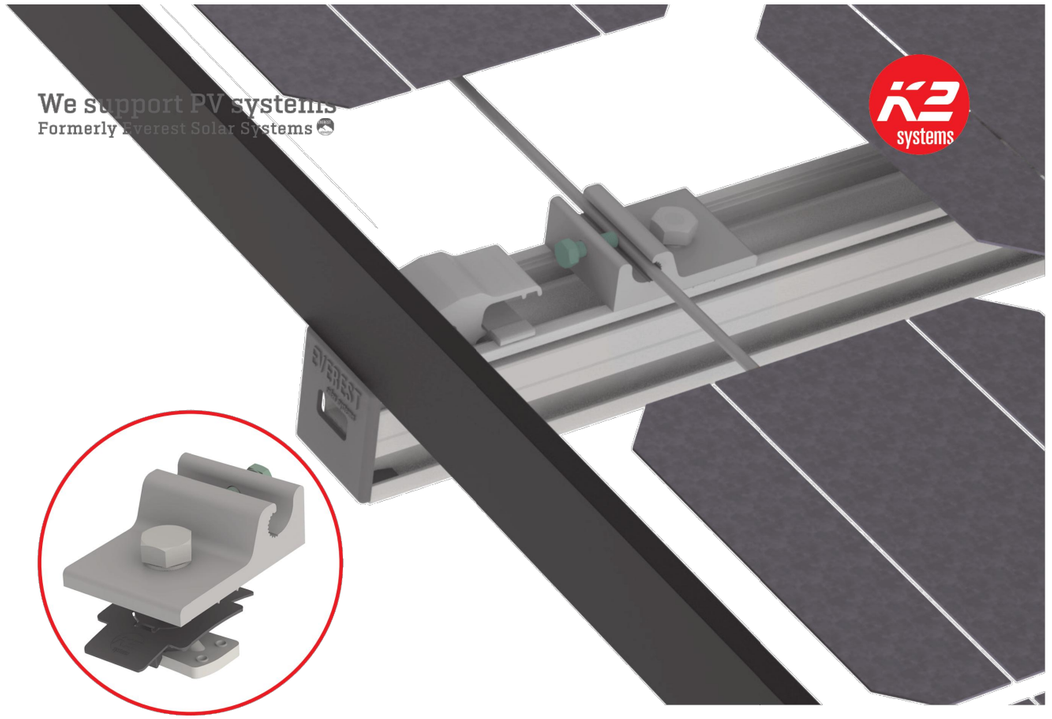
DS-04




# 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.

## 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.

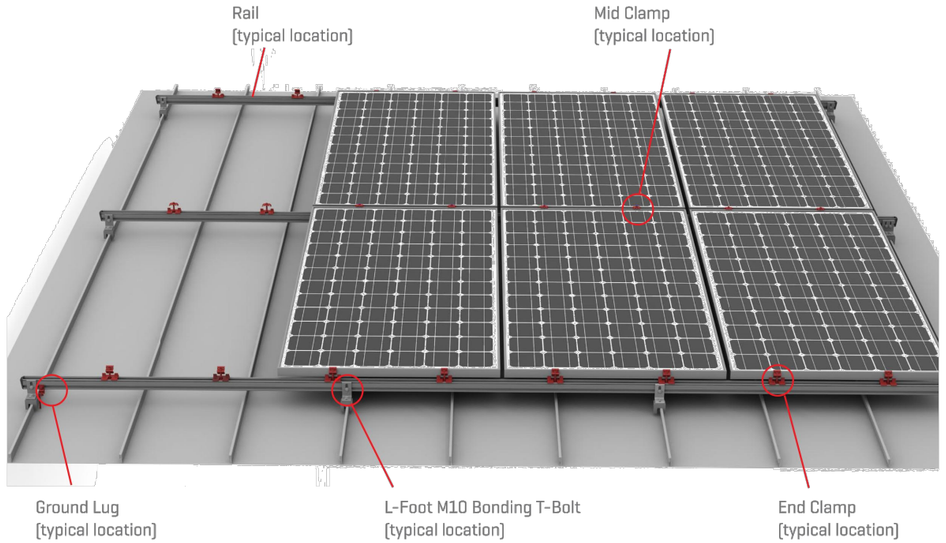



Figure 1: Bonding connections shown in red. For certain jurisdictions, bonding and grounding connections are identified at typical locations.



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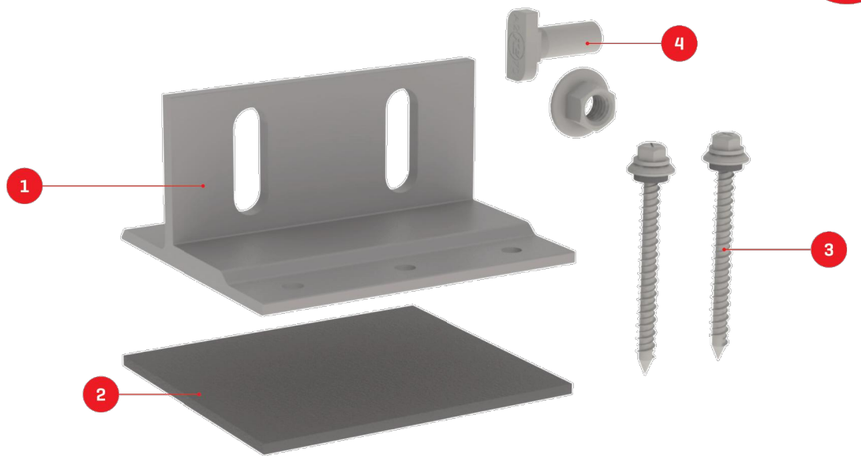
SHEET NAME
DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-05

We support PV systems
Formerly Everest Solar Systems




# 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 | |

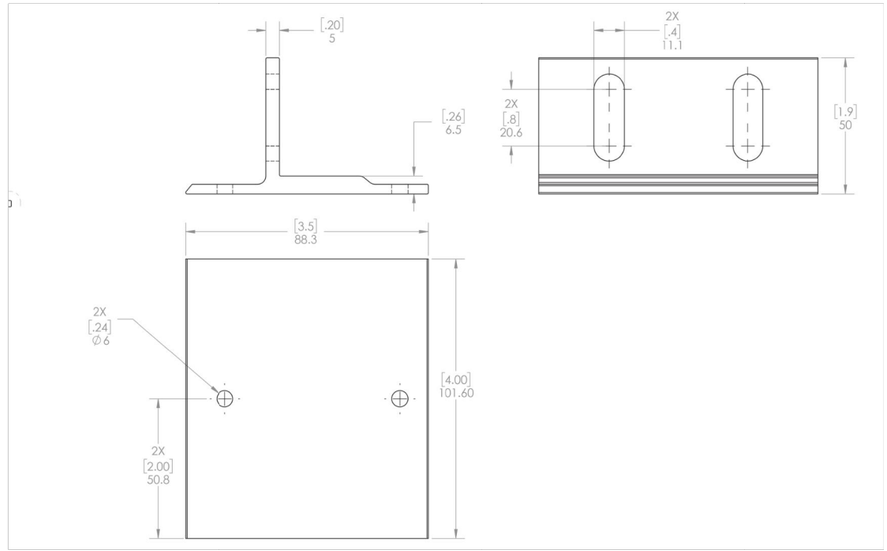
### Technical Data

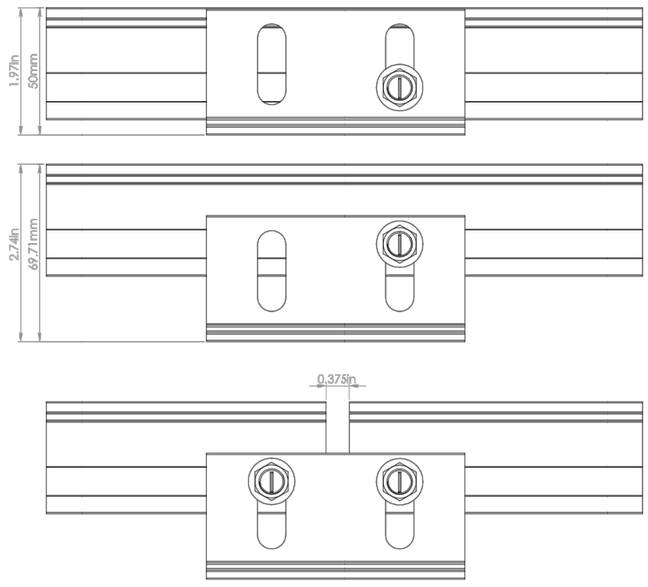
| | Splice Foot X |
|---|---|
| Roof Type | Composition shingle |
| Material | Aluminum with stainless steel hardware |
| Finish | Mill |
| Roof Connection | M5 x 60 lag screws |
| Code Compliance | UL 2703 |
| Compatibility | CrossRail 44-X, 48-X, 48-XL, 80 |



We support PV systems
Formerly Everest Solar Systems

Units: [in] mm



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620 N. WYMORE ROAD,
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MAITLAND, NC32751
TEL: (407) 289-2575
ERMOCRATES E. CASTILLO - NC PE 050478



REVISIONS

| DESCRIPTION | DATE | REV |
|---|---|---|
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PROJECT INSTALLER

TITAN SOLAR POWER

NORTH CAROLINA PROFESSIONAL SEAL 050478 ENGINEER ERMOCRATES E. CASTILLO

Digitally signed by: Ermocrates E Castillo
Date: 2022.07.27 13:32:14

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-06