HETRICK RESIDENCE

13.600kW PV SYSTEM

446 NW CAMBRIDGE HILL WAY, LAKE CITY, FL 32055

PROJECT DESCRIPTION:

34x400 HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES
ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES

SYSTEM SIZE: 13.600 kW DC STC
ARRAY AREA #1: 718.11 SQ FT.

EQUIPMENT SUMMARY
34 HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES
34 ENPHASE: IQ7PLUS-72-2-US MICROINVERTERS

RACKING: IRONRIDGE XR100
ATTACHMENT: S-5-PROTEA

DESIGN CRITERIA:

WIND SPEED (ULT):	130 MPH
WIND SPEED (ASD):	101 MPH
RISK CATEGORY:	II
EXPOSURE:	B

CODES AND STANDARDS

GOVERNING CODES :
FLORIDA RESIDENTIAL CODE, 7TH EDITION 2020 (FRC)
FLORIDA PLUMBING CODE, 7TH EDITION 2020 (FPC)
FLORIDA BUILDING CODE, 7TH EDITION 2020 (FBC)
FLORIDA MECHANICAL CODE, 7TH EDITION 2020 (FMC)
NATIONAL ELECTRICAL CODE 2017 (NEC)
ASCE 7-16

OWNER

HETRICK, CHRISTOPHER

INSTALLER

SEM POWER LLC
4466 Eagle Falls Pl, Tampa,
FL 33619, United States
(888) 496-1119

ENGINEER

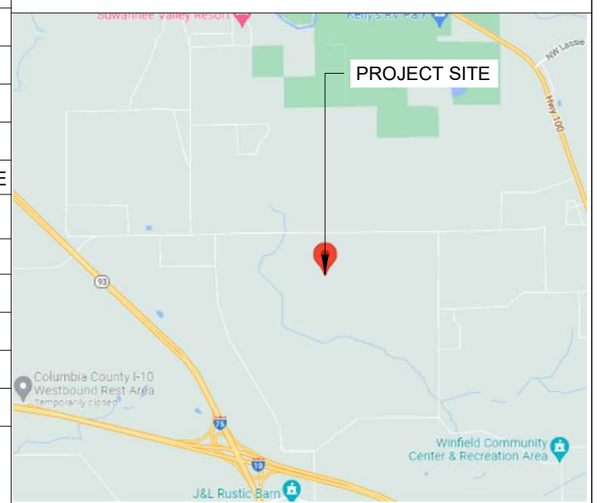
Castillo Engineering Services LLC
620 N. Wymore Road, Suite 250, Maitland, FL 32751
TEL: (407) 289-2575
Ermocrates E. Castillo
License#: FL PE 52590

SHEET INDEX

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

HOUSE PHOTO

VICINITY MAP



STRUCTURAL CERTIFICATION:

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.

ELECTRICAL CERTIFICATION:

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

Castillo Engineering
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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

Signature with seal
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
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 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.

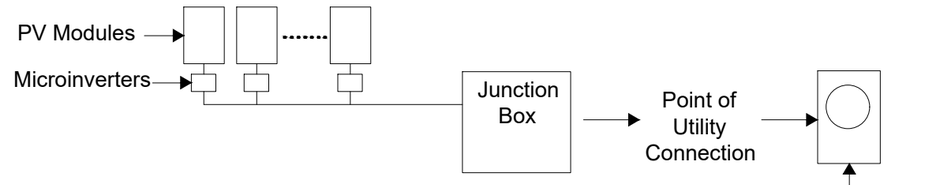


Figure 1: PV System Block Diagram

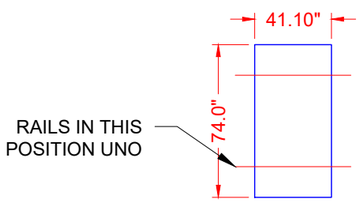
The inverter meets the requirements of IEEE 1547 and UL 1741.

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)



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

ALLOWABLE/DESIGN PRESSURE	PSF
DOWN PRESSURE	75
UPLIFT PRESSURE, 2 RAILS	55

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

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

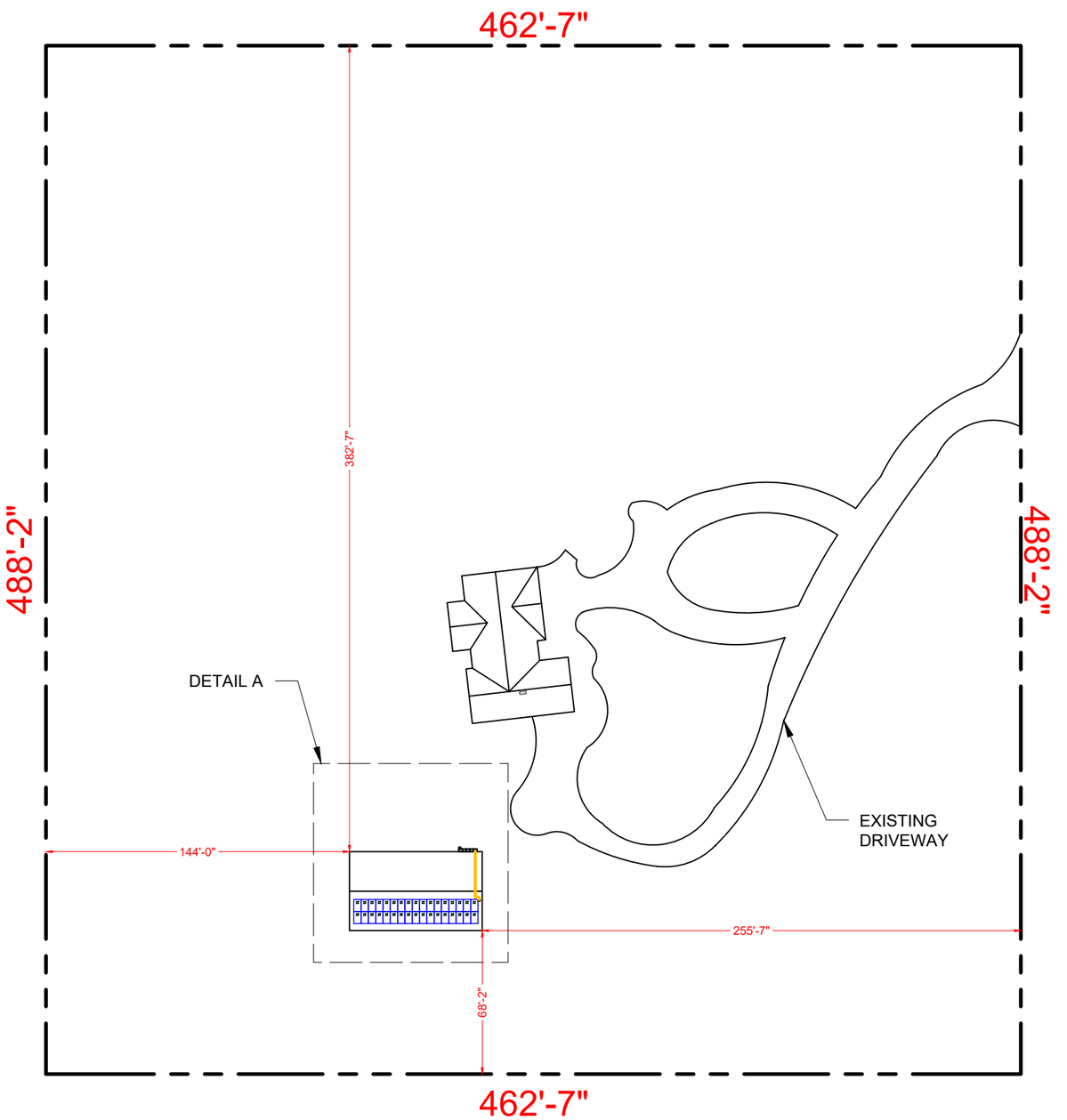
PROJECT NAME

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

SHEET NAME
NOTES AND DESCRIPTION

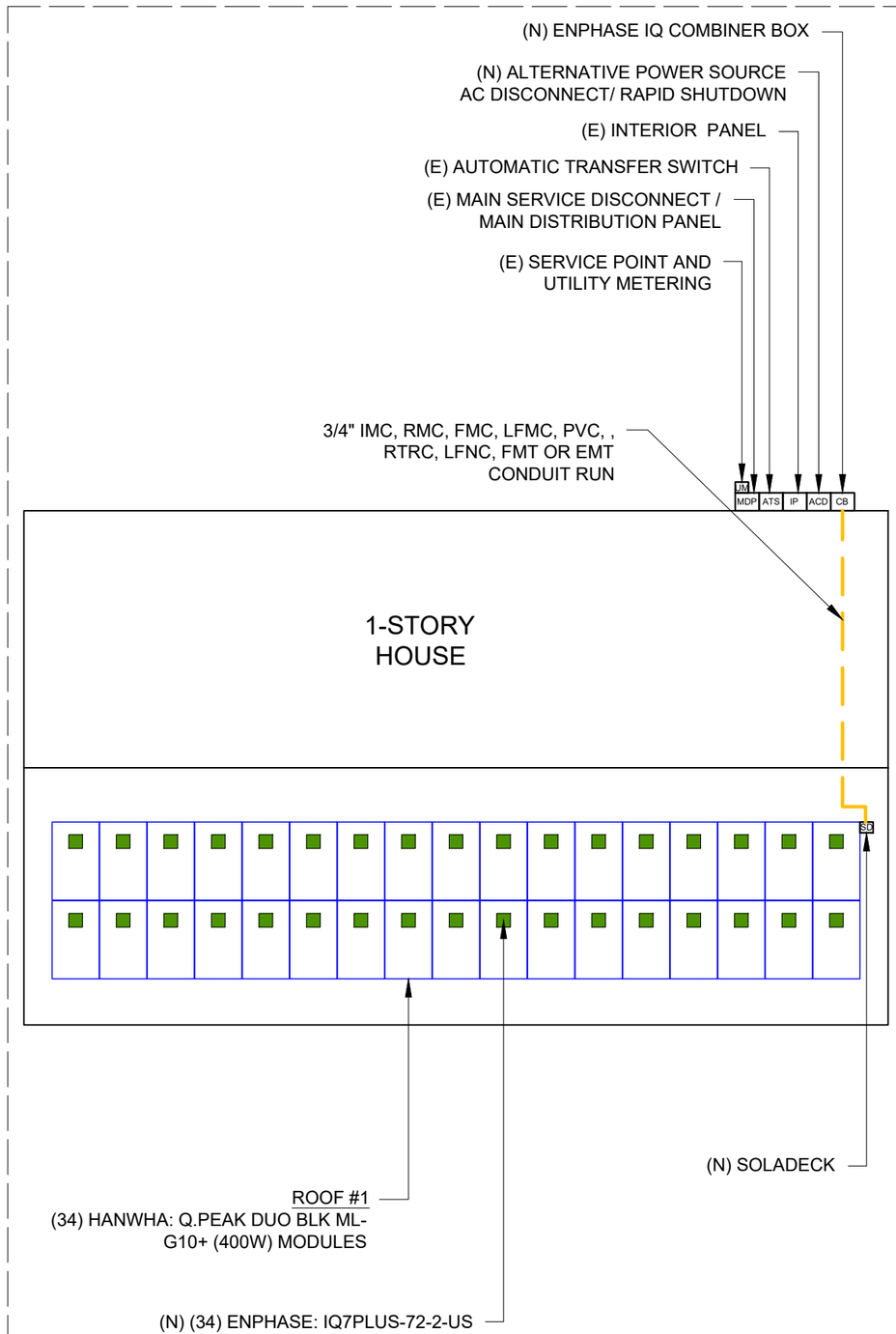
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
A-00



1 | A-01 ROOF PLAN AND PROPERTY LINES

SCALE: 1/64" = 1'-0"



2 | A-01 DETAIL A

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

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SHEET NAME

ROOF PLAN

SHEET SIZE

ANSI B
11" X 17"

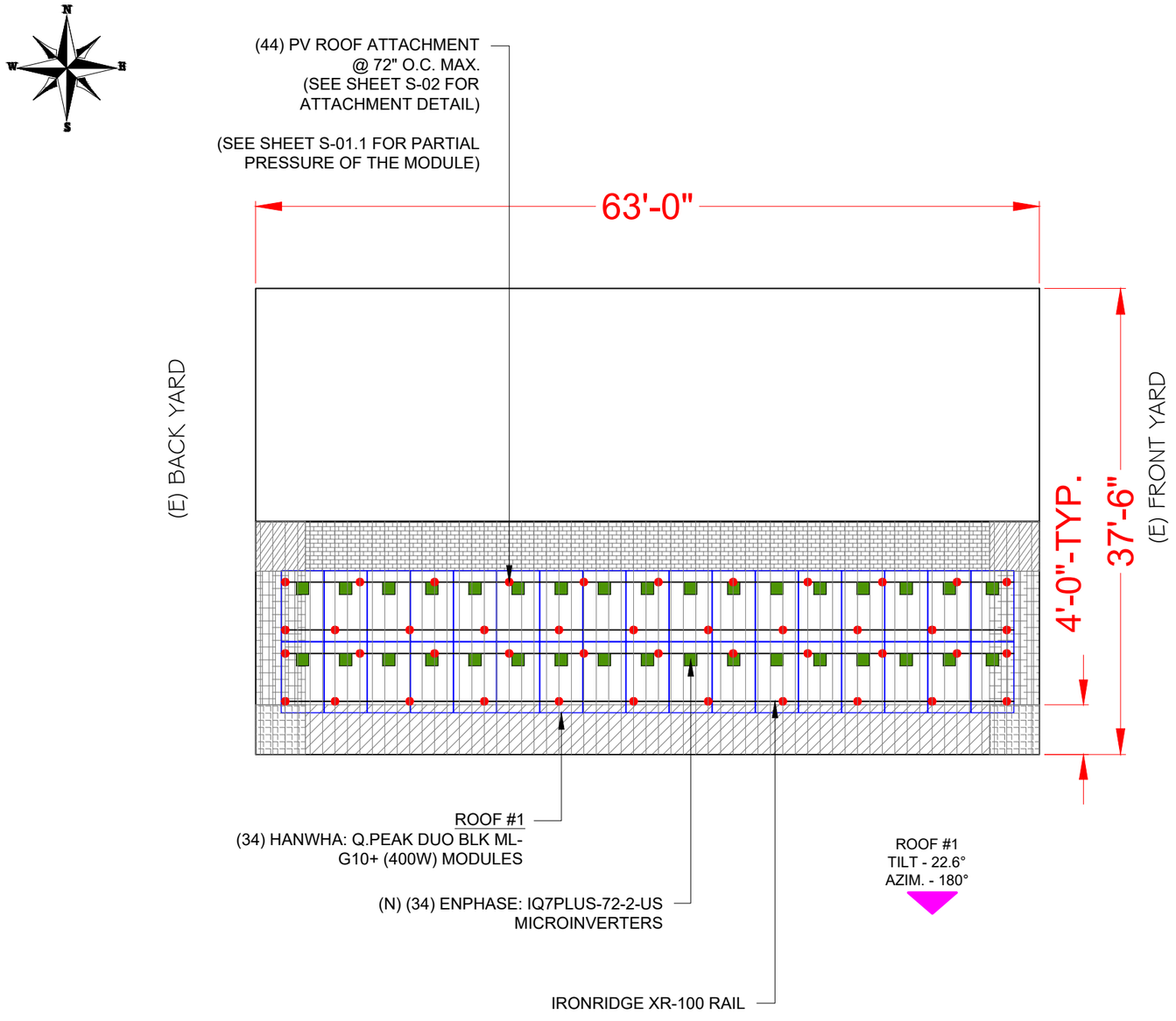
SHEET NUMBER

A-01

MODULE TYPE, DIMENSIONS & WEIGHT

NUMBER OF MODULES = 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				



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

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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SHEET NAME
MODULE LAYOUT

SHEET SIZE
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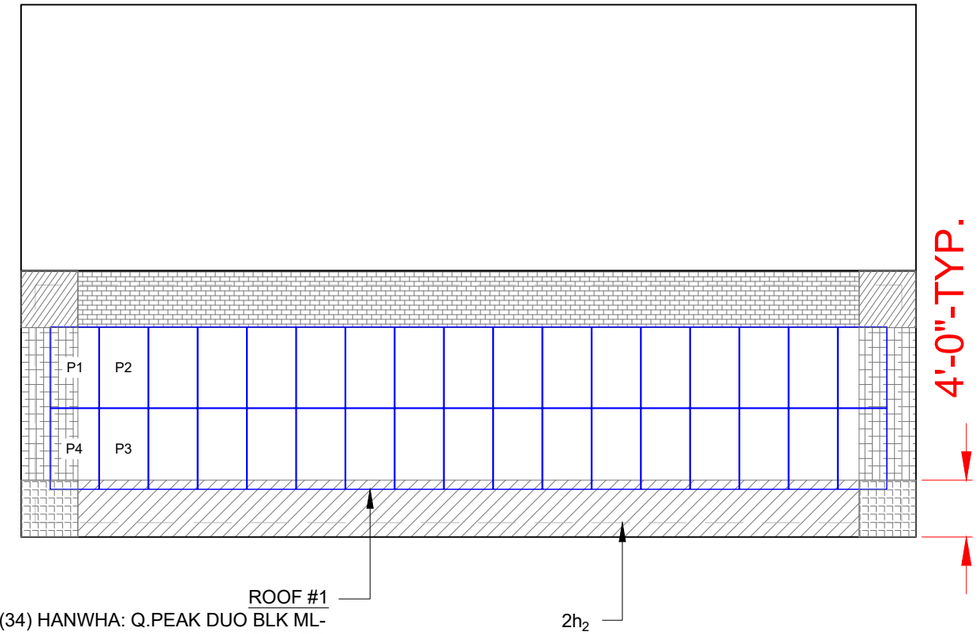
(E) BACK YARD



(E) FRONT YARD

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
	1	1'	2e	2n	2r	3e	3r	Pressure
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

$2h_2$ 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.

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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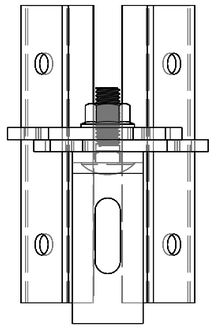
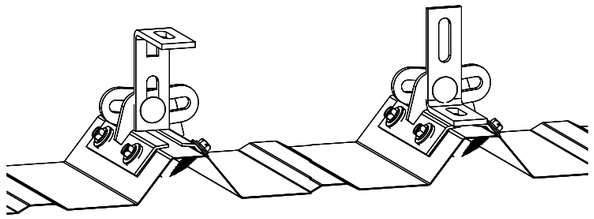
LAKE CITY, FL 32055

SHEET NAME
PARTIAL PRESSURE AND MODULES EXPOSURE

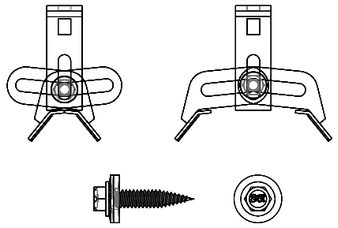
SHEET SIZE
ANSI B
11" X 17"

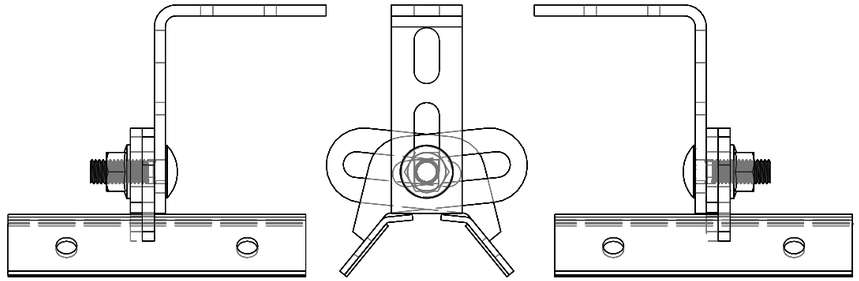
SHEET NUMBER
S-01.1





ProteaBracket

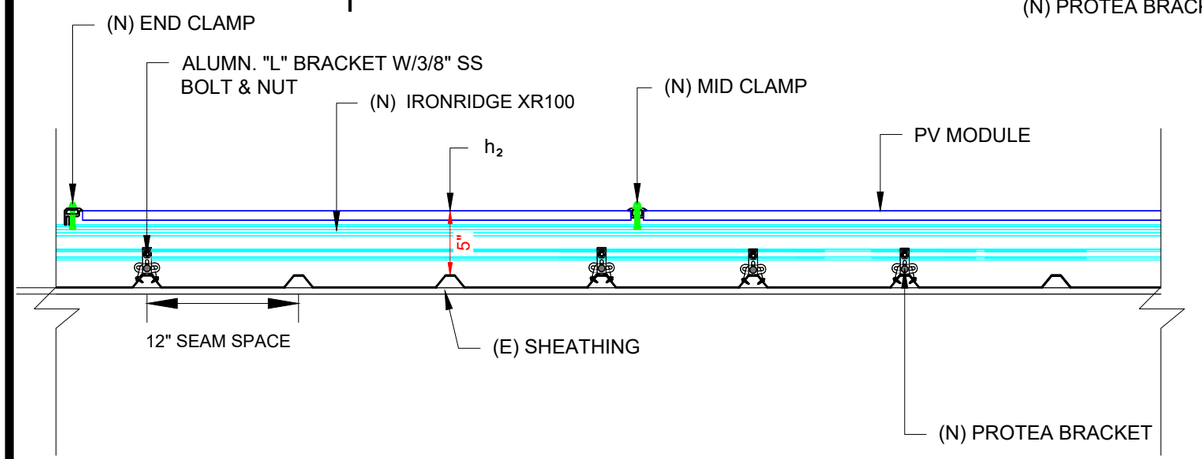




FOR STANDING SEAM SPECIFIC MECHANICAL LOAD TEST INFORMATION AND CLAMP INSTALLATION INFORMATION PLEASE VISIT: WWW.S-5.COM

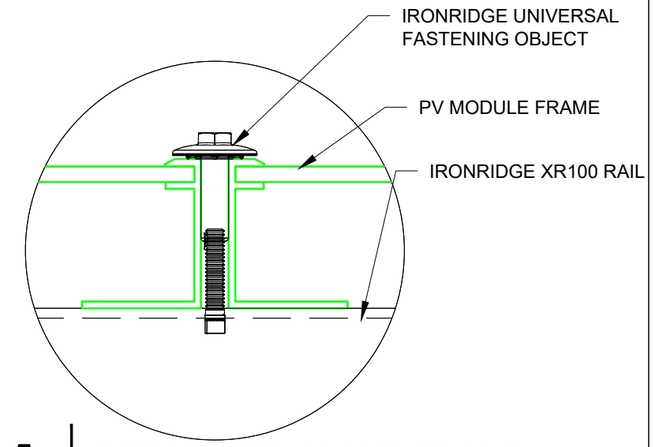
1 ATTACHMENT DETAIL

S-02 — SCALE: NTS



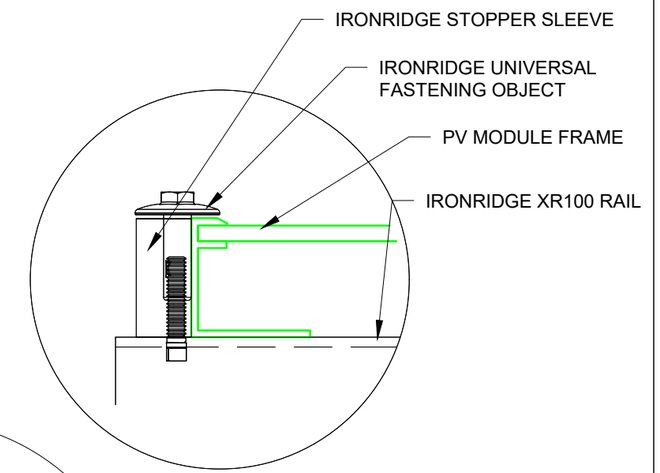
2 ATTACHMENT DETAIL & ENLARGED VIEW

S-02 — SCALE: 1' = 1'-0"



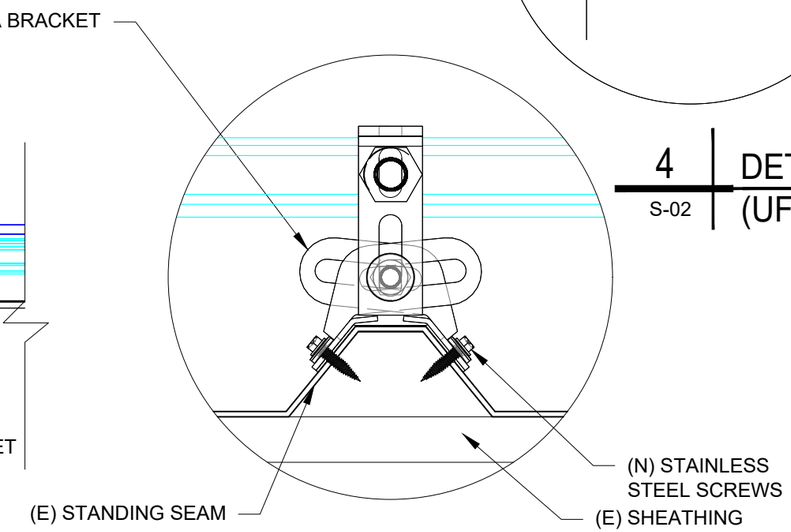
5 DETAIL, MID CLAMP FRONT

S-02 — Scale: 6"=1'-0"



4 DETAIL, END CLAMP (UFO) FRONT

S-02 — Scale: 6"=1'-0"



3 ENLARGED VIEW

S-02 — SCALE: 1" = 1'-0"

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

Signature with seal — Digitally signed by: Ermocrates E Castillo Date: 2022.05.11 12:24:01

PROJECT NAME

HETRICK RESIDENCE

446 NW CAMBRIDGE HILL WAY, LAKE CITY, FL 32055

SHEET NAME

ATTACHMENT DETAIL

SHEET SIZE

ANSI B
11" X 17"

SHEET NUMBER

S-02

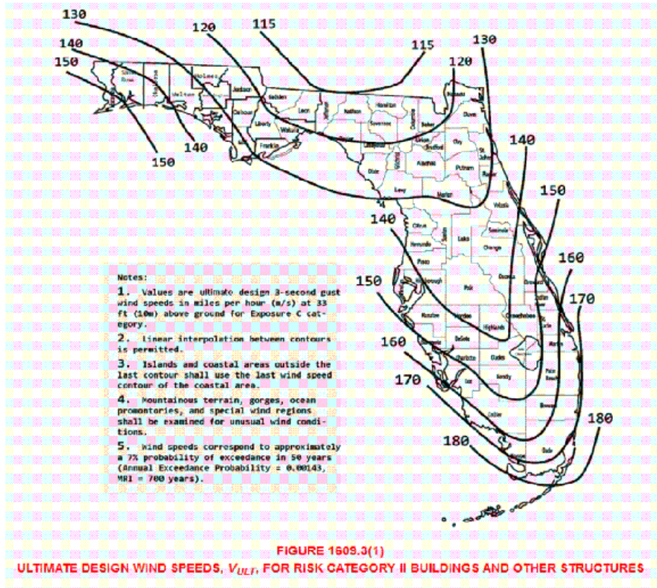

FIGURE 1609.3(1)
ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

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_e)	1.000
MODULE AREA (sq. ft.)	21.12	TEMPERATURE FACTOR (C_t)	1.000
GROUND SNOW LOAD (psf)	0.0	IMPORTANCE FACTOR (I_s)	1.000
DEAD LOAD (psf)	3.0	SLOPE FACTOR (C_s)	0.910
SLOPED ROOF SNOW LOAD (psf)	0.0	K_D	0.850
EFFECTIVE WIND AREA (ft^2)	21.1	K_{ZT}	1.000
GROUND ELEVATION (ft)	104.0	K_e	0.996
HVHZ	NO	K_z	0.624

DESIGN CALCULATIONS

VELOCITY PRESSURE (q) = $.00256*K_E K_z K_{ZT} K_D V^2$

VELOCITY PRESSURE(ASD) 13.7 psf

WIDTH OF PRESSURE COEFFICIENT	37.6' * 10%	=	3.76'	ZONE WIDTH A	4 FT
	20' * 40%	=	8'	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 EQUALIZATION FACTOR	0.67012
ARRAY EDGE FACTOR (NON-EXPOSED)	1		

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	

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MAITLAND, FL 32751
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ERMOCRATES E. CASTILLO - FL PE 52590

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

Signature with Seal
Digitally signed by: Ermocrates E Castillo
Date: 2022.05.11 12:24:01

PROJECT NAME

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

SHEET NAME
STRUCTURE CALCULATION

SHEET SIZE
ANSI B
11" X 17"

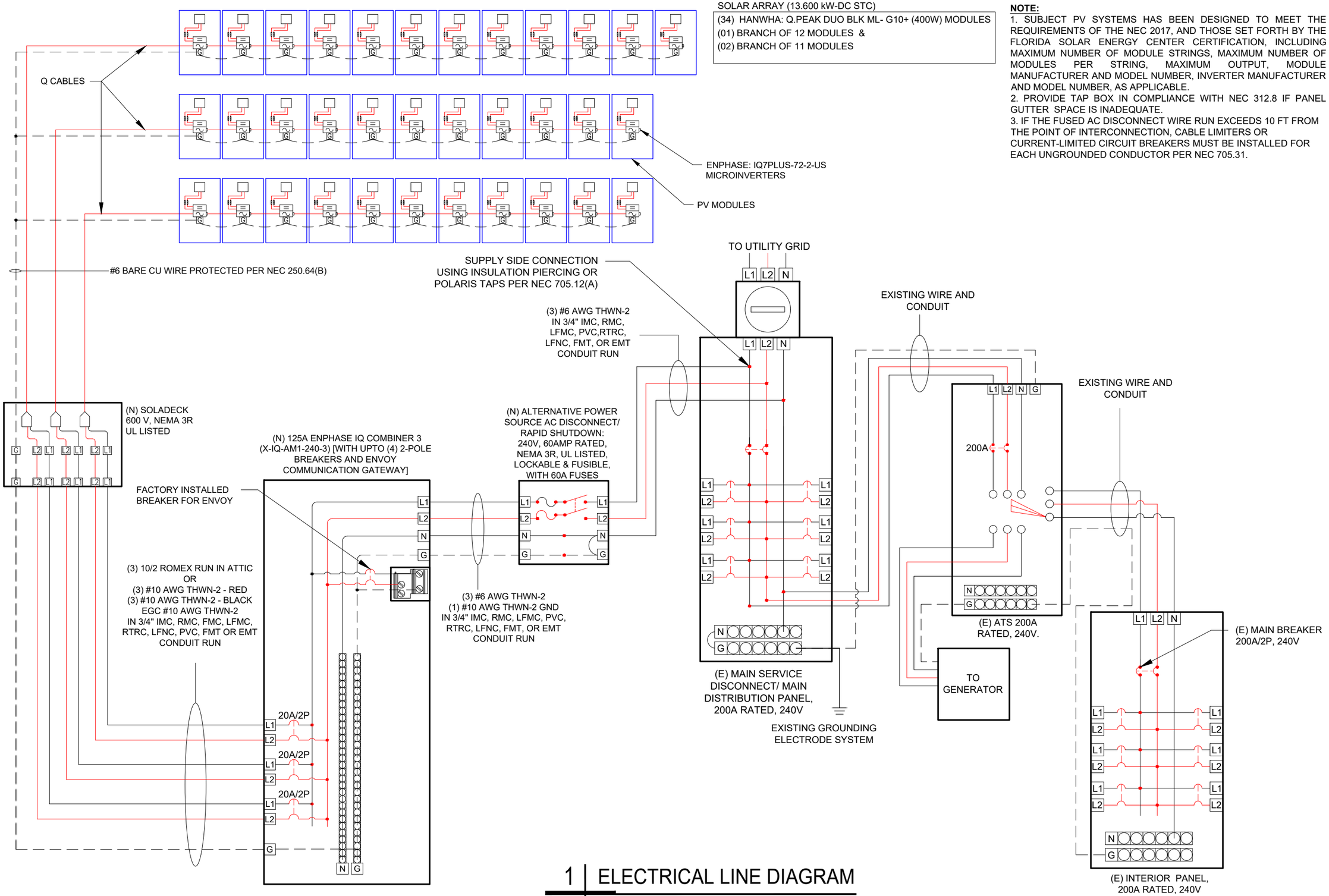
SHEET NUMBER
S-02.1

SOLAR ARRAY (13.600 kW-DC STC)

(34) HANWHA: Q.PEAK DUO BLK ML- G10+ (400W) MODULES
(01) BRANCH OF 12 MODULES &
(02) BRANCH OF 11 MODULES

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.



1 | ELECTRICAL LINE DIAGRAM

E-01

SCALE: NTS

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REVISIONS

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Signature with Seal

Digitally signed by: Ermocrates 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 0.a 40C
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	24CV 1-Phase

Module Properties			
Voc	45.3	Isc	11.14
Vmpp	37.13	Imp	8.51
TC Voc	-0.27%/K	TC Vmp	-0.34%/K
Pmp	400.0	NOCT	45 °C

Design Temperature	
Min. Ambient Temp. °F	32
Max. Ambient Temp. °F	117
Calculated Max. Voc	49
Calculated M n Vmp	29
Conduit Fill	
Number of conduits	1

Inverter Properties	
Output Voltage	240 L-L 1-Ph
Max Input dc voltage	60 Vdc
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

Ampacity Calculations

Circuit	Max Amps	1.25 x Max Amps	AWG	90 °C Ampacity	Ambient Temp °F	Temp Derate	Conduit Fill	Fill Derate	Derated Ampacity	Maximum Circuit 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 Combiner 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 Mills	I	V	Max Length
Circuit 1	#10	10360	14.5	240	33 Feet
Circuit 2	#10	10360	13.3	240	45 Feet
Circuit 2	#10	10360	13.3	240	45 Feet
Combiner 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
	Informaton 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

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.

Castillo Engineering
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CASTILLO ENGINEERING SERVICES, LLC
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MAITLAND, FL 32751
TEL: (407) 289-2575
ERMOCRATES E. CASTILLO - FL PE 52590

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

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

PROJECT NAME

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

SHEET NAME

WIRING CALCULATIONS

SHEET SIZE

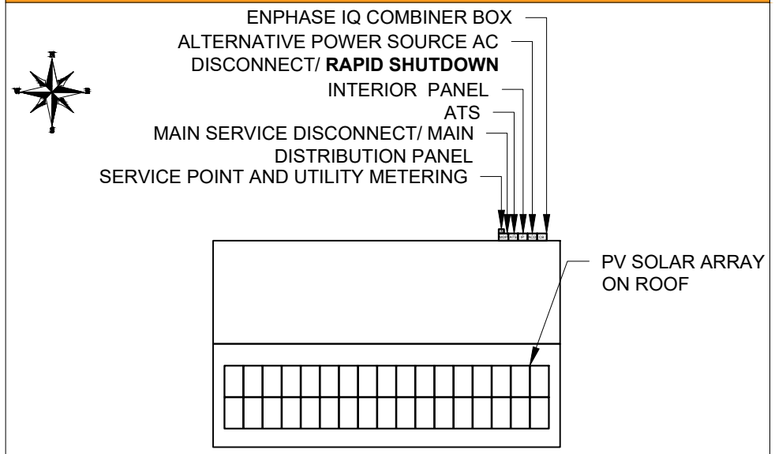
ANSI B
11" X 17"

SHEET NUMBER

E-02

CAUTION!

POWER TO THIS BUILDING
SUPPLIED FROM MULTIPLE SOURCES

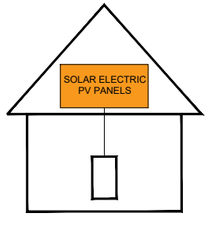


446 NW CAMBRIDGE HILL WAY, LAKE CITY, FL 32055

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 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 FOR AC MODULE PROTECTION PER CIRCUIT-	20	A

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

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

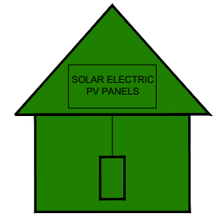
LABEL LOCATION:
AC DISCONNECT
(PER CODE: NEC690.56(C)(3))

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)

SEM SOLAR

⚠ EMERGENCY CONTACT: ⚠
PH. NO. : (407)289-2575

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

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]

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CASTILLO ENGINEERING SERVICES, LLC
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MAITLAND, FL 32751
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ERMOCRATES E. CASTILLO - FL PE 52590

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

Signature with seal
Digitally signed by: Ermocrates 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

EUPD RESEARCH TOP BRAND PV MODULES AUSTRALIA 2017 2018 2021 2020 2019

25 YR Warranty Product & Performance

Q CELLS Yield Security

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 warranty[1].

[1] See data sheet on rear for further information.

THE IDEAL SOLUTION FOR:

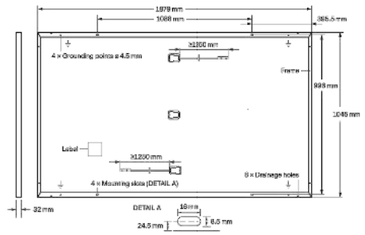
Rooftop arrays on residential buildings

Engineered in Germany

Q CELLS

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 Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥1250 mm, (–) ≥1250 mm
Connector	Stäubli MC4; IP68

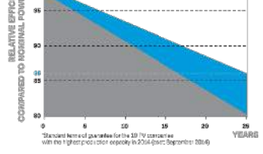


ELECTRICAL CHARACTERISTICS

POWER CLASS				385	390	395	400	405	410
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / –0 W)									
Minimum	Power at MPP[1]	P_{MPP}	[W]	385	390	395	400	405	410
	Short Circuit Current[1]	I_{SC}	[A]	11.04	11.07	11.10	11.14	11.17	11.20
	Open Circuit Voltage[1]	V_{OC}	[V]	45.19	45.23	45.27	45.30	45.34	45.37
	Current at MPP	I_{MPP}	[A]	10.59	10.65	10.71	10.77	10.83	10.89
	Voltage at MPP	V_{MPP}	[V]	36.36	36.62	36.88	37.13	37.39	37.64
	Efficiency[1]	η	[%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6	20.9
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	307.6
	Short Circuit Current	I_{SC}	[A]	8.90	8.92	8.95	8.97	9.00	9.03
	Open Circuit Voltage	V_{OC}	[V]	42.62	42.65	42.69	42.72	42.76	42.79
	Current at MPP	I_{MPP}	[A]	8.35	8.41	8.46	8.51	8.57	8.62
	Voltage at MPP	V_{MPP}	[V]	34.59	34.81	35.03	35.25	35.46	35.68

[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

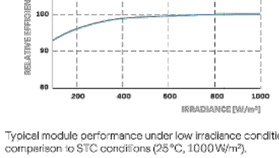
Q CELLS PERFORMANCE WARRANTY



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	[°C]	43±3

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage	V_{SYS}	[V]	1000	PV module classification	Class II
Maximum Reverse Current	I_R	[A]	20	Fire Rating based on ANSI / UL 61730	C/TYPE 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. QCPV Certification ongoing. Certification holder: Hanwha Q CELLS GmbH

TÜVRheinland CERTIFIED www.tuv.com ID 11119280077

CE

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

Specifications subject to technical changes © Q CELLS Q.PEAK DUO BLK ML-G10+_385-410_2021-06_Rev01_AU

Engineered in Germany

Q CELLS

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ERMOCRATES E. CASTILLO - FL PE 52590

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REVISIONS

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Digitally signed by: Ermocrates E Castillo
Date: 2022.05.11 12:24:03

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

Data Sheet
Enphase Microinverters
Region: US

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.

Easy to Install

- Lightweight and simple
- Faster installation with improved, lighter two-wire cabling
- Built-in rapid shutdown compliant (NEC 2014 & 2017)

Productive and Reliable

- Optimized for high powered 60-cell and 72-cell* modules
- More than a million hours of testing
- Class II double-insulated enclosure
- UL listed

Smart Grid Ready

- Complies with advanced grid support, voltage and frequency ride-through requirements
- Remotely updates to respond to changing grid requirements
- Configurable for varying grid profiles
- Meets CA Rule 21 (UL 1741-SA)

* The IQ 7+ Micro is required to support 72-cell modules.

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE.

Enphase IQ 7 and IQ 7+ Microinverters

INPUT DATA (DC)	IQ7-60-2-US	IQ7PLUS-72-2-US
Commonly used module pairings[1]	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[2]	240 V / 211-264 V	208 V / 183-229 V	240 V / 211-264 V	208 V / 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[3]	16 (240 VAC) 13 (208 VAC)		13 (240 VAC) 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 H4 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. 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) UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 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**

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

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Date: 2022.05.11 12:24:03

PROJECT NAME

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

SHEET NAME
DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

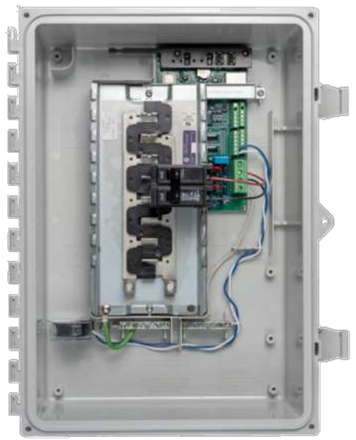
SHEET NUMBER
DS-02

Data Sheet
Enphase Networking

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

UL LISTED

To learn more about Enphase offerings, visit **enphase.com**

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Enphase IQ Combiner 3

MODEL NUMBER	
IQ Combiner 3 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™ CELLMODEM-03 (4G/12-year data plan) CELLMODEM-01 (3G/5-year data plan) 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 **CT-200-SPLIT** *** Consumption monitoring is required for Enphase Storage Systems**	**Split core current transformers enable whole home consumption metering (+/- 2.5%).**
Ensemble Communications Kit 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 **BRK-10A-2-240** **BRK-15A-2-240** **BRK-20A-2P-240**	**Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers.** **Circuit breaker, 2 pole, 10A, Eaton BR210** **Circuit breaker, 2 pole, 15A, Eaton BR215** **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** • **60 A breaker branch input: 4 to 1/0 AWG copper conductors** • **Main lug combined output: 10 to 2/0 AWG copper conductors** • **Neutral and ground: 14 to 1/0 copper conductors** **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 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**

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REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER

SEM POWER

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Date: 2022.05.11 12:24:04

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

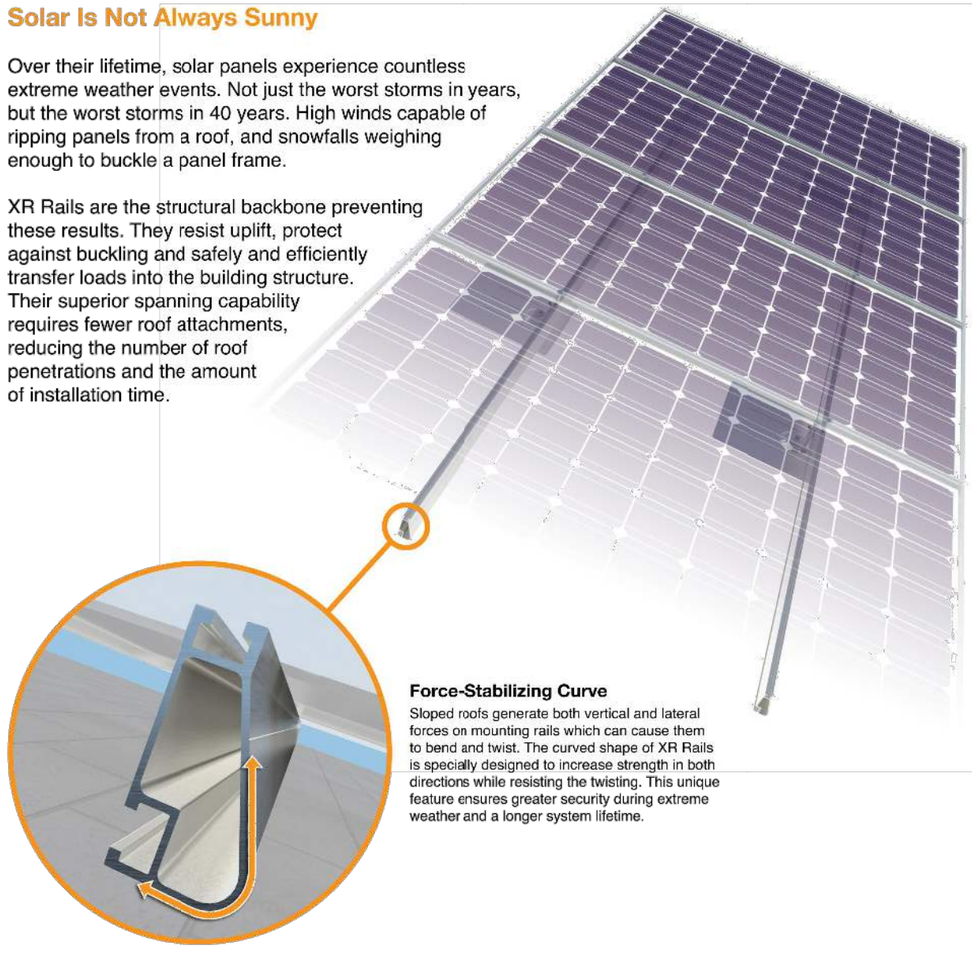
IRONRIDGE

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.

Tech Brief

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 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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11" X 17"

SHEET NUMBER

DS-04

Tech Brief

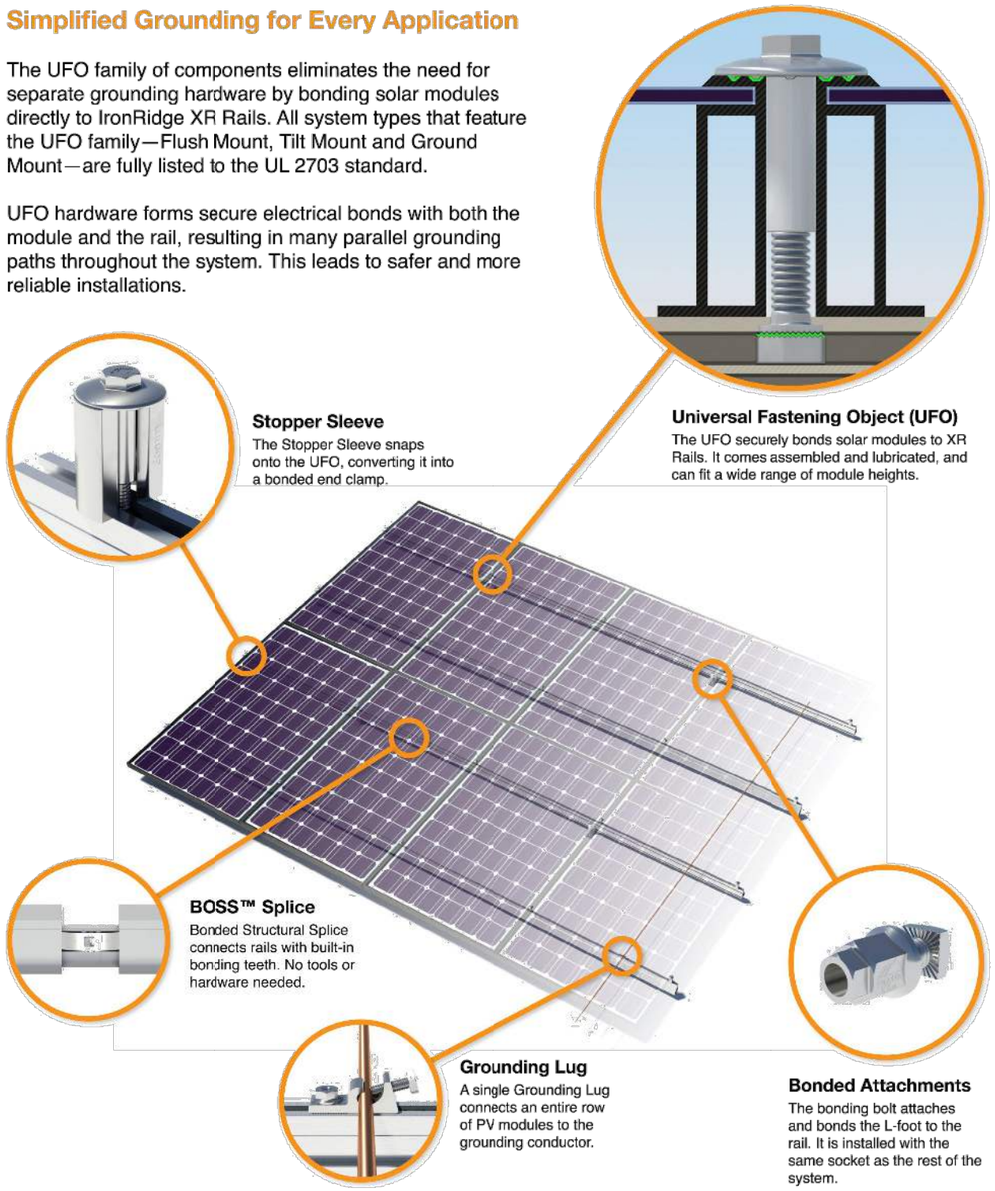
IRONRIDGE

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.

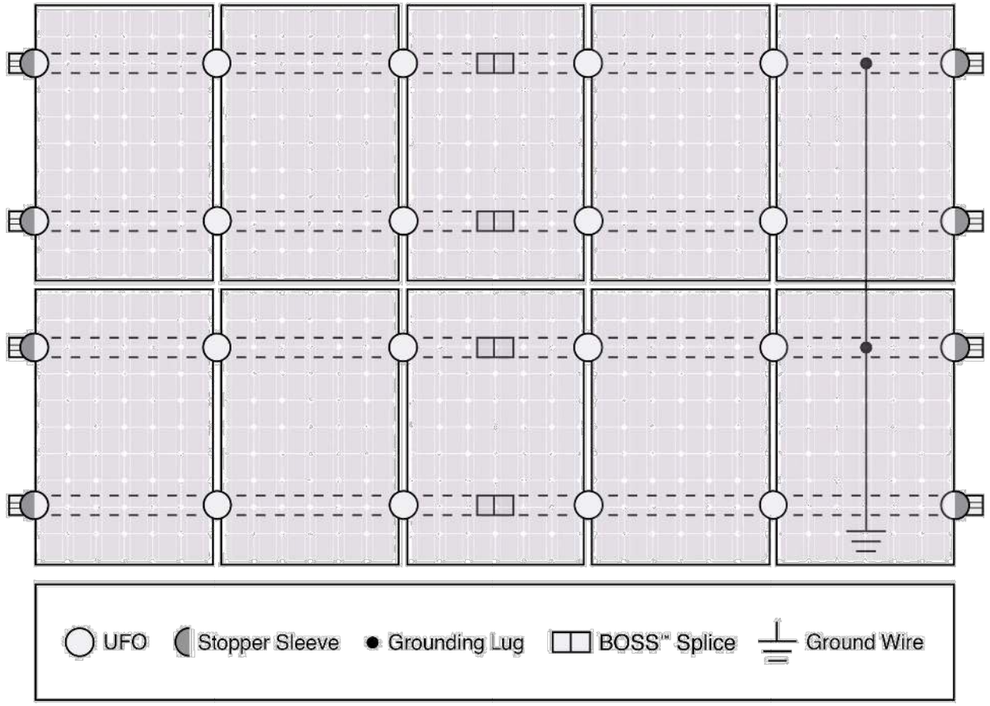
BOSS™ Splice
Bonded Structural Splice connects rails with built-in bonding teeth. No tools or hardware needed.

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.

Tech Brief

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

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.		

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LAKE CITY, FL 32055

SHEET NAME
DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-05

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.

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

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

MADE IN USA

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.

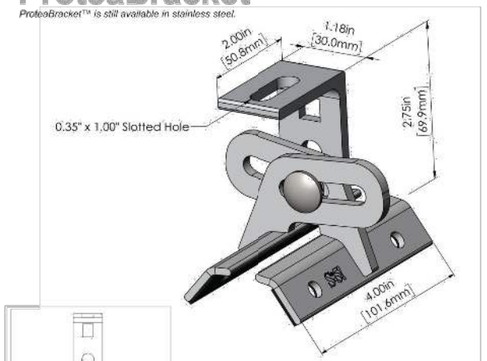
Note: All four pre-punched holes must be used to achieve tested strength. Fasteners are provided.

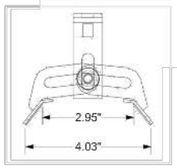
For design assistance, ask your distributor, or visit **www.S-5.com** for the independent lab test data that can be used for load-critical designs and applications. Also, please visit our website for more information including metallurgical compatibilities and specifications.

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

ProteaBracket™

ProteaBracket™ is still available in stainless steel.

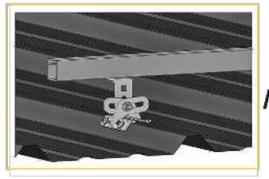




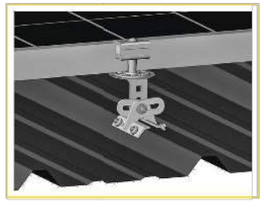
ProteaBracket fits profiles up to 3 inches

Multiple Attachment Options:

Side Mount Rail



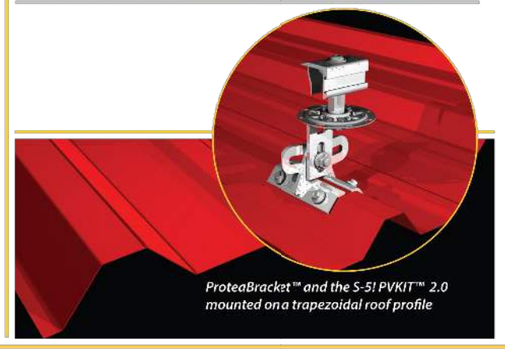
Bottom Mount Rail



w/ S-5! PVKIT™ (rail-less)

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.

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DS-06