

HETRICK RESIDENCE  
13.600kW PV SYSTEM  
446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055



CASTILLO ENGINEERING SERVICES, LLC  
COA# 28345  
620 N. WYMORE ROAD,  
SUITE 250,  
MAITLAND, FL 32751  
TEL: (407) 289-2575  
ERMOCRATES E. CASTILLO - FL PE 52590

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PROJECT INSTALLER

SEM POWER

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Date:  
2022.05.11  
12:23:59

HETRICK RESIDENCE

446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME

COVER SHEET

SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

G-01

| PROJECT DESCRIPTION:   | CODES AND STANDARDS   | OWNER  | HOUSE PHOTO                           |
|--|---|--|---------------------------------------|
| <p>34x400 HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES<br/>ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES<br/>SYSTEM SIZE: 13.600 kW DC STC<br/>ARRAY AREA #1: 718.11 SQ FT.</p> <p>EQUIPMENT SUMMARY<br/>34 HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES<br/>34 ENPHASE: IQ7PLUS-72-2-US MICROINVERTERS</p> <p>RACKING: IRONRIDGE XR100<br/>ATTACHMENT: S-5-PROTEA</p> <p>DESIGN CRITERIA:<br/>WIND SPEED (ULT): 130 MPH<br/>WIND SPEED (ASD): 101 MPH<br/>RISK CATEGORY: II<br/>EXPOSURE: B</p> | <p>GOVERNING CODES :<br/>FLORIDA RESIDENTIAL CODE, 7TH EDITION 2020 (FRC)<br/>FLORIDA PLUMBING CODE, 7TH EDITION 2020 (FPC)<br/>FLORIDA BUILDING CODE, 7TH EDITION 2020 (FBC)<br/>FLORIDA MECHANICAL CODE, 7TH EDITION 2020 (FMC)<br/>NATIONAL ELECTRICAL CODE 2017 (NEC)<br/>ASCE 7-16</p>   | HETRICK, CHRISTOPHER   |                                       |
|  |   | INSTALLER  |                                       |
|  |   | SEM POWER LLC<br>4466 Eagle Falls Pl, Tampa,<br>FL 33619, United States<br>(888) 496-1119  |                                       |
|  |   | ENGINEER   |                                       |
|  |   | Castillo Engineering Services LLC<br>620 N. Wymore Road, Suite 250, Maitland, FL 32751<br>TEL: (407) 289-2575<br>Ermocrates E. Castillo<br>License#: FL PE 52590 |                                       |
|  |   | SHEET INDEX  |                                       |
| STRUCTURAL CERTIFICATION:  | ELECTRICAL CERTIFICATION:   |  | VICINITY MAP                          |
| <p>I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC: RESIDENTIAL 2020 7th ED., CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES, AND EQUIPMENT DEAD LOADS.</p>   | <p>I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE FLORIDA BUILDING CODE. FBC 107, THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION</p> | SHEET #  | SHEET DESCRIPTION                     |
|  |   | G-01   | COVER SHEET                           |
|  |   | A-00   | NOTES AND DESCRIPTION                 |
|  |   | A-01   | ROOF PLAN                             |
|  |   | S-01   | MODULE LAYOUT                         |
|  |   | S-01.1   | PARTIAL PRESSURE AND MODULES EXPOSURE |
|  |   | S-02   | ATTACHMENT DETAIL                     |
|  |   | S-02.1   | STRUCTURE CALCULATION                 |
|  |   | E-01   | ELECTRICAL LINE DIAGRAM               |
|  |   | E-02   | WIRING CALCULATIONS                   |
|  |   | E-03   | SYSTEM LABELING                       |
|  |   | DS-01-06   | DATA SHEETS                           |
|  |   |  |                                       |

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

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 .....

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 34x400 HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) Modules with a combined STC rated dc output power of 13,600 W. The modules are connected into 34 ENPHASE: IQ7PLUS-72-2-US Microinverters. 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.

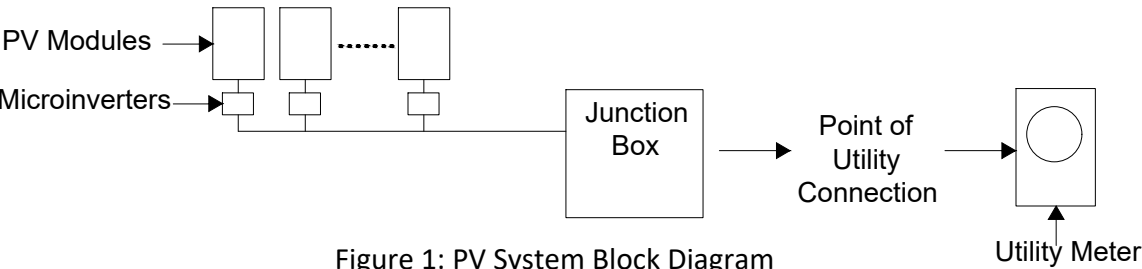


Figure 1: PV System Block Diagram

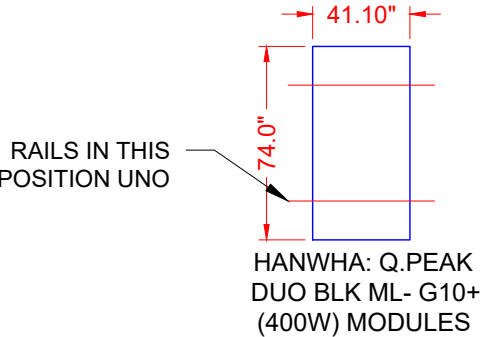
The inverter meets the requirements of IEEE 1547 and UL 1741.

**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             | 75  |
| UPLIFT PRESSURE, 2 RAILS  | 55  |

**Castillo Engineering**  
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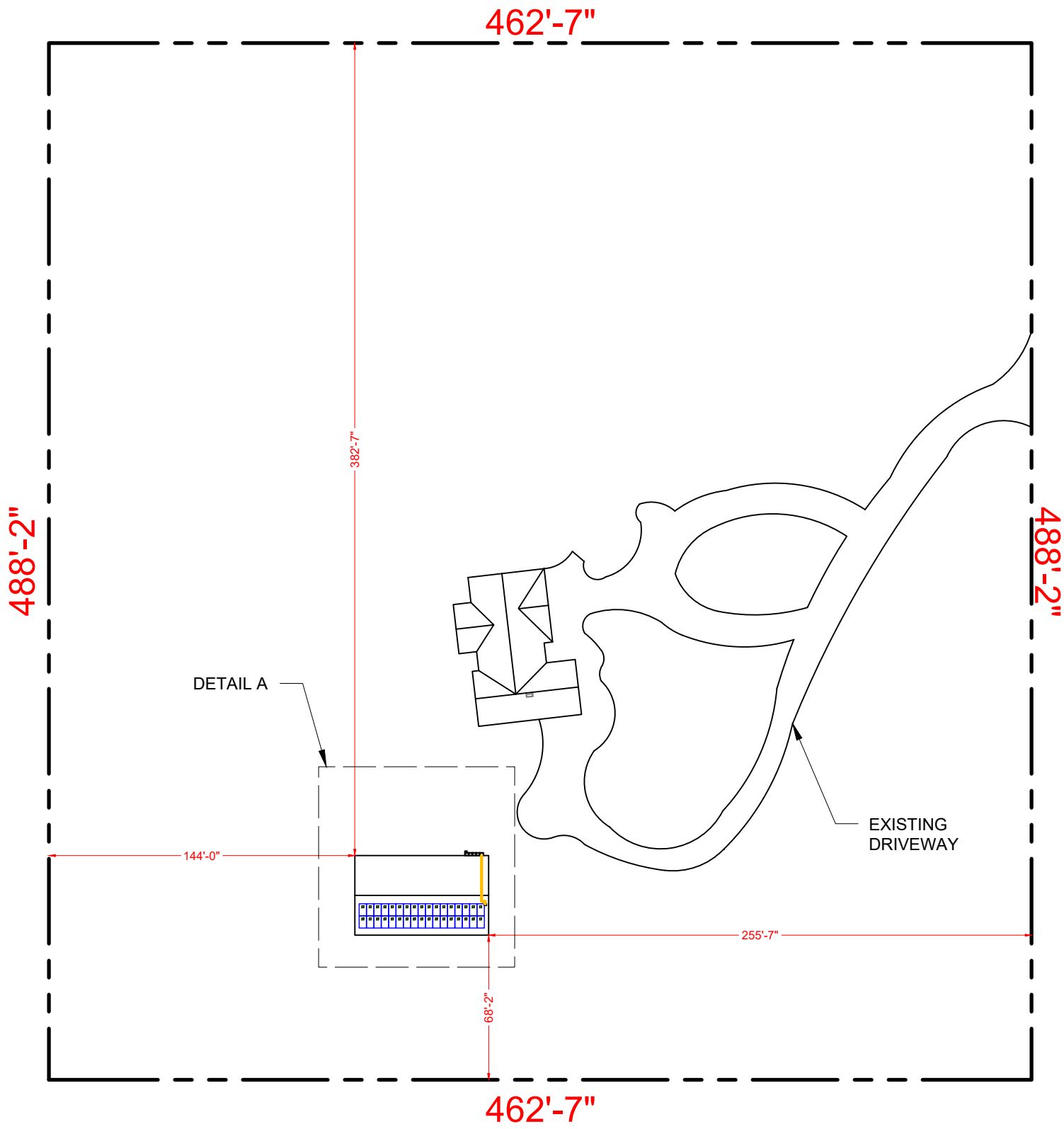
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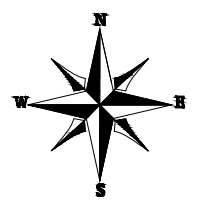
SHEET NAME  
NOTES AND DESCRIPTION

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

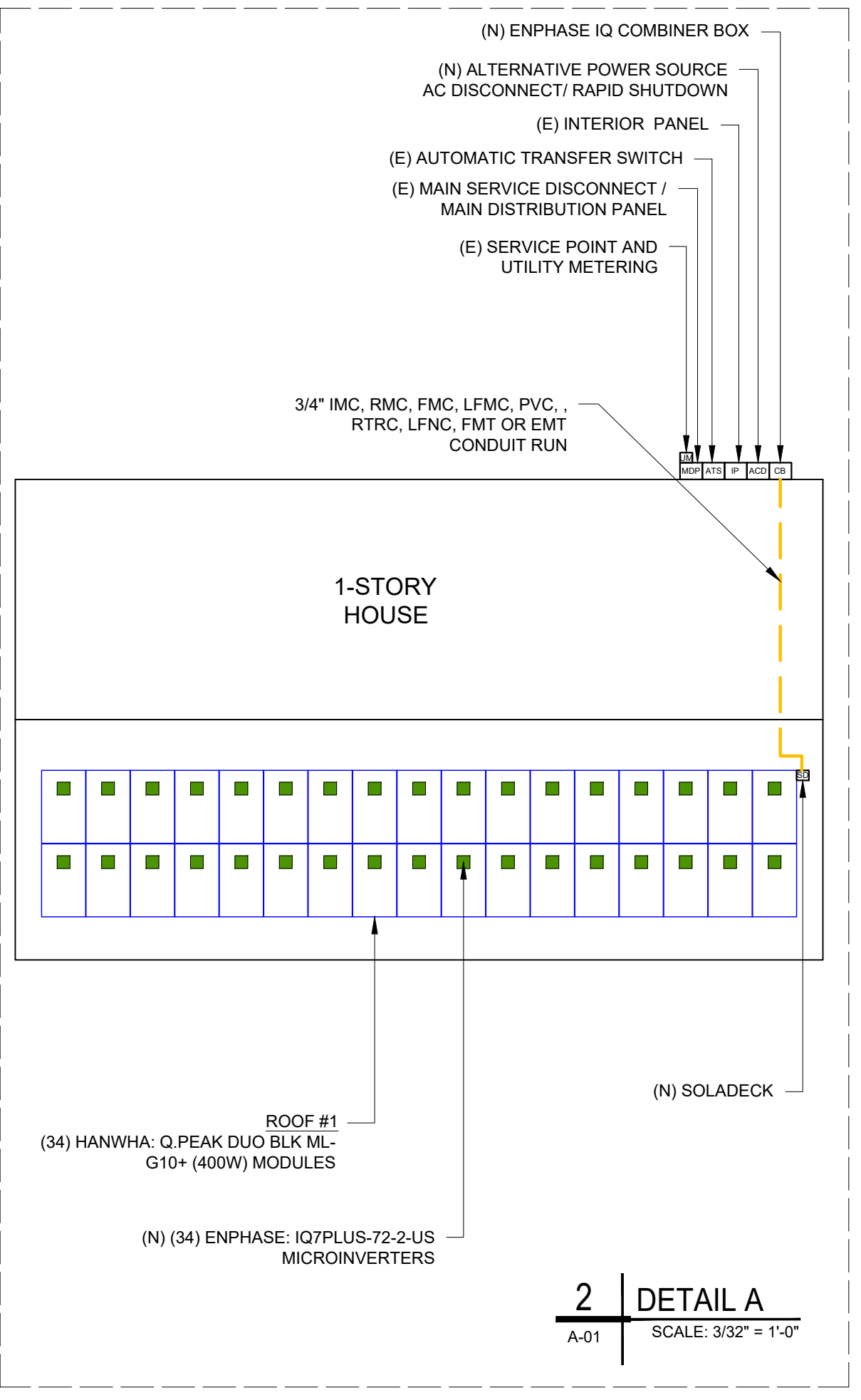
SHEET NUMBER  
**A-00**



1 | ROOF PLAN AND PROPERTY LINES  
A-01 | SCALE: 1/64" = 1'-0"



NW CAMBRIDGE HILL WAY,



ROOF #1  
(34) HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) MODULES  
(N) (34) ENPHASE: IQ7PLUS-72-2-US MICROINVERTERS

2 | DETAIL A  
A-01 | SCALE: 3/32" = 1'-0"

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PROJECT INSTALLER

**SEM POWER**

Signature with Seal  
No. 52590  
STATE OF FLORIDA  
Professional Engineer  
ERMOCRATES E. CASTILLO

Digitally signed by:  
Ermocrates E Castillo  
Date:  
2022.05.11 12:23:59

PROJECT NAME  
**HETRICK RESIDENCE**  
446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME  
ROOF PLAN

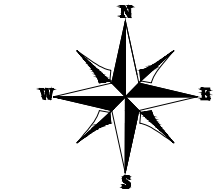
SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
A-01

MODULE TYPE, DIMENSIONS & WEIGHT

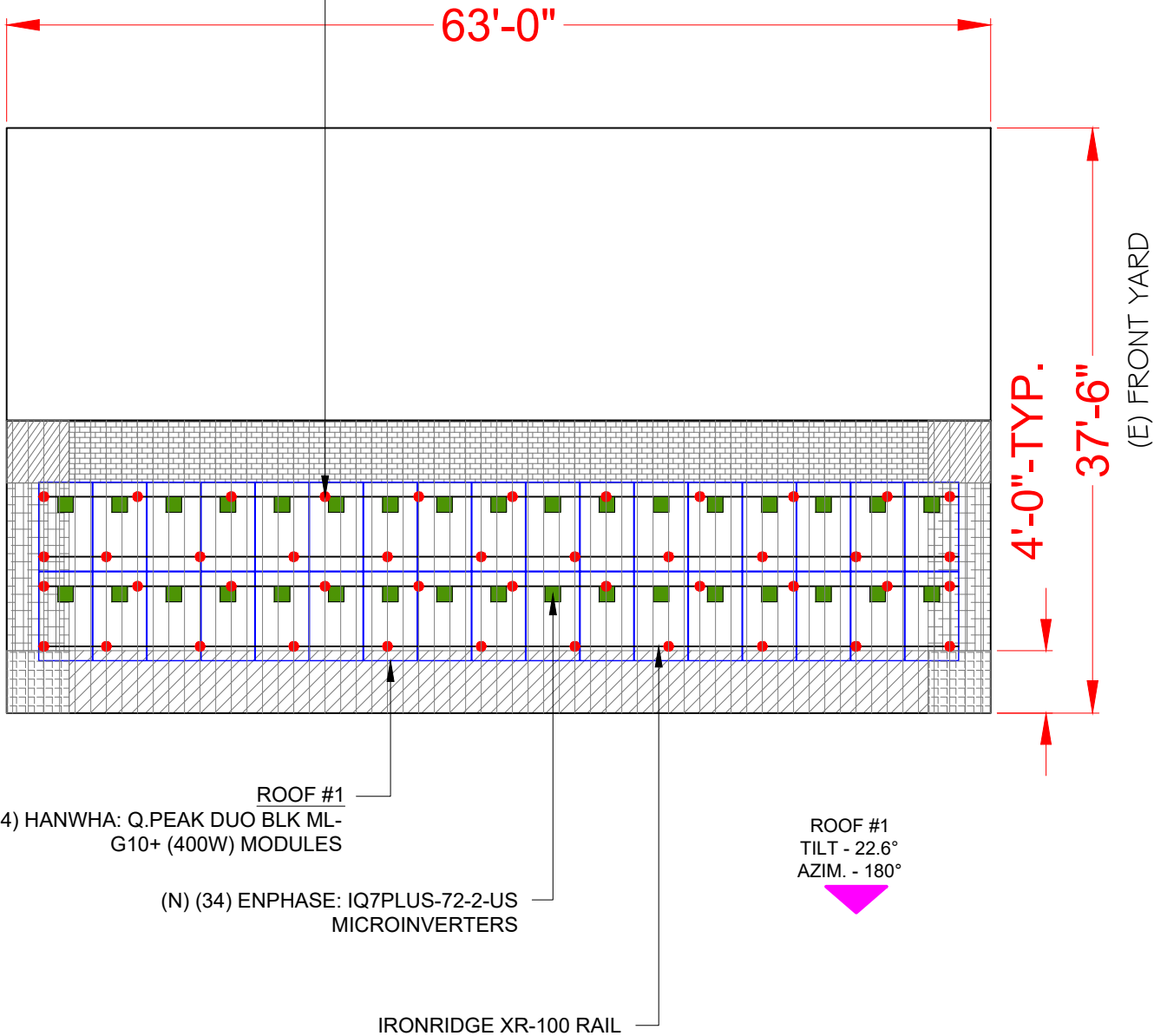
NUMBER OF MODULES = 34 MODULES  
MODULE TYPE = HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES  
MODULE WEIGHT = 44.09 LBS / 20 KG.  
MODULE DIMENSIONS = 74.0"x 41.10" = 21.12 SF  
UNIT WEIGHT OF ARRAY = 2.09 PSF

| 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 | SEAM SPACING |
| #1                            | METAL     | 718.11              | 1180.26             | 60.84                          | 22.6° | 180°    | 2"X4"      | 12" o.c.     |
| TOTAL PLAN VIEW               |           | 718.11              | 2360.53             | 30.42                          |       |         |            |              |



(44) PV ROOF ATTACHMENT @ 72" O.C. MAX. (SEE SHEET S-02 FOR ATTACHMENT DETAIL)  
(SEE SHEET S-01.1 FOR PARTIAL PRESSURE OF THE MODULE)

(E) BACK YARD



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

(N) (34) ENPHASE: IQ7PLUS-72-2-US MICROINVERTERS

ROOF #1  
TILT - 22.6°  
AZIM. - 180°

IRONRIDGE XR-100 RAIL

GENERAL INSTALLATION PLAN NOTES:

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

| WIND ZONES | NON - EXPOSED MODULES |            | EDGE / EXPOSED MODULES |            |
|------------|-----------------------|------------|------------------------|------------|
|            | SPAN                  | CANTILEVER | SPAN                   | CANTILEVER |
| ZONE 1     | 6' - 0"               | 1' - 4"    | 5' - 0"                | 1' - 4"    |
| ZONE 1'    | X                     | X          | X                      | X          |
| ZONE 2e    | 6' - 0"               | 1' - 4"    | 5' - 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    | 5' - 0"               | 1' - 4"    | 3' - 0"                | 1' - 0"    |

SEE SHEET S-02.2 FOR SUPPORTING CALCULATIONS.

2) EXISTING RESIDENTIAL BUILDING IS A METAL ROOF WITH A MEAN ROOF HEIGHT OF 20 FT AND SYP 2"X4" ROOF SEAM SPACED 12" 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 ADVERSLY AFFECTED BY THE ADDITIONAL LOADS IMPOSED BY THE SOLAR SYSTEM.

\* I CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC: RESIDENTIAL 2020 7th ED. CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES AND EQUIPMENT DEAD LOADS. \*

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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Date: 2022.05.11 12:24:00

PROJECT NAME

HETRICK RESIDENCE  
446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME

MODULE LAYOUT

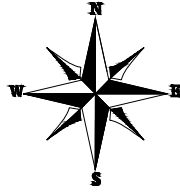
SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

S-01





FOR NON-EXPOSED MODULES

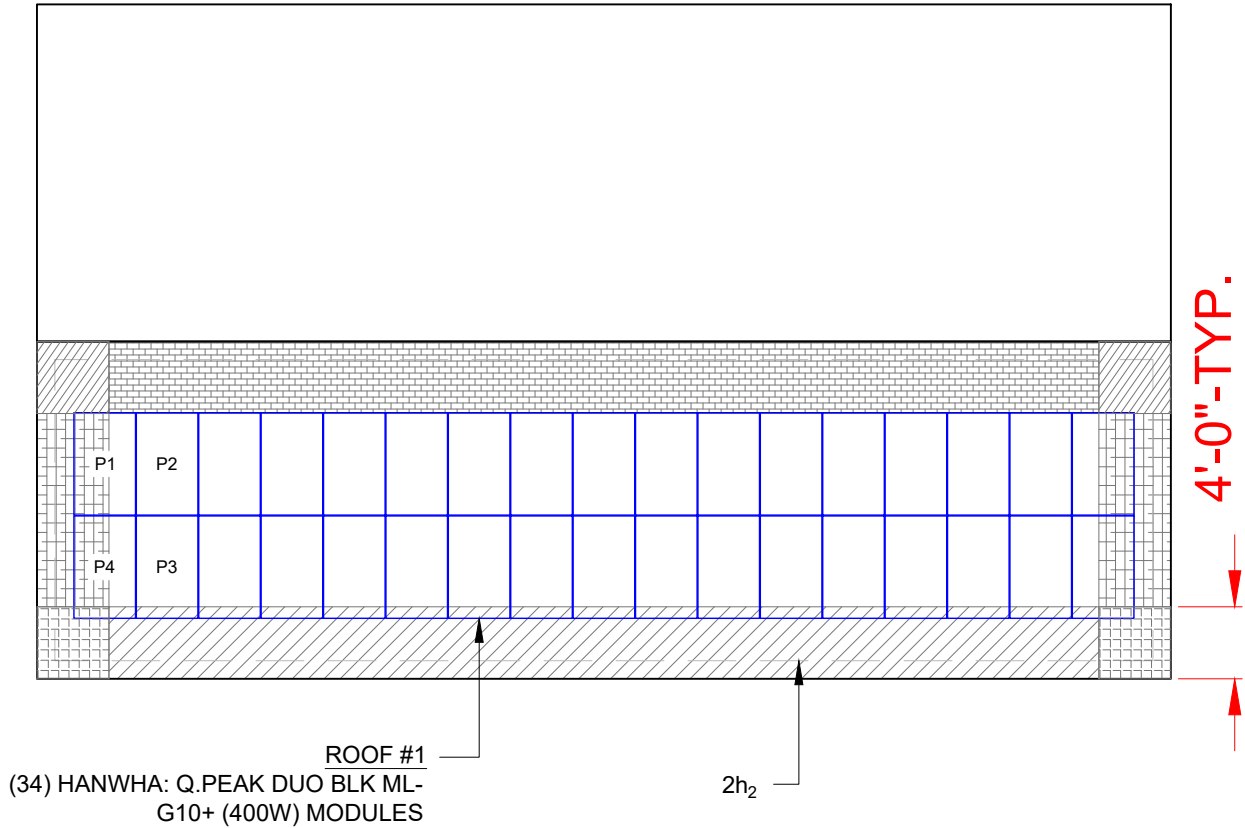
|    |    |    |      |      |      |      |
|----|----|----|------|------|------|------|
| 1  | 1' | 2e | 2n   | 2r   | 3e   | 3r   |
| 16 | 0  | 16 | 21.3 | 21.3 | 21.3 | 23.8 |

|             |       |         |
|-------------|-------|---------|
| Module Size | 21.12 | Sq. ft. |
|-------------|-------|---------|

| Non-Exposed modules |       |    |      |       |      |      |      | Partial Pressure |
|---------------------|-------|----|------|-------|------|------|------|------------------|
|                     | 1     | 1' | 2e   | 2n    | 2r   | 3e   | 3r   |                  |
| P1                  | 9.04  | 0  | 0    | 11.91 | 0.08 | 0    | 0.10 | 19.04            |
| P2                  | 20.95 | 0  | 0    | 0     | 0.17 | 0    | 0    | 16.04            |
| P3                  | 18.73 | 0  | 2.39 | 0     | 0    | 0    | 0    | 16.00            |
| P4                  | 8.08  | 0  | 1.03 | 10.64 | 0    | 1.37 | 0    | 19.01            |

ALLOWABLE MODULE UPLIFT PRESSURE 2 RAILS: 55 PSF

(E) BACK YARD



(E) FRONT YARD

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)

2h<sub>2</sub> DISTANCE : 1' - 0"  
0.5h DISTANCE : 10' - 0"

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.

REVISIONS

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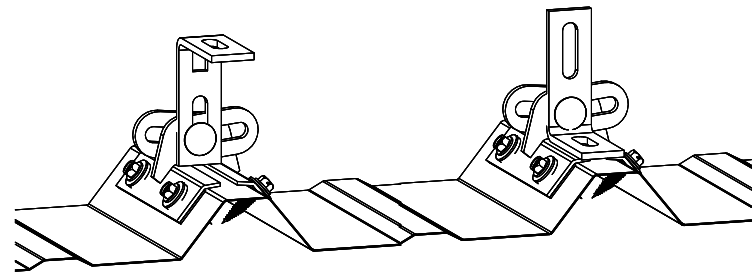
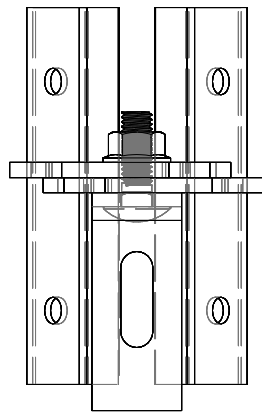
PARTIAL PRESSURE AND MODULES EXPOSURE

SHEET SIZE

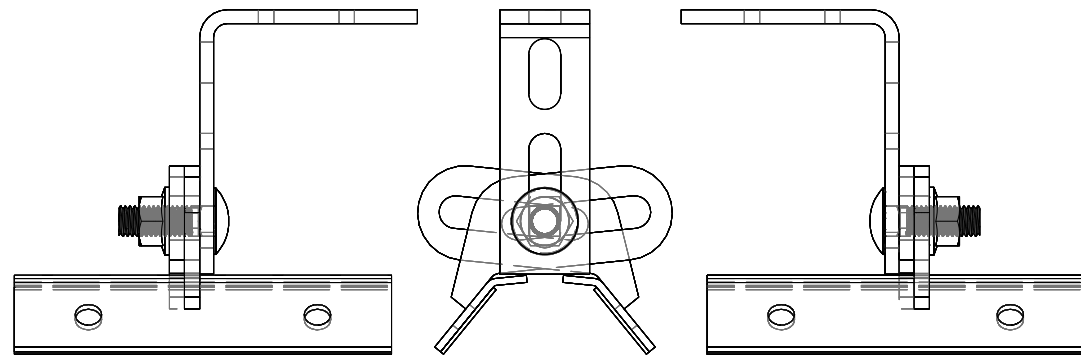
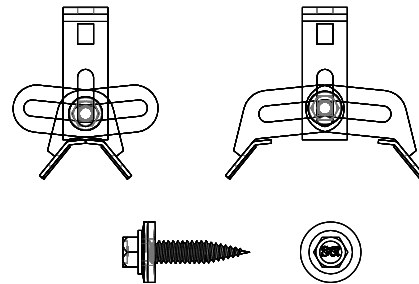
ANSI B  
11" X 17"

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S-01.1



### ProteaBracket



LEFT VIEW

FRONT VIEW

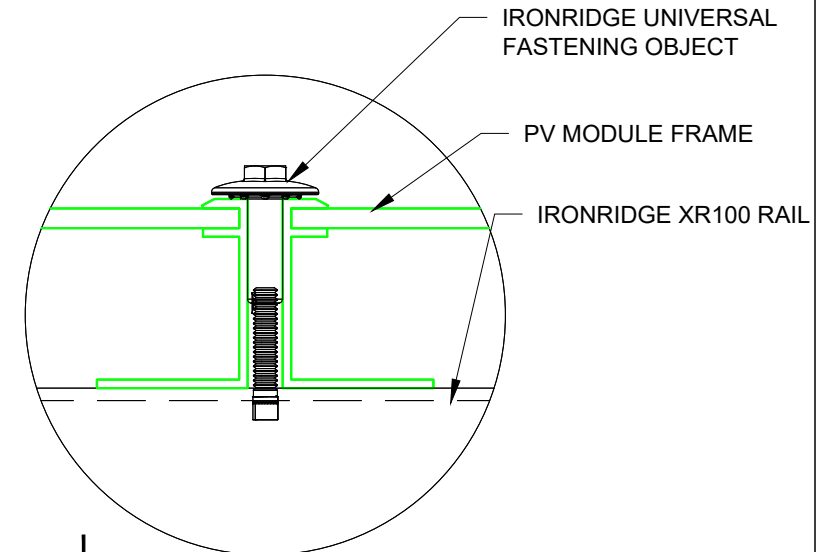
RIGHT VIEW

### 1 ATTACHMENT DETAIL

S-02

SCALE: NTS

FOR STANDING SEAM SPECIFIC MECHANICAL LOAD TEST  
INFORMATION AND CLAMP INSTALLATION INFORMATION  
PLEASE VISIT: [WWW.S-5.COM](http://WWW.S-5.COM)

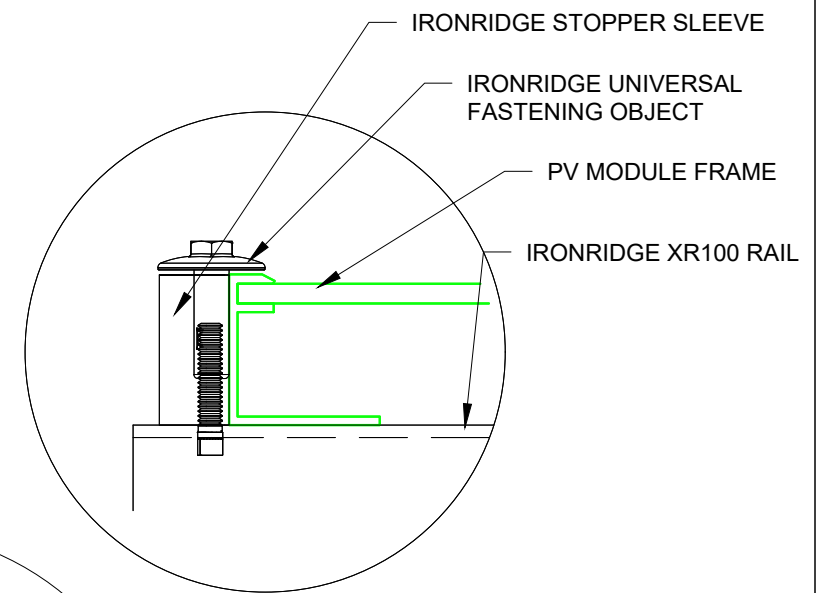


5

### DETAIL, MID CLAMP FRONT

S-02

Scale: 6"=1'-0"



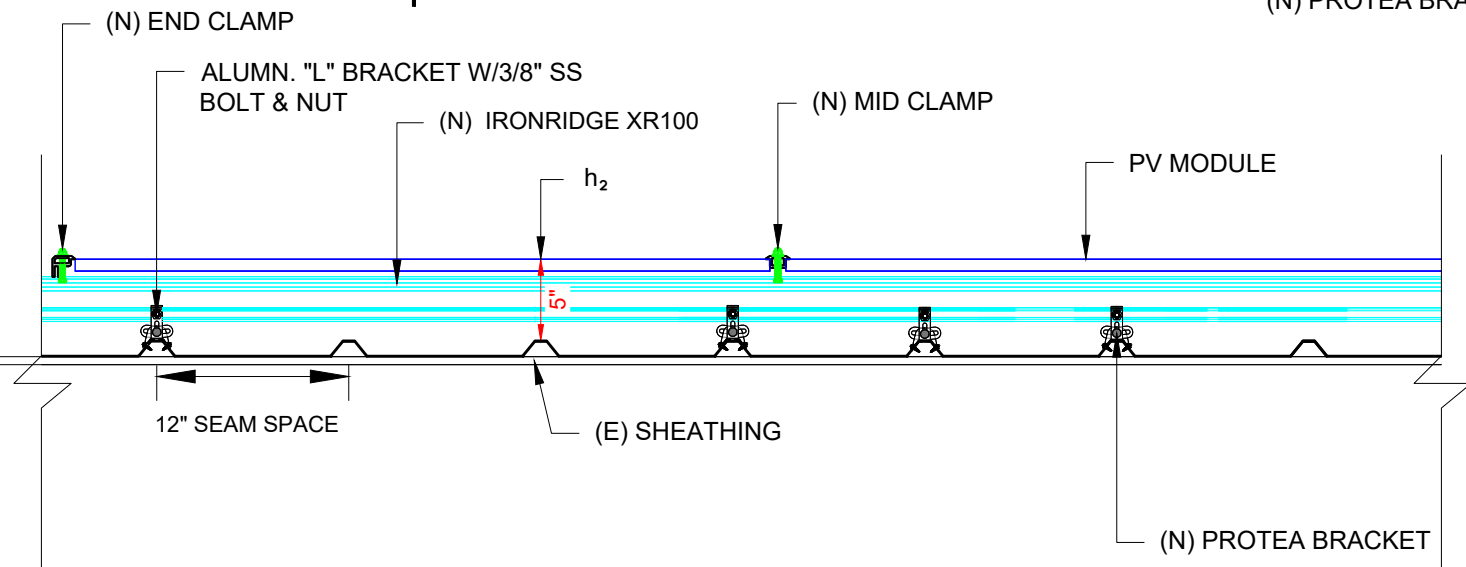
4

### DETAIL, END CLAMP

S-02

(UFO) FRONT

Scale: 6"=1'-0"

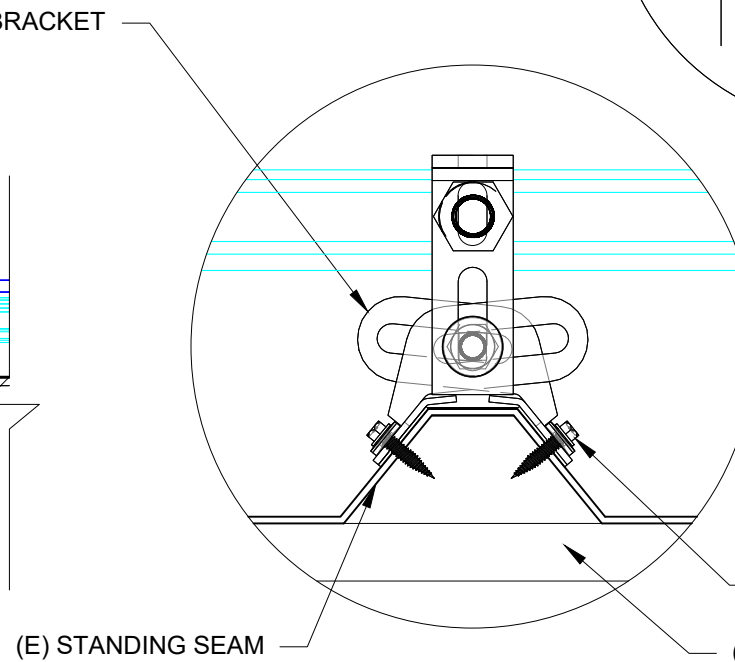


2

### ATTACHMENT DETAIL & ENLARGED VIEW

S-02

SCALE: 1' = 1'-0"



3

### ENLARGED VIEW

S-02

SCALE: 1" = 1'-0"

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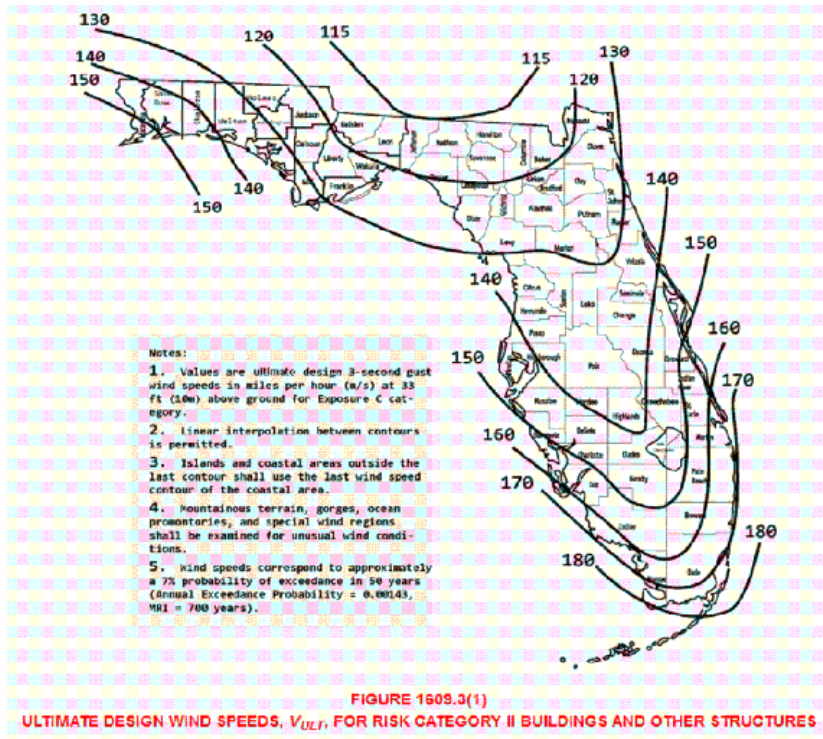
STRUCTURE  
CALCULATION

SHEET SIZE

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SHEET NUMBER

S-02.1

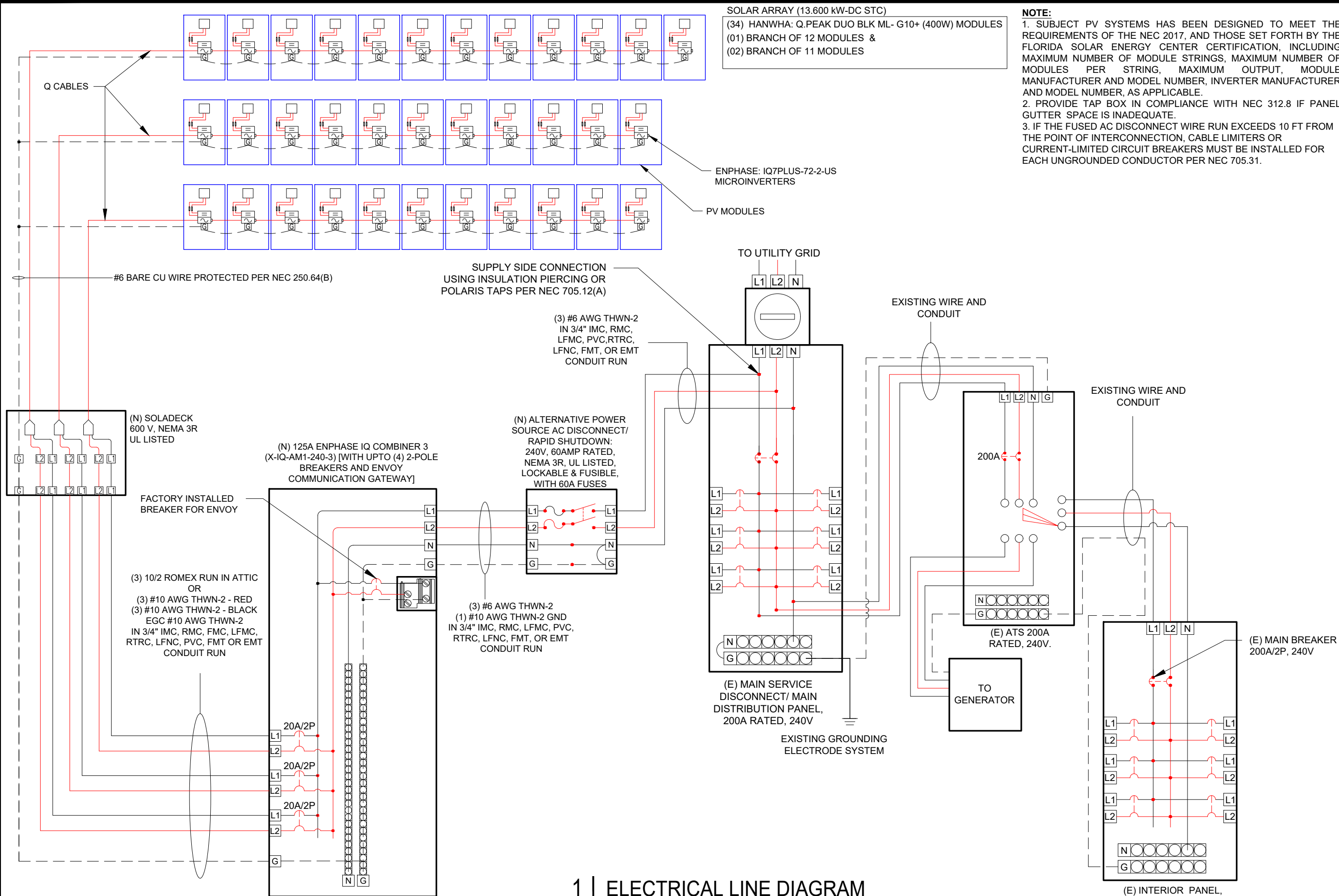


WIND LOAD CALCULATIONS FOR MODULES INSTALLED ON ROOFS WITH A HEIGHT LESS THAN 60'

| SITE INFORMATION  |              |                                      |                |
|---|--------------|--------------------------------------|----------------|
| FBC VERSION   | 2020         | RISK CATEGORY                        | II             |
| MEAN ROOF HEIGHT (ft)   | 20.0         | EXPOSURE CATEGORY                    | B              |
| ROOF LENGTH (ft)  | 63.0         | ROOF SLOPE                           | 5 / 12         |
| ROOF WIDTH (ft)   | 37.6         | ROOF SLOPE (°)                       | 22.6           |
| PARAPET HEIGHT (ft)   | 0.0          | ROOF TYPE                            | GABLE          |
| MODULE LENGTH (in)  | 74           | ULTIMATE WIND SPEED                  | 130 mph        |
| MODULE WIDTH (in)   | 41.10        | NOMINAL WIND SPEED                   | 101 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)  | 0.0          | IMPORTANCE FACTOR (I <sub>s</sub> )  | 1.000          |
| DEAD LOAD (psf)   | 3.0          | SLOPE FACTOR (C <sub>s</sub> )       | 0.910          |
| SLOPED ROOF SNOW LOAD (psf)   | 0.0          | K <sub>D</sub>                       | 0.850          |
| EFFECTIVE WIND AREA (ft <sup>2</sup> )  | 21.1         | K <sub>ZT</sub>                      | 1.000          |
| GROUND ELEVATION (ft)   | 104.0        | K <sub>e</sub>                       | 0.996          |
| HVHZ  | NO           | K <sub>z</sub>                       | 0.624          |
| DESIGN CALCULATIONS   |              |                                      |                |
| VELOCITY PRESSURE (q) = .00256*K <sub>e</sub> K <sub>ZT</sub> K <sub>D</sub> V <sup>2</sup> |              |                                      |                |
| VELOCITY PRESSURE(ASD) 13.7 psf   |              |                                      |                |
| WIDTH OF PRESSURE COEFFICIENT   | 37.6' * 10%  | =                                    | 3.76'          |
|   | 20' * 40%    | =                                    | 8'             |
| ZONE WIDTH A  | 4 FT         |                                      |                |
|   | 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'      | X                                    | 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 (+/-)   |              | 0.18                                 |                |

| DESIGN PRESSURES                |       |              |                      |                                  |                        |
|---------------------------------|-------|--------------|----------------------|----------------------------------|------------------------|
| ROOF ZONE                       | DOWN  | UP           |                      |                                  |                        |
| 1                               | 16.0  | -22.8        | psf                  |                                  |                        |
| 1'                              | X     | X            | psf                  |                                  |                        |
| 2e                              | 16.0  | -22.8        | psf                  | Module allowable uplift pressure | 55 psf                 |
| 2n                              | 16.0  | -31.8        | psf                  | Module allowable down pressure   | 75 psf                 |
| 2r                              | 16.0  | -31.8        | psf                  |                                  |                        |
| 3e                              | 16.0  | -31.8        | psf                  |                                  |                        |
| 3r                              | 16.0  | -35.6        | psf                  |                                  |                        |
| ARRAY FACTORS                   |       |              |                      |                                  |                        |
| ARRAY EDGE FACTOR (EXPOSED)     |       | 1.5          | SOLAR PANEL PRESSURE |                                  | 0.67012                |
| ARRAY EDGE FACTOR (NON-EXPOSED) |       | 1            | EQUALIZATION FACTOR  |                                  |                        |
| ADJUSTED DESIGN PRESSURES       |       |              |                      |                                  |                        |
| ROOF ZONE                       | DOWN  | UP (Exposed) | UP (N. Exposed)      |                                  |                        |
| 1                               | 16.0  | -23.0        | -16.0                | psf                              |                        |
| 1'                              | X     | X            | X                    | psf                              |                        |
| 2e                              | 16.0  | -23.0        | -16.0                | psf                              |                        |
| 2n                              | 16.0  | -32.0        | -21.3                | psf                              |                        |
| 2r                              | 16.0  | -32.0        | -21.3                | psf                              |                        |
| 3e                              | 16.0  | -32.0        | -21.3                | psf                              |                        |
| 3r                              | 16.0  | -35.8        | -23.8                | psf                              |                        |
| ATTACHMENTS USED                |       |              |                      |                                  |                        |
| ATTACHMENT MODEL                |       | S-5 protea   |                      |                                  |                        |
| ATTACHMENT STRENGTH             |       | 422          |                      | lbs                              |                        |
| MAX DESIGN LOADS ALLOWABLE      |       |              |                      |                                  |                        |
| LIMIT MAX SPAN TO               |       | N/A          | in                   |                                  |                        |
| RAFTER/SEAM SPACING             |       | 12           | in                   | NO. OF RAILS                     | Exposed: 2 Non. Exp: 2 |
| ROOF ZONE                       | DOWN  | UP (Exposed) | UP (N. Exposed)      | SPANS (E)                        | SPANS (N E)            |
| 1                               | 296.0 | 354.1        | 296.0                | lbs                              | 60 in 72 in            |
| 1'                              | X     | X            | X                    | lbs                              | X in X in              |
| 2e                              | 296.0 | 354.1        | 296.0                | lbs                              | 60 in 72 in            |
| 2n                              | 296.0 | 394.7        | 394.7                | lbs                              | 48 in 72 in            |
| 2r                              | 296.0 | 394.7        | 394.7                | lbs                              | 48 in 72 in            |
| 3e                              | 296.0 | 394.7        | 394.7                | lbs                              | 48 in 72 in            |
| 3r                              | 246.7 | 330.8        | 367.6                | lbs                              | 36 in 60 in            |





**NOTE:**  
1. SUBJECT PV SYSTEMS HAS BEEN DESIGNED TO MEET THE REQUIREMENTS OF THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION, 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. PROVIDE TAP BOX IN COMPLIANCE WITH NEC 312.8 IF PANEL GUTTER SPACE IS INADEQUATE.  
3. IF THE FUSED AC DISCONNECT WIRE RUN EXCEEDS 10 FT FROM THE POINT OF INTERCONNECTION, CABLE LIMITERS OR CURRENT-LIMITED CIRCUIT BREAKERS MUST BE INSTALLED FOR EACH UNGROUNDED CONDUCTOR PER NEC 705.31.



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PROJECT INSTALLER



Digitally  
signed by:  
Ermocrates  
s E Castillo  
Date:  
2022.05.11  
12:24:02

PROJECT NAME

**HETRICK RESIDENCE**  
446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME  
ELECTRICAL  
LINE DIAGRAM

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
E-01



ELECTRICAL CALCULATION

| Module Manufacturer      | HANWHA                       |
|--------------------------|------------------------------|
| Module Model             | Q.PEAK DUO DLK ML C 10.A 4DC |
| Inverter Manufacturer    | ENPHASE                      |
| Inverter Model           | ENPHASE IQ 7 PLUS            |
| Modules/Branch Circuit 1 | 12                           |
| Modules/Branch Circuit 2 | 11                           |
| Modules/Branch Circuit 3 | 11                           |
| TOTAL ARRAY POWER (KW)   | 13.600                       |
| SYSTEM AC VOLTAGE        | 240V 1-PHASE                 |

| DESIGN TEMPERATURE    |     |
|-----------------------|-----|
| MIN. AMBIENT TEMP. °F | 32  |
| MAX. AMBIENT TEMP. °F | 117 |
| CALCULATED MAX. VOC   | 49  |
| CALCULATED MIN VMP    | 29  |
| CONDUIT FILL          |     |
| NUMBER OF CONDUITS    | 1   |

| AMPACITY CALCULATIONS      |          |                    |     |                   |                    |                |                 |                |                     |                            |  |
|----------------------------|----------|--------------------|-----|-------------------|--------------------|----------------|-----------------|----------------|---------------------|----------------------------|--|
| CIRCUIT                    | MAX AMPS | 1.25 X<br>MAX AMPS | AWG | 90 °C<br>AMPACITY | AMBIENT<br>TEMP °F | TEMP<br>DERATE | CONDUIT<br>FILL | FILL<br>DERATE | DERATED<br>AMPACITY | MAXIMUM CIRCUIT<br>BREAKER |  |
| CIRCUIT 1                  | 14.5     | 18.1               | #10 | 40                | 130                | 0.76           | 3               | 0.7            | 21.28               | 20 A                       |  |
| CIRCUIT 2                  | 13.3     | 16.6               | #10 | 40                | 130                | 0.76           | 3               | 0.7            | 21.28               | 20 A                       |  |
| CIRCUIT 3                  | 13.3     | 16.6               | #10 | 40                | 130                | 0.76           | 3               | 0.7            | 21.28               | 20 A                       |  |
| AC COMBINE<br>PANEL OUTPUT | 41.1     | 51.4               | #6  | 75                | 95                 | 0.96           | 3               | 1              | 72                  | 60 A                       |  |

|                              |    |
|------------------------------|----|
| MAXIMUM CIRCUIT VOLTAGE DROP | 2% |
|------------------------------|----|

| VOLTAGE DROP CALCULATIONS |     |                   |      |     |               |
|---------------------------|-----|-------------------|------|-----|---------------|
| CIRCUIT                   | AWG | CIRCULAR<br>MILLS | I    | V   | MAX<br>LENGTH |
| CIRCUIT 1                 | #10 | 10380             | 14.5 | 240 | 33 FEET       |
| CIRCUIT 2                 | #10 | 10380             | 13.3 | 240 | 45 FEET       |
| CIRCUIT 3                 | #10 | 10380             | 13.3 | 240 | 45 FEET       |
| COMBINE PANEL OUTPUT      | #6  | 26240             | 41.1 | 240 | 19 FEET       |

| NOTES   |  |
|---|--|
| TEMP DERATE BASED ON NEC TABLE 310.15(B)(2)(A)  |  |
| CONDUIT FILL DERATE BASED ON NEC TABLE 310.5(B)(3)(A)                                     |  |
| MAXIMUM VOC CALCULATED USING MODULE MANUFACTURE TEMPERATURE COEFFICIENTS PER NEC 690.7(A) |  |
| UNLESS OTHERWISE SPECIFIED, ALL WIRING MUST BE THHN OR THWN-2 COPPER                      |  |
| ALL WIRE SIZES LISTED ARE THE MINIMUM ALLOWABLE   |  |
|   | IN ANY CELL INDICATES THAT THE SYSTEM IS SAFE AND COMPLIES WITH NEC REQUIREMENTS |
|   | IN ANY CELL INDICATES A POTENTIALLY UNSAFE CONDITION                             |
|   | INFORMATION INPUT BY SYSTEM DESIGNER   |
|   | INFORMATION OBTAINED FROM MANUFACTURER DATASHEETS                                |

I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE FLORIDA BUILDING CODE. FBC 107, THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION

| MODULE PROPERTIES |          |        |          |
|-------------------|----------|--------|----------|
| VOC               | 45.0     | ISC    | 11.14    |
| VMPP              | 37.19    | IMP    | 8.51     |
| TC VOC            | -0.27%/K | TC VMP | -0.34%/K |
| PMP               | 400.0    | NOCT   | 45 °C    |

| INVERTER PROPERTIES  |              |
|----------------------|--------------|
| OUTPUT VOLTAGE       | 240 L-L 1-PH |
| MAX INPUT DC VOLTAGE | 60 VOC       |
| OPERATING RANGE      | 16 - 60 VDC  |
| MPPT VOLTAGE RANGE   | 27 - 45 VDC  |
| START VOLTAGE        | 22 VDC       |
| MAX INPUT POWER      | 440 WDC      |
| CONTINUOUS AC POWER  | 290 VA       |

ELECTRICAL NOTES

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 DEGREE 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. THE POLARITY OF THE GROUNDED CONDUCTORS IS NEGATIVE .
12. UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
13. MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
14. RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
15. CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.10 (D).
16. CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).
17. THIS SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN OF PV CONDUCTORS IN COMPLIANCE WITH NEC 690.12.
18. LABELING IN COMPLIANCE WITH NEC 690.12 AND 690.56(C) IS SHOWN ON SHEET E-03.
19. ALL CONDUITS TO BE INSTALLED AT A MINIMUM OF 7/8" ABOVE ROOF SURFACE.



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PROJECT INSTALLER

SEM POWER

Signature with Seal

STATE OF FLORIDA  
Professional Engineer  
ERMOCRATES E. CASTILLO  
No. 52590

Digitally signed by:  
Ermocrates E Castillo  
Date:  
2022.05.11 12:24:02

HETRICK RESIDENCE

446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

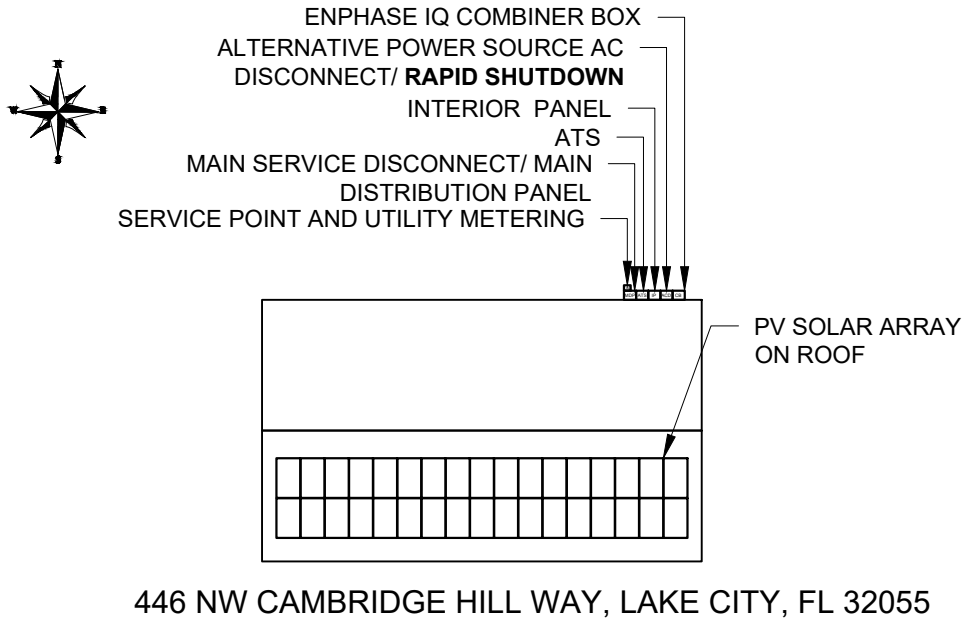
SHEET NAME  
WIRING CALCULATIONS

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
E-02

## CAUTION!

POWER TO THIS BUILDING  
SUPPLIED FROM MULTIPLE SOURCES



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 41.1 AMPS AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC690.54)

## 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))


DATA PER PANEL


|  |      |    |
|--|------|----|
| NOMINAL OPERATING AC VOLTAGE -   | 240  | V  |
| NOMINAL OPERATING AC FREQUENCY-  | 60   | Hz |
| MAXIMUM AC POWER-  | 290  | VA |
| MAXIMUM AC CURRENT-  | 1.21 | A  |
| MAXIMUM OVERCURRENT DEVICE RATING<br>FOR AC MODULE PROTECTION PER CIRCUIT- | 20   | A  |

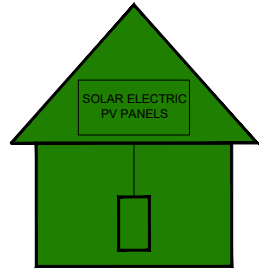
LABEL LOCATION:  
COMBINER BOX  
(PER CODE: NEC690.52)

## 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)



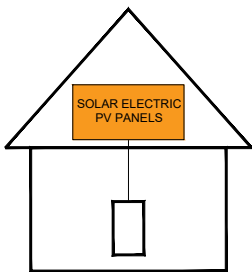
**SEM SOLAR**  
EMERGENCY CONTACT:  
PH. NO. : (407)289-2575



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

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))

## RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL LOCATION:  
AC DISCONNECT  
(PER CODE: NEC690.56(C)(3))

ADHESIVE FASTENED SIGNS:  
• THE LABEL SHALL BE VISIBLE, REFLECTIVE AND SUITABLE FOR THE ENVIRONMENT WHERE IT IS INSTALLED [NFPA 1, 11.12.2.1]  
• WHERE REQUIRED ELSEWHERE IN THIS CODE, ALL FIELD APPLIED LABELS, WARNINGS, AND MARKINGS SHOULD COMPLY WITH ANSI Z535.4 [NEC 110.21(B) FIELD MARKING].  
• ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT [IFC 605.11.1.3]

**Castillo**  
Engineering  
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PROJECT INSTALLER

**SEM POWER**

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s E Castillo  
Date:  
2022.05.11  
12:24:02

PROJECT NAME

HETRICK RESIDENCE

446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME

SYSTEM LABELING

SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

E-03





## Q.peak Duo BLK ML-G10+ 385-410

ENDURING HIGH  
PERFORMANCE



### BREAKING THE 20% EFFICIENCY BARRIER

Q.ANTUM DUO Z Technology with zero gap cell layout  
boosts module efficiency up to 21.1%.



### 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 behaviour.



### ENDURING HIGH PERFORMANCE

Long-term yield security with Anti LID Technology,  
Hot-Spot Protect and Traceable Quality Tra.Q™.



### EXTREME WEATHER RATING

High-tech aluminium 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 warranty¹.

¹ See data sheet on rear for further information.

### THE IDEAL SOLUTION FOR:



Rooftop arrays on  
residential buildings

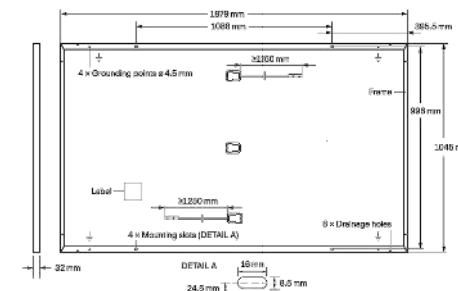
Engineered in Germany

**Q CELLS**

Engineered in Germany

### MECHANICAL SPECIFICATION

|              |  |
|--------------|--|
| Format       | 1879 mm × 1045 mm × 32 mm (including frame)                                  |
| Weight       | 22.0 kg  |
| Front Cover  | 3.2 mm thermally pre-stressed glass with anti-reflection technology          |
| Back Cover   | Composite film   |
| Frame        | Black anodised aluminium   |
| Cell         | 6 × 22 monocrystalline Q.ANTUM solar half cells                              |
| Junction box | 53-101 mm × 32-60 mm × 15-18 mm<br>Protection class IP67, with bypass diodes |
| Cable        | 4 mm² Solar cable; (+) ≥ 1250 mm, (-) ≥ 1250 mm                              |
| Connector    | Stäubli MC4; IP68  |

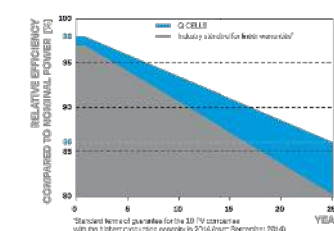


### ELECTRICAL CHARACTERISTICS

| POWER CLASS   | 385                  | 390    | 395    | 400    | 405    | 410    |
|---|----------------------|--------|--------|--------|--------|--------|
| MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC¹ (POWER TOLERANCE +5 W / -0 W) |                      |        |        |        |        |        |
| Power at MPP²   | P <sub>MPP</sub> [W] | 385    | 390    | 395    | 400    | 410    |
| Short Circuit Current³  | I <sub>SC</sub> [A]  | 11.04  | 11.07  | 11.10  | 11.14  | 11.20  |
| Open Circuit Voltage⁴   | V <sub>OC</sub> [V]  | 45.19  | 45.23  | 45.27  | 45.30  | 45.37  |
| Current at MPP  | I <sub>MPP</sub> [A] | 10.59  | 10.85  | 10.71  | 10.77  | 10.89  |
| Voltage at MPP  | V <sub>MPP</sub> [V] | 36.36  | 36.62  | 36.88  | 37.13  | 37.64  |
| Efficiency¹   | η [%]                | ≥ 19.6 | ≥ 19.9 | ≥ 20.1 | ≥ 20.4 | ≥ 20.6 |
| MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT²                           |                      |        |        |        |        |        |
| Power at MPP  | P <sub>MPP</sub> [W] | 288.8  | 292.6  | 296.3  | 300.1  | 307.6  |
| Short Circuit Current   | I <sub>SC</sub> [A]  | 8.90   | 8.92   | 8.95   | 8.97   | 9.03   |
| Open Circuit Voltage  | V <sub>OC</sub> [V]  | 42.62  | 42.65  | 42.69  | 42.72  | 42.79  |
| 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  | 35.68  |

¹ Measurement tolerances P<sub>MPP</sub> ± 3%; I<sub>SC</sub>, V<sub>OC</sub> ± 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

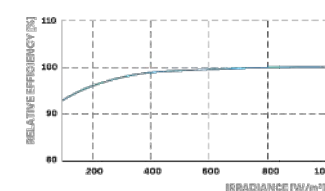
### Q CELLS PERFORMANCE WARRANTY



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 88% 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 <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 [°C] | 43 ± 3 |

### PROPERTIES FOR SYSTEM DESIGN

|                               |                      |             |   |                 |
|-------------------------------|----------------------|-------------|---|-----------------|
| Maximum System Voltage        | V <sub>sys</sub> [V] | 1000        | PV module classification                        | Class II        |
| Maximum Reverse Current       | I <sub>R</sub> [A]   | 20          | Fire Rating based on ANSI/UL 61730              | C/TYP 2         |
| Max. Design Load, Push / Pull | [Pa]                 | 3600 / 2660 | Permitted Module Temperature on Continuous Duty | -40 °C - +85 °C |
| Max. Test Load, Push / Pull   | [Pa]                 | 5400 / 4000 |   |                 |

### QUALIFICATIONS AND CERTIFICATES

Quality Controlled PV - TÜV Rheinland  
IEC 61215:2016, IEC 61730:2016  
This data sheet complies with DIN EN 50380  
QC/PV Certification ongoing  
Certification holder:  
Hanwha Q CELLS GmbH



### PACKAGING INFORMATION

|                      |         |         |         |        |            |            |            |
|----------------------|---------|---------|---------|--------|------------|------------|------------|
| Horizontal packaging | 1940 mm | 1100 mm | 1220 mm | 751 kg | 28 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.

Made in Korea

Hanwha Q CELLS Australia Pty Ltd

Suite 1, Level 1, 15 Blue Street, North Sydney, NSW 2060, Australia | TEL +61 (0)2 9016 3033 | FAX +61 (0)2 9016 3032 | EMAIL q-cells-australia@q-cells.com | WEB www.q-cells.com/au

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### PROJECT NAME

**HETRICK RESIDENCE**

**446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055**

### SHEET NAME

**DATA SHEET**

### SHEET SIZE

**ANSI B  
11" X 17"**

### SHEET NUMBER

**DS-01**

**Q CELLS**



# Enphase IQ 7 and IQ 7+ Microinverters

The high-powered smart grid-ready **Enphase IQ 7 Micro™** and **Enphase IQ 7+ Micro™** dramatically simplify the installation process while achieving the highest system efficiency.

Part of the Enphase IQ System, the IQ 7 and IQ 7+ Microinverters integrate seamlessly with the Enphase IQ Envoy™, Enphase Q Aggregator™, Enphase IQ Battery™, and the Enphase Enlighten™ monitoring and analysis software.

IQ Series Microinverters extend the reliability standards set forth by previous generations and undergo over a million hours of power-on testing, enabling Enphase to provide an industry-leading warranty of up to 25 years.



To learn more about Enphase offerings, visit [enphase.com](https://enphase.com)



## Enphase IQ 7 and IQ 7+ Microinverters

| INPUT DATA (DC)  | IQ7-60-2-US   |                      | IQ7PLUS-72-2-US                |                      |
|--|---|----------------------|--------------------------------|----------------------|
| Commonly used module pairings <sup>1</sup>               | 235 W - 350 W +   |                      | 235 W - 440 W +                |                      |
| Module compatibility                                     | 60-cell PV modules only   |                      | 60-cell and 72-cell PV modules |                      |
| Maximum input DC voltage                                 | 48 V  |                      | 60 V                           |                      |
| Peak power tracking voltage                              | 27 V - 37 V   |                      | 27 V - 45 V                    |                      |
| Operating range  | 16 V - 48 V   |                      | 16 V - 60 V                    |                      |
| Min/Max start voltage                                    | 22 V / 48 V   |                      | 22 V / 60 V                    |                      |
| Max DC short circuit current (module Isc)                | 15 A  |                      | 15 A                           |                      |
| Overvoltage class DC port                                | II  |                      | II                             |                      |
| DC port backfeed current                                 | 0 A   |                      | 0 A                            |                      |
| PV array configuration                                   | 1 x 1 ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit   |                      |                                |                      |
| OUTPUT DATA (AC)   | IQ 7 Microinverter  |                      | IQ 7+ Microinverter            |                      |
| Peak output power  | 250 VA  |                      | 295 VA                         |                      |
| Maximum continuous output power                          | 240 VA  |                      | 290 VA                         |                      |
| Nominal (L-L) voltage/range <sup>2</sup>                 | 240 V /<br>211-264 V  | 208 V /<br>183-229 V | 240 V /<br>211-264 V           | 208 V /<br>183-229 V |
| Maximum continuous output current                        | 1.0 A   | 1.15 A               | 1.21 A                         | 1.39 A               |
| Nominal frequency  | 60 Hz   |                      | 60 Hz                          |                      |
| Extended frequency range                                 | 47 - 68 Hz  |                      | 47 - 68 Hz                     |                      |
| AC short circuit fault current over 3 cycles             | 5.8 Arms  |                      | 5.8 Arms                       |                      |
| Maximum units per 20 A (L-L) branch circuit <sup>3</sup> | 16 (240 VAC)<br>13 (208 VAC)  |                      | 13 (240 VAC)<br>11 (208 VAC)   |                      |
| Overvoltage class AC port                                | III   |                      | III                            |                      |
| AC port backfeed current                                 | 0 A   |                      | 0 A                            |                      |
| Power factor setting                                     | 1.0   |                      | 1.0                            |                      |
| Power factor (adjustable)                                | 0.7 leading ... 0.7 lagging   |                      | 0.7 leading ... 0.7 lagging    |                      |
| EFFICIENCY   | @240 V  | @208 V               | @240 V                         | @208 V               |
| Peak CEC efficiency                                      | 97.6 %  | 97.6 %               | 97.5 %                         | 97.3 %               |
| CEC weighted efficiency                                  | 97.0 %  | 97.0 %               | 97.0 %                         | 97.0 %               |
| MECHANICAL DATA  | IQ 7 Microinverter  |                      |                                |                      |
| Ambient temperature range                                | -40°C to +65°C  |                      |                                |                      |
| Relative humidity range                                  | 4% to 100% (condensing)   |                      |                                |                      |
| Connector type   | MC4 (or Amphenol H-4 UTX with additional Q-DCC-5 adapter)   |                      |                                |                      |
| Dimensions (WxHxD)                                       | 212 mm x 175 mm x 30.2 mm (without bracket)   |                      |                                |                      |
| Weight   | 1.08 kg (2.38 lbs)  |                      |                                |                      |
| Cooling  | Natural convection - No fans  |                      |                                |                      |
| Approved for wet locations                               | Yes   |                      |                                |                      |
| Pollution degree   | PD3   |                      |                                |                      |
| Enclosure  | Class II double-insulated, corrosion resistant polymeric enclosure  |                      |                                |                      |
| Environmental category / UV exposure rating              | NEMA Type 6 / outdoor   |                      |                                |                      |
| FEATURES   |   |                      |                                |                      |
| Communication  | Power Line Communication (PLC)  |                      |                                |                      |
| Monitoring   | Enlighten Manager and MyEnlighten monitoring options.<br>Both options require installation of an Enphase IQ Envoy.  |                      |                                |                      |
| Disconnecting means                                      | The AC and DC connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.   |                      |                                |                      |
| Compliance   | CA Rule 21 (UL 1741-SA)<br>UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01<br>This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC-2014 and NEC-2017 section 690.12 and C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according manufacturer's instructions. |                      |                                |                      |

1. No enforced DC/AC ratio. See the compatibility calculator at <https://enphase.com/en-us/support/module-compatibility>.  
2. Nominal voltage range can be extended beyond nominal if required by the utility.  
3. Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

To learn more about Enphase offerings, visit [enphase.com](https://enphase.com)

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LAKE CITY, FL 32055

SHEET NAME  
DATA SHEET

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
DS-02

# Enphase IQ Combiner 3 (X-IQ-AM1-240-3)

The **Enphase IQ Combiner 3™** with Enphase IQ Envoy™ consolidates interconnection equipment into a single enclosure and streamlines PV and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

## Smart

- Includes IQ Envoy for communication and control
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and optional consumption monitoring
- Supports Ensemble Communications Kit for communication with Enphase Encharge™ storage and Enphase Enpower™ smart switch

## Simple

- Reduced size from previous combiner
- Centered mounting brackets support single stud mounting
- Supports back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80 A total PV or storage branch circuits

## Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- UL listed

## Enphase IQ Combiner 3

| MODEL NUMBER   |  |
|--|--|
| IQ Combiner 3<br>X-IQ-AM1-240-3  | IQ Combiner 3 with Enphase IQ Envoy™ printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional* consumption monitoring (+/- 2.5%).   |
| ACCESSORIES and REPLACEMENT PARTS (not included, order separately)   |  |
| Enphase Mobile Connect™<br>CELLMODEM-03 (4G/12-year data plan)<br>CELLMODEM-01 (3G/5-year data plan)<br>CELLMODEM-M1 (4G based LTE-M/5-year data plan) | Plug and play industrial grade cellular modem with data plan for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.)  |
| Consumption Monitoring* CT<br>CT-200-SPLIT   | Split core current transformers enable whole home consumption metering (+/- 2.5%).   |
| * Consumption monitoring is required for Enphase Storage Systems   |  |
| Ensemble Communications Kit<br>COMMS-KIT-01  | Installed at the IQ Envoy. For communications with Enphase Encharge™ storage and Enphase Enpower™ smart switch. Includes USB cable for connection to IQ Envoy or Enphase IQ Combiner™ and allows wireless communication with Encharge and Enpower.   |
| Circuit Breakers<br>BRK-10A-2-240<br>BRK-15A-2-240<br>BRK-20A-2P-240   | Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers.<br>Circuit breaker, 2 pole, 10A, Eaton BR210<br>Circuit breaker, 2 pole, 15A, Eaton BR215<br>Circuit breaker, 2 pole, 20A, Eaton BR220  |
| EPLC-01  | Power line carrier (communication bridge pair), quantity - one pair  |
| XA-SOLARSHIELD-ES  | Replace the default solar shield with this Ensemble Combiner Solar Shield to match the look and feel of the Enphase Enpower™ smart switch and the Enphase Encharge™ storage system   |
| XA-PLUG-120-3  | Accessory receptacle for Power Line Carrier in IQ Combiner 3 (required for EPLC-01)  |
| XA-ENV-PCBA-3  | Replacement IQ Envoy printed circuit board (PCB) for Combiner 3  |
| ELECTRICAL SPECIFICATIONS  |  |
| Rating   | Continuous duty  |
| System voltage   | 120/240 VAC, 60 Hz   |
| Eaton BR series busbar rating  | 125 A  |
| Max. continuous current rating (output to grid)  | 65 A   |
| Max. fuse/circuit rating (output)  | 90 A   |
| Branch circuits (solar and/or storage)   | Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)   |
| Max. continuous current rating (input from PV)   | 64 A   |
| Max. total branch circuit breaker rating (input)   | 80 A of distributed generation / 95 A with IQ Envoy breaker included   |
| Envoy breaker  | 10A or 15A rating GE Q-line/Siemens Type QP /Eaton BR series included  |
| Production Metering CT   | 200 A solid core pre-installed and wired to IQ Envoy   |
| MECHANICAL DATA  |  |
| Dimensions (WxHxD)   | 49.5 x 37.5 x 16.8 cm (19.5" x 14.75" x 6.63"). Height is 21.06" (53.5 cm with mounting brackets).   |
| Weight   | 7.5 kg (16.5 lbs)  |
| Ambient temperature range  | -40° C to +46° C (-40° to 115° F)  |
| Cooling  | Natural convection, plus heat shield   |
| Enclosure environmental rating   | Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction  |
| Wire sizes   | • 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors<br>• 60 A breaker branch input: 4 to 1/0 AWG copper conductors<br>• Main lug combined output: 10 to 2/0 AWG copper conductors<br>• Neutral and ground: 14 to 1/0 copper conductors<br>Always follow local code requirements for conductor sizing. |
| Altitude   | To 2000 meters (6,560 feet)  |
| INTERNET CONNECTION OPTIONS  |  |
| Integrated Wi-Fi   | 802.11b/g/n  |
| Ethernet   | Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)  |
| Cellular   | CELLMODEM-M1 4G based LTE-M cellular modem (not included). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.  |
| COMPLIANCE   |  |
| Compliance, Combiner   | UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003<br>Production metering: ANSI C12.20 accuracy class 0.5 (PV production)  |
| Compliance, IQ Envoy   | UL 60601-1/CANCSA 22.2 No. 61010-1   |

To learn more about Enphase offerings, visit [enphase.com](https://enphase.com)

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PROJECT NAME

**HETRICK RESIDENCE**  
446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME  
DATA SHEET

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
DS-03





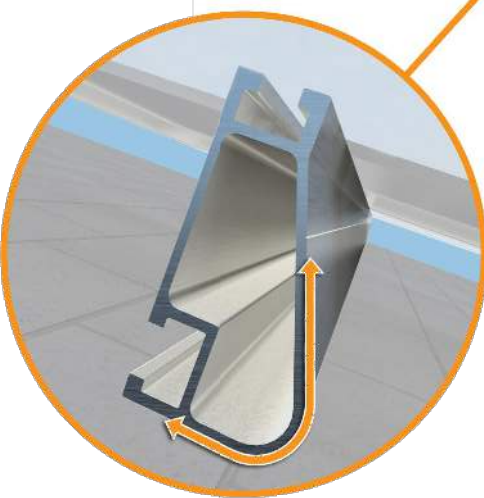
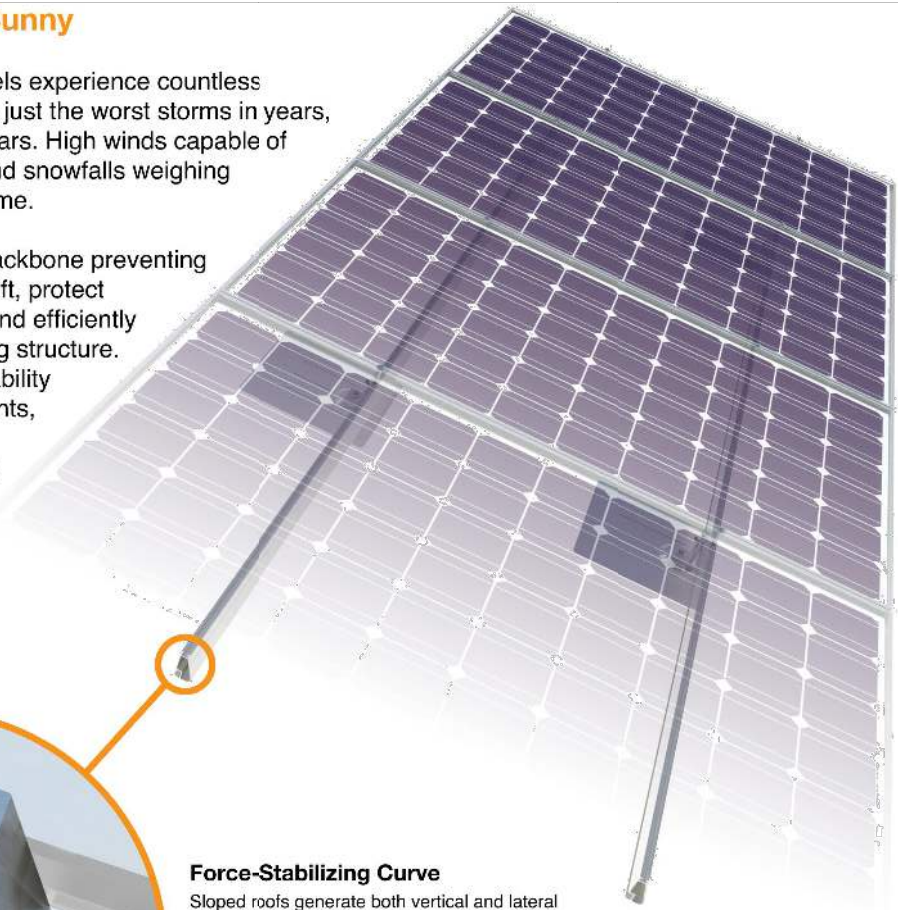
Tech Brief

## XR Rail Family

### Solar Is Not Always Sunny

Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



**Force-Stabilizing Curve**  
Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.

**Compatible with Flat & Pitched Roofs**

XR Rails are compatible with FlashFoot and other pitched roof attachments.

IronRidge offers a range of tilt leg options for flat roof mounting applications.

**Corrosion-Resistant Materials**

All XR Rails are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.

### XR Rail Family

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



**XR10**

XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves spans up to 6 feet, while remaining light and economical.

- 6' spanning capability
- Moderate load capability
- Clear & black anodized finish
- Internal splices available



**XR100**

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 10 feet.

- 10' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



**XR1000**

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme climates and spans up to 12 feet for commercial applications.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish
- Internal splices available

### Rail Selection

The table below was prepared in compliance with applicable engineering codes and standards.\* Values are based on the following criteria: ASCE 7-16, Gable Roof Flush Mount, Roof Zones 1 & 2e, Exposure B, Roof Slope of 8 to 20 degrees and Mean Building Height of 30 ft. Visit [IronRidge.com](http://IronRidge.com) for detailed certification letters.

| Load       |            | Rail Span |       |       |    |        |     |
|------------|------------|-----------|-------|-------|----|--------|-----|
| Snow (PSF) | Wind (MPH) | 4'        | 5' 4" | 6'    | 8' | 10'    | 12' |
| None       | 90         | XR10      |       | XR100 |    | XR1000 |     |
|            | 120        |           |       |       |    |        |     |
|            | 140        |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 20         | 90         |           |       |       |    |        |     |
|            | 120        |           |       |       |    |        |     |
|            | 140        |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 30         | 90         |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 40         | 90         |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 80         | 160        |           |       |       |    |        |     |
| 120        | 160        |           |       |       |    |        |     |

\*Table is meant to be a simplified span chart for conveying general rail capabilities. Use approved certification letters for actual design guidance.



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DS-04





Tech Brief

UFO Family of Components

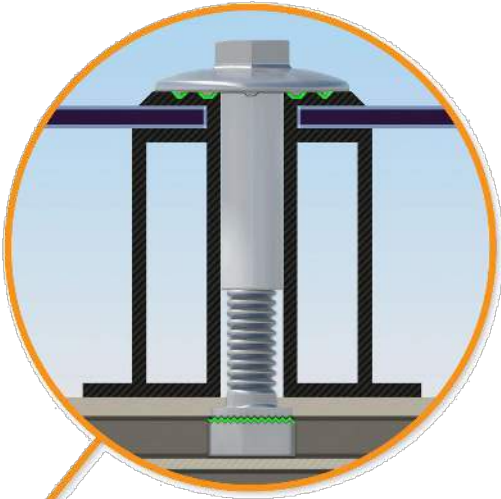
Simplified Grounding for Every Application

The UFO family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge XR Rails. All system types that feature the UFO family—Flush Mount, Tilt Mount and Ground Mount—are fully listed to the UL 2703 standard.

UFO hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.



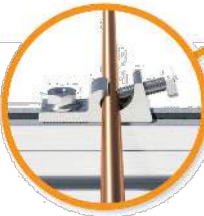
**Stopper Sleeve**  
The Stopper Sleeve snaps onto the UFO, converting it into a bonded end clamp.



**Universal Fastening Object (UFO)**  
The UFO securely bonds solar modules to XR Rails. It comes assembled and lubricated, and can fit a wide range of module heights.



**BOSS™ Splice**  
Bonded Structural Splice connects rails with built-in bonding teeth. No tools or hardware needed.

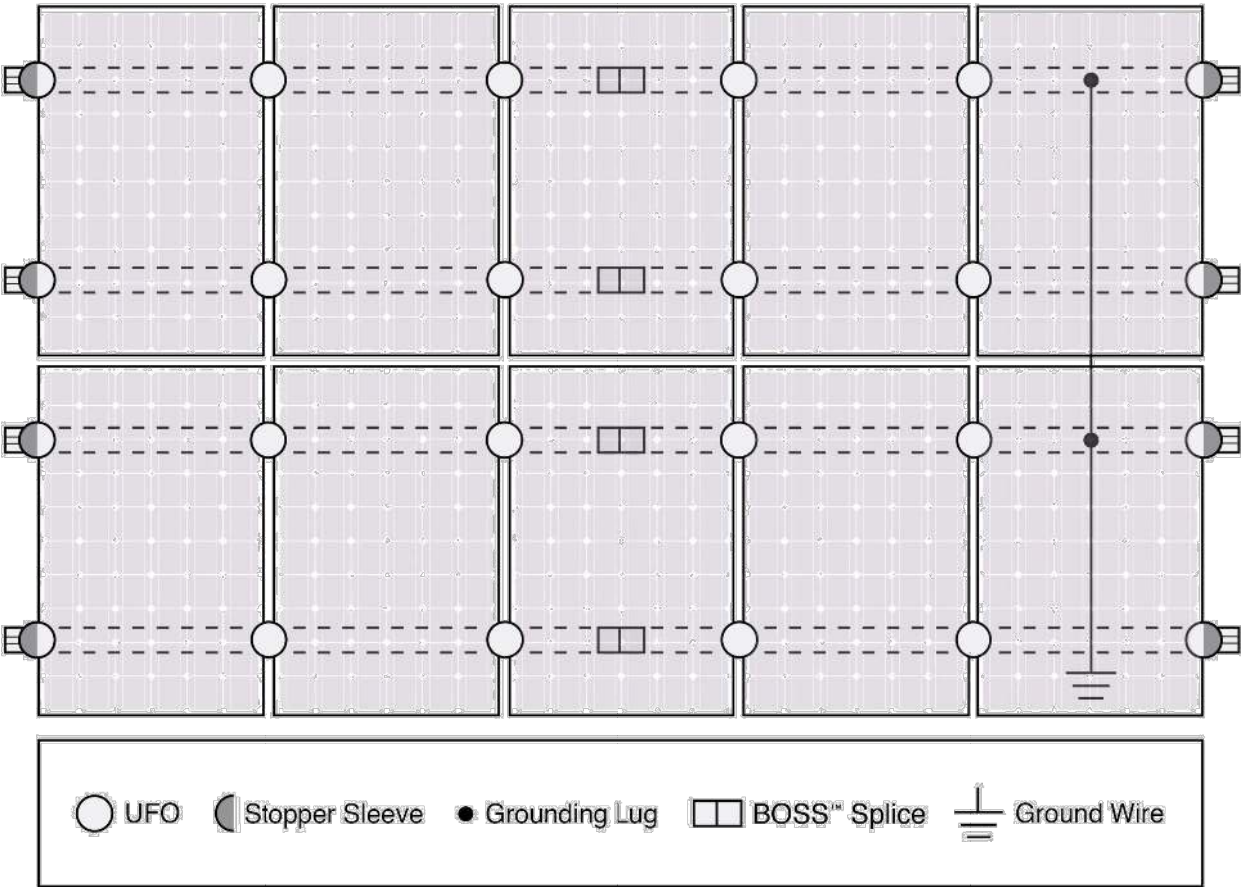


**Grounding Lug**  
A single Grounding Lug connects an entire row of PV modules to the grounding conductor.



**Bonded Attachments**  
The bonding bolt attaches and bonds the L-foot to the rail. It is installed with the same socket as the rest of the system.

System Diagram



Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

UL Certification

The IronRidge Flush Mount, Tilt Mount, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

Go to [IronRidge.com/UFO](https://www.ironridge.com/UFO)

| Cross-System Compatibility        |  |            |              |
|-----------------------------------|--|------------|--------------|
| Feature                           | Flush Mount  | Tilt Mount | Ground Mount |
| XR Rails                          | ✓  | ✓          | XR1000 Only  |
| UFO/Stopper                       | ✓  | ✓          | ✓            |
| BOSS™ Splice                      | ✓  | ✓          | N/A          |
| Grounding Lugs                    | 1 per Row  | 1 per Row  | 1 per Array  |
| Microinverters & Power Optimizers | Compatible with most MLPE manufacturers. Refer to system installation manual.                        |            |              |
| Fire Rating                       | Class A  | Class A    | N/A          |
| Modules                           | Tested or Evaluated with over 400 Framed Modules. Refer to installation manuals for a detailed list. |            |              |

Tech Brief

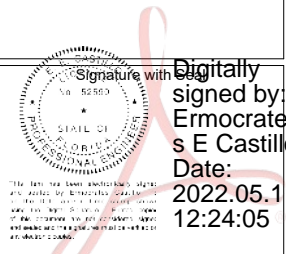


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ANSI B  
11" X 17"

SHEET NUMBER

DS-05



The right way to attach solar PV to trapezoidal roof profiles!

# S-5!®

## The Right Way!™

NEW

NOW AVAILABLE  
IN ALUMINUM

ProteaBracket™

### ProteaBracket™

A versatile bracket for  
mounting solar PV to  
trapezoidal roof profiles

ProteaBracket™ is now made in aluminum. Still the most versatile trapezoidal metal roof attachment solution on the market, the S-5! ProteaBracket just got better!

The bracket features an adjustable attachment base and module attachment options to accommodate different roof profile dimensions and mounting options.

Our pre-applied EPDM gasket with peel and stick adhesive makes installation a snap, ensuring accurate and secure placement the first time.

With no messy sealants, faster installation, and a weather-proof fit, ProteaBracket offers you the most versatile solar attachment solution available.

ProteaBracket\* can be used for  
rail mounting or "direct-attach"  
with S-5! PVKIT™

### Features and Benefits

- 34% lighter - saves on shipping
- Stronger L-Foot™
- Load-tested for engineered application
- Corrosion-resistant materials
- Adjustable - Fits rib profiles up to 3"
- Peel-and-Stick prevents accidental shifting during installation
- Fully pre-assembled
- 25-year warranty\*

\*When ProteaBracket is used in conjunction with the S-5! PVKIT, an additional nut is required during installation.

\*See www.S-5.com for details.



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

# S-5!®

The Right Way!™

ProteaBracket™ is the perfect solar attachment solution for most trapezoidal rib, exposed-fastened metal roof profiles!

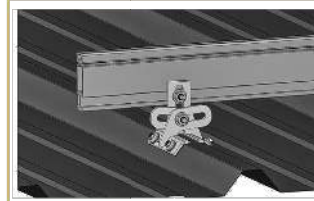
ProteaBracket™ is compatible with common metal roofing materials and comes with a pre-applied EPDM gasket on the base.

**Note:** All four pre-punched holes must be used to achieve tested strength. Fasteners are provided.

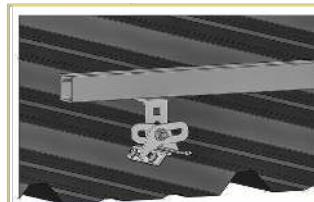
For design assistance, ask your distributor, or visit [www.S-5.com](http://www.S-5.com) for the independent lab test data that can be used for load-critical designs and applications. Also, please visit our website for more information including metallurgical compatibilities and specifications.

S-5!® holding strength is unmatched in the industry.

### Multiple Attachment Options:



Side  
Mount Rail



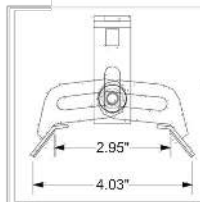
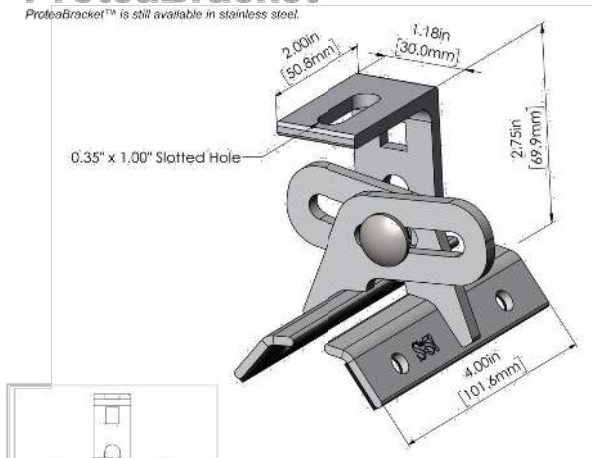
Bottom  
Mount Rail



w/ S-5!  
PVKIT™  
(rail-less)

### ProteaBracket™

ProteaBracket™ is still available in stainless steel.



ProteaBracket fits profiles  
up to 3 inches

INSTALLATION:

**No surface preparation needed.** (1) Wipe away excess oil and debris. (2) Peel off adhesive release paper. (3) Align and mount bracket directly onto crown of panel. (4) Secure ProteaBracket through pre-punched holes, using piercing-point S-5! screws.



ProteaBracket™ and the S-5! PVKIT™ 2.0  
mounted on a trapezoidal roof profile

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

Products are protected by multiple U.S. and foreign patents. For published data regarding holding strength, bolt torque, patents, and trademarks, visit the S-5! website at [www.S-5.com](http://www.S-5.com).

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| REVISIONS   |      |     |
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| DESCRIPTION | DATE | REV |
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PROJECT INSTALLER

SEM POWER

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PROJECT NAME

HETRICK RESIDENCE

446 NW CAMBRIDGE HILL WAY,  
LAKE CITY, FL 32055

SHEET NAME

DATA SHEET

SHEET SIZE

ANSI B  
11" X 17"

SHEET NUMBER

DS-06