PROJECT DESCRIPTION:

28 x 400 URECO SOLAR FBM400MFG-BB (400W) MODULES
ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES

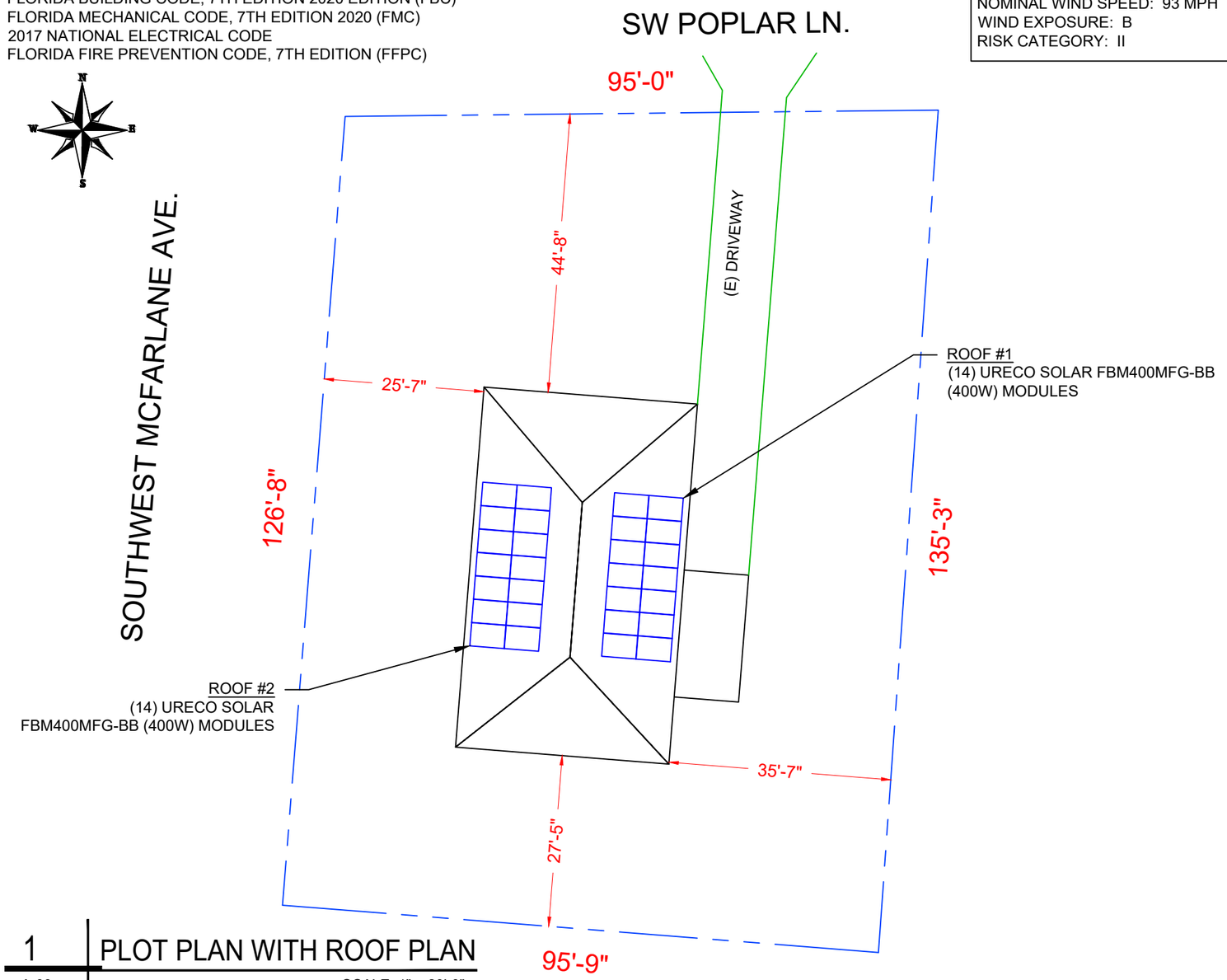
SYSTEM SIZE: 11.2 kW DC STC

EQUIPMENT SUMMARY
28 URECO SOLAR FBM400MFG-BB MODULES
28 DURACELL D350-M1 MICRO-INVERTERS

GOVERNING CODES :
FLORIDA RESIDENTIAL CODE, 7TH EDITION 2020 (FRC)
FLORIDA PLUMBING CODE, 7TH EDITION 2020 (FPC)
FLORIDA BUILDING CODE, 7TH EDITION 2020 EDITION (FBC)
FLORIDA MECHANICAL CODE, 7TH EDITION 2020 (FMC)
2017 NATIONAL ELECTRICAL CODE
FLORIDA FIRE PREVENTION CODE, 7TH EDITION (FFPC)

SHEET INDEX

A-00	PLOT PLAN & VICINITY MAP
S-01	ROOF PLAN & MODULES
S-02	ATTACHMENT DETAILS
S-03	STRUCTURAL CALCULATIONS
E-01	ELECTRICAL SITE PLAN
E-02	ELECTRICAL LINE DIAGRAM & WIRING CALCULATIONS
E-03	SYSTEM LABELING
DS-01	MODULE DATA SHEET
DS-02	MICRO INVERTER DATA SHEET
DS-03	RAIL DATA SHEET
DS-04	ATTACHMENT DATA SHEET
DS-05	ATTACHMENT DATA SHEET

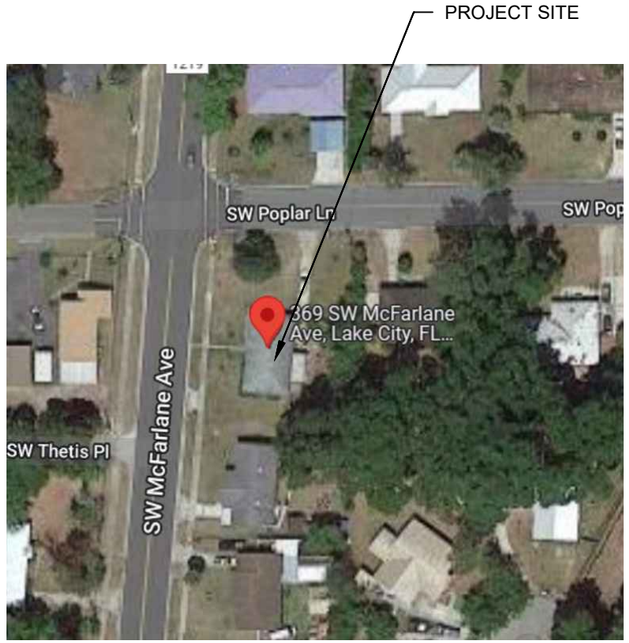


1 PLOT PLAN WITH ROOF PLAN
A-00 SCALE: 1" = 20'-0"

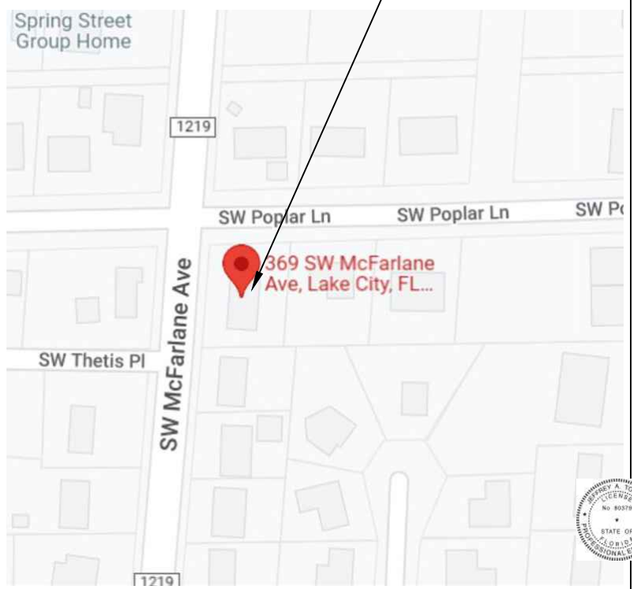
DISCLAIMER :
THE SET OF PLANS FOR THIS PROJECT IS FOR DESIGNING THE PROJECT FOR BUILDING CODE COMPLIANCE. THIS DOES NOT EXPRESS OR IMPLY A PERFORMANCE GUARANTEE OF ANY KIND. CONTRACTOR RESPONSIBLE TO REVIEW AND APPROVE THE LAYOUT WITH THE END USER AND ANY OTHER PARTIES INVOLVED PRIOR TO INSTALLATION.

ALL DIMENSION AND CONDITION SHOWN ON THE SET OF PLANS IS BASED ON THE BEST POSSIBLE INFORMATION GIVEN. CONTRACTOR RESPONSIBLE TO FILED VERIFY ALL CONDITION IN THE FILED PRIOR TO INSTALLATION OR ACCEPTS FULL RESPONSIBLE

ASCE 7-16 WIND DESIGN CRITERIA
ULTIMATE WIND SPEED: 120 MPH
NOMINAL WIND SPEED: 93 MPH
WIND EXPOSURE: B
RISK CATEGORY: II



2 HOUSE PHOTO
A-00 SCALE: NTS



3 VICINITY MAP
A-00 SCALE: NTS

SOLAR ENERGY SPECIALIST
SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
PLOT PLAN & VICINITY MAP

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
A-00

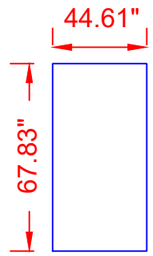
Signature with Seal
Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:48:12 -05'00'

JEFFREY A. TORRES, PE
FL PE #80379
SUNSMART ENGINEERING LLC
FL COA #35170
925 SUNSHINE LANE, STE 1010
ALTAMONTE SPRINGS, FL 32714
(407) 710-1147

MODULE TYPE, DIMENSIONS & WEIGHT

NUMBER OF MODULES = 28 MODULES
MODULE TYPE = URECO SOLAR FBM400MFG-BB (400W) MODULES
WEIGHT = 47.84 LBS / 21.7 KG.
MODULE DIMENSIONS = 67.83" x 44.61" = 21.01 SF

TOTAL ARRAY AREA = 588.37 SQ. FT.
TOTAL ROOF FACE AREA = 1982.29 SQ. FT.
588.37 / 1982.29= 29.68% OF ROOF FACE AREA COVERED BY ARRAY
18" RIDGE SETBACKS OK PER R324.6.2



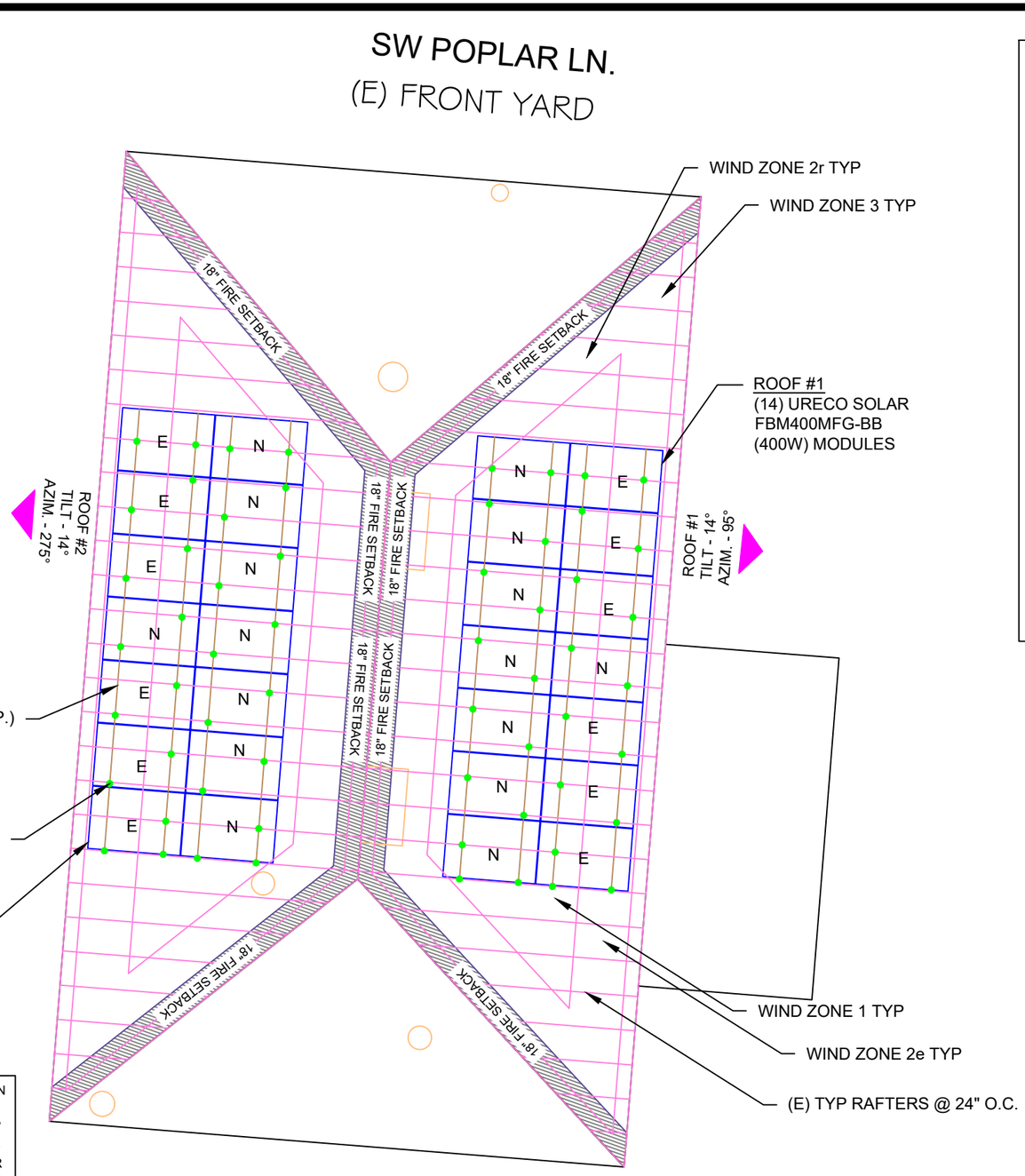
URECO SOLAR
FBM400MFG-BB (400W)
MODULES

SOUTHWEST MCFARLANE AVE.

(N) IRONRIDGE XR-10 RAIL (TYP.)

(N) IRONRIDGE FLASHFOOT 2 PV ROOF ATTACHMENT @ 48" O.C.

ROOF #2
(14) URECO SOLAR
FBM400MFG-BB (400W) MODULES



NOTE :THE TRUSS LOCATIONS AND ATTACHMENT POINTS SHOWN ON SHEET S-01 IS ONLY SHOWS AN ILLUSTRATIVE REPRESENTATION OF A TYPICAL 2X4 TRUSS LAYOUT SPACED 24" ON CENTER WITH ATTACHMENT POINTS TO THE TRUSS. IT DOES NOT REPRESENT THE EXACT LOCATIONS AND THE CONTRACTOR IS RESPONSIBLE TO VERIFY THAT IN THE FIELD. AS LONG AS THE SPACING OF THE ROOF ATTACHMENTS AND THE RAIL CANTILEVER ARE WITHIN THE PARAMETERS ALLOWED AS STATED IN THE GENERAL STRUCTURAL NOTES SECTION ON SHEET S-01, IT COMPLIES WITH THE REQUIREMENTS OF MY DRAWINGS AND PER THE 2020 FLORIDA BUILDING CODE (7TH EDITION).

1 ROOF PLAN & MODULES
S-01 SCALE: 1/8" = 1'-0"

GENERAL STRUCTURAL NOTES:

1. APPLICABLE CODE: 2020 FLORIDA RESIDENTIAL CODE (7TH EDITION) & ASCE 7-16 MINIMUM DESIGN LOADS FOR BUILDING AND OTHER STRUCTURES.
2. ATTACHMENT STRENGTH OF IRONRIDGE FLASHFOOT 2 ATTACHMENTS ARE BASED OFF IRONRIDGE'S PULL TEST DATA AND IRONRIDGE MANUFACTURERS SPECIFICATIONS AND IT IS ASSUMED THE EXISTING WOOD TRUSSES ARE SOUTHERN YELLOW PINE.
3. SPACING OF THE IRONRIDGE FLASHFOOT 2 ATTACHMENTS SHALL BE AS FOLLOWS:
NON-EXPOSED MODULES
*WIND ZONE 1, 2e, 2r, 3 = 4'-0" ON CENTER, 1'-7" CANTILEVER
EXPOSED MODULES
*WIND ZONE 1, 2e, 2r, 3 = 4'-0" ON CENTER, 1'-7" CANTILEVER
4. IRONRIDGE FLASHFOOT 2 ATTACHMENT SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS AND CONTRACTOR SHALL FOLLOW MANUFACTURER'S RECOMMENDATIONS TO WEATHER PROOF AND SEAL ALL ROOF PENETRATIONS.
5. EXISTING ROOF IS A TYPICAL HIP ROOF FROM 7 DEGREES TO 20 DEGREES WITH A ROOF COVERING OF ASPHALT SHINGLES. MEAN ROOF HEIGHT = 15 FT OR LESS ABOVE GRADE WHERE MODULES ARE.
MODULES LOCATED ON THE HIP PORTION OF THE ROOF AS SHOWN.
6. DESIGN PARAMETERS SHOWN ARE BASED ON ALLOWABLE STRESS DESIGN (ASD) NOMINAL WIND SPEED PRESSURES PER SECTION 29.4.4 FOR ROOFTOP SOLAR PANELS PARALLEL TO THE ROOF SURFACE WITH EXPOSURE "B", RISK CATEGORY II, ENCLOSED BUILDING AND h < 60'-0" PER ASCE 7-16 "MINIMUM DESIGN LOADS FOR BUILDING AND OTHER STRUCTURES" AND 2020 F.B.C. (7TH EDITION). EXPOSED AND NON-EXPOSED MODULES ARE LABELED AS SHOWN.
7. ROOF SURFACE TO UNDERSIDE OF PANEL HEIGHT IS APPROXIMATELY 5 INCHES AND INCREASED UPLIFT ON THE PORTION OF MODULES WITHIN A 10 INCH CLEARANCE OF THE ROOF EDGES HAS BEEN CONSIDERED.
8. "a" DIMENSION AS DEFINED PER ASCE 7-16 SHALL BE 4 FT REGARDLESS PER THE 2020 FLORIDA RESIDENTIAL CODE (7TH EDITION).
10. SOLAR PANELS AND MOUNTING SYSTEM SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
11. MODULES SHALL BE LOCATED AS SHOWN FOR THE WIND LOAD CALCULATIONS ON SHEET S-03 TO BE VALID. ANY RELOCATION OF MODULES SHALL BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO RELOCATION OF MODULES.
12. ALL FIRE SETBACKS SHOWN COMPLY WITH THE REQUIREMENTS OF THE 2020 FLORIDA RESIDENTIAL CODE AND 2020 FLORIDA FIRE PREVENTION CODE.

I CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC: RESIDENTIAL CHAPTER 3. THE ADDITION OF THE SOLAR MODULES AND ALL ACCESSORIES TO THE EXISTING BUILDING WILL NOT ADVERSELY AFFECT THE STRUCTURAL INTEGRITY OF THE BUILDING AND CAN SAFELY ACCOMODATE THE NEW IMPOSED LOADS OF THE SOLAR SYSTEM.

LEGEND

ED - EDGE MODULE
E - EXPOSED MODULE
N - NON-EXPOSED MODULE
- ROOF OBSTRUCTION
- PV ROOF ATTACHMENT
- RAFTERS

SOLAR ENERGY SPECIALIST
SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ROOF PLAN & MODULES

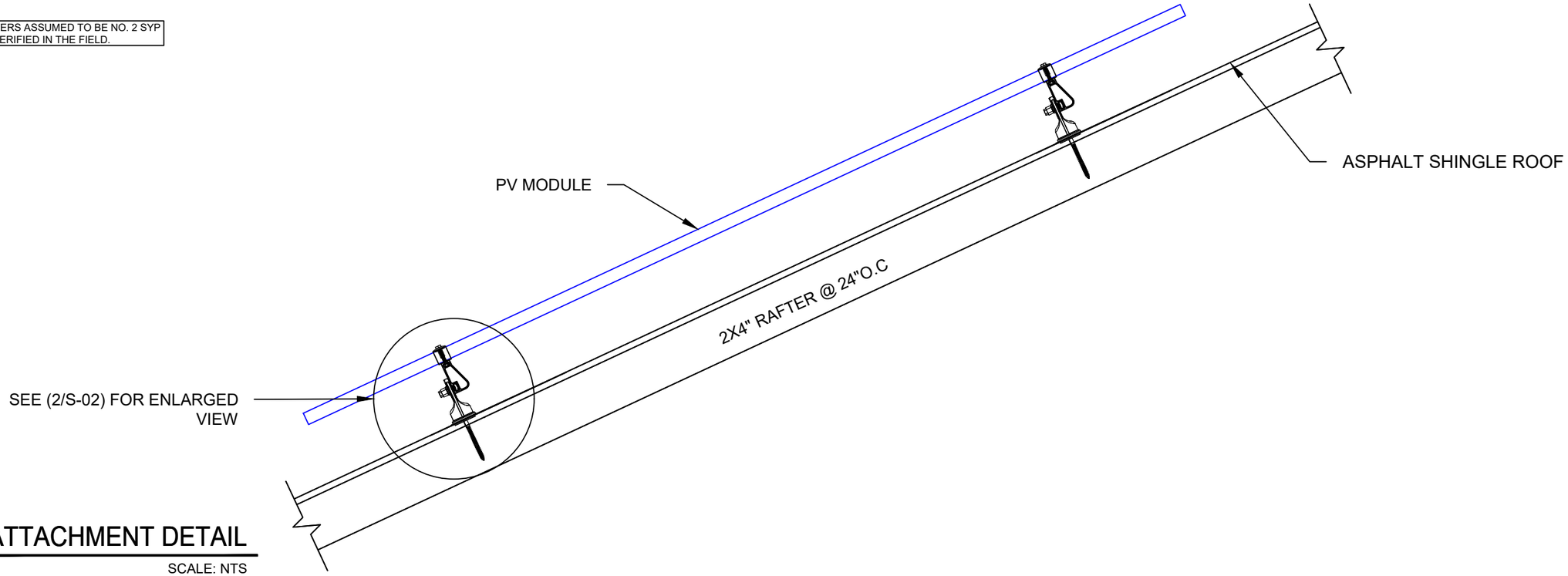
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
S-01

Signature with Seal
Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:48:26 -05'00'

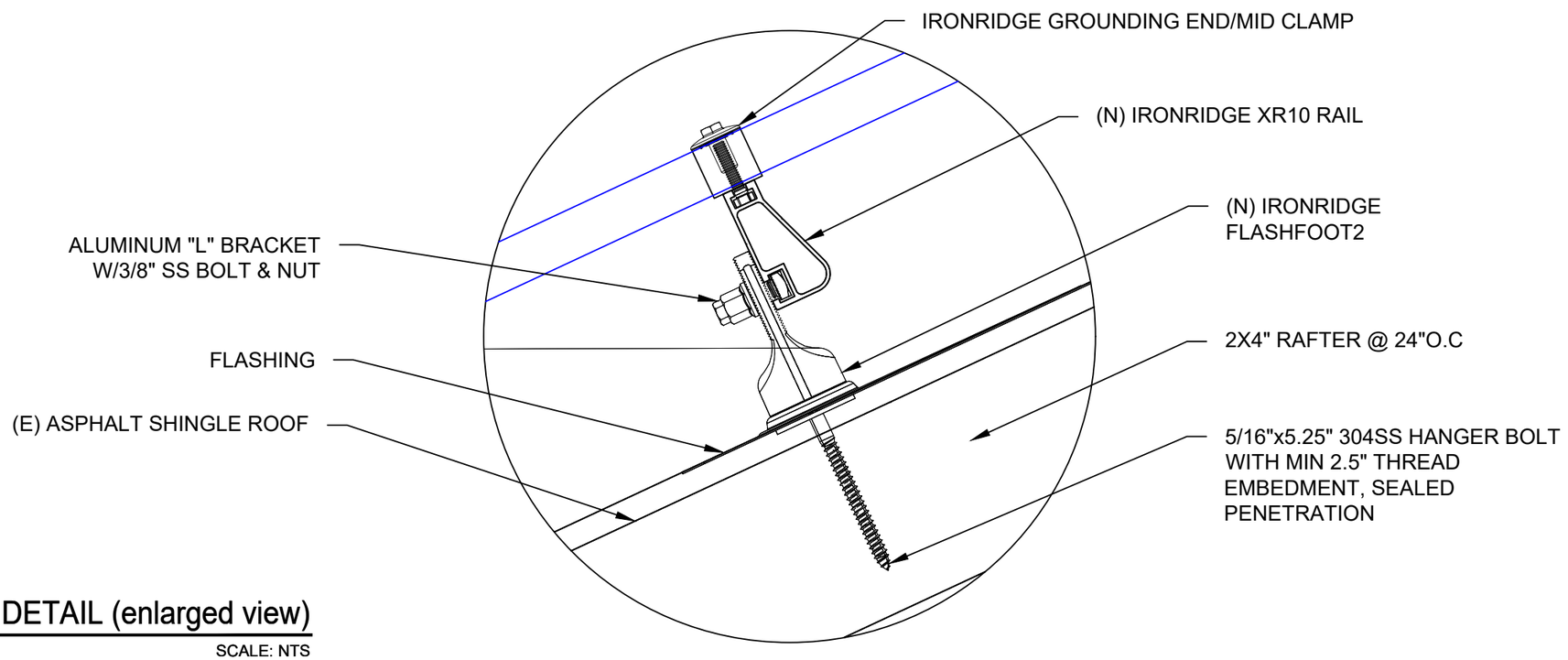
JEFFREY A. TORRES, PE
FL PE #80379
SUNSMART ENGINEERING LLC
FL COA #35170
925 SUNSHINE LANE, STE 1010
ALTAMONTE SPRINGS, FL 32714
(407) 710-1147

NOTE: 2X4 RAFTERS ASSUMED TO BE NO. 2 SYP AND SHALL BE VERIFIED IN THE FIELD.



1 ATTACHMENT DETAIL

S-02 SCALE: NTS



ATTACHMENT DETAIL (enlarged view)

SCALE: NTS

SOLAR ENERGY SPECIALIST

SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME

THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ATTACHMENT DETAILS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
S-02

Signature with Seal

Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:48:33 -05'00'

JEFFREY A. TORRES, PE
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(407) 710-1147

BASE WIND LOAD CALCULATION

Engineering Calculations

120 MPH Solar Panel Flush Mount Wind Pressure Calculations for Residential and Low Rise Commercial Buildings

Wind Velocity Pressure Calculation per ASCE 7-16 $q_h = 0.00256^* K_z^* K_{zt}^* K_d^* K_e^* V^2$		
Ultimate Wind Speed - V (MPH)	=	120
ASD Wind Speed - V (MPH)	=	93.0
Mean roof height of where modules are located (ft)	=	15
Velocity Pressure Coefficient for **Wind Exposure B** - K_z	=	0.57
Topographic Factor - K_{zt}	=	1
Ground Elevation Factor - K_e	=	1
Wind Directionality Factor - K_d	=	0.85
Length of a single solar module (inches)	=	67.83
Width of a single solar module (inches)	=	44.61
Center to Center Spacing of Roof Attachment (ft)	=	4
Effective Wind Area of a Single Module (sf)	=	21.01
Effective Wind Area of a roof connection tributary area (sf)	=	11.31
ASD Wind Velocity Pressure (psf)	=	10.72

MODULE CAPACITY CHECK

Uplift Capacity of Solar Module		
Test Capacity of Module (PSF) (Portrait)	=	50
Minimum Factor of Safety Required	=	1.5
Design Capacity of Module (PSF)	=	33.3
Module with worst case partial pressure loading (PSF)	=	24.22
		THEREFORE OK

NON-EXPOSED CALCULATION

Uplift Pressures on Solar Panels - Hip Roof 7 to 20 degrees				Overhang Uplift Pressures (Edge Modules)	
P = Qh*(GCp)(Ye)(Ya) (lb/ft2)- Per Chapter 29.4		Module	Roof Connection	Module	Roof Connection
GCp - Wind Zone Group 1 (WZ1)	=	-1.80	-1.80	N/A	N/A
GCP - Wind Zone Group 2 (WZ2r)	=	-2.17	-2.36	-2.91	-3.07
GCP - Wind Zone Group 3 (WZ2e. WZ3)	=	-2.25	-2.54	-3.25	-3.63
Effective Wind Area of structural element considered (sf)	=	21.01	11.31	21.01	11.31
Array Edge Factor (use 1 if module is non-exposed - 1.5 if exposed)	=	1	1	1	1
Pressure Equalization Factor	=	0.67	0.779	0.67	0.779
Wind Zone Group 1 Worst Case Scenario Pressure (psf)	=	-12.94	-15.02	N/A	N/A
Wind Zone Group 2 Worst Case Scenario Pressure (psf)	=	-15.63	-19.72	-20.90	-25.60
Wind Zone Group 3 Worst Case Scenario Pressure (psf)	=	-16.15	-21.21	-23.36	-30.25

EXPOSED/EDGE CALCULATION

Uplift Pressures on Solar Panels - Hip Roof 7 to 20 degrees				Overhang Uplift Pressures (Edge Modules)	
P = Qh*(GCp)(Ye)(Ya) (lb/ft2)- Per Chapter 29.4		Module	Roof Connection	Module	Roof Connection
GCp - Wind Zone Group 1 (WZ1)	=	-1.80	-1.80	N/A	N/A
GCP - Wind Zone Group 2 (WZ2r)	=	-2.17	-2.36	-2.91	-3.07
GCP - Wind Zone Group 3 (WZ2e. WZ3)	=	-2.25	-2.54	-3.25	-3.63
Effective Wind Area of structural element considered (sf)	=	21.01	11.31	21.01	11.31
Array Edge Factor (use 1 if module is non-exposed - 1.5 if exposed)	=	1.5	1.5	1.5	1.5
Pressure Equalization Factor	=	0.67	0.779	0.67	0.779
Wind Zone Group 1 Worst Case Scenario Pressure (psf)	=	-19.41	-22.53	N/A	N/A
Wind Zone Group 2 Worst Case Scenario Pressure (psf)	=	-23.45	-29.57	-31.35	-38.40
Wind Zone Group 3 Worst Case Scenario Pressure (psf)	=	-24.22	-31.81	-35.04	-45.38

NON-EXPOSED CONNECTION CALCULATION

Required Lag Bolt Size and Length to Wood Truss		
Per 2018 Edition ASD NDS for Wood Construction		
$W' = W^*(C_d)^*(C_m)^*(C_t)$		
Southern Pine Wood Truss Specific Gravity - G	=	0.55
Withdraw Value for 5/16" Lag Bolt (lbs/in) and specified Specific Gravity	=	307
Embedment Depth (in)	=	2.5
Allowable Embedment Withdraw Design Value - W (lbs)	=	767.5
Load Duration Factor (C_d) for Wind Load (Ten Minute Intervals)	=	1.6
Wet Service Factor (C_m) in areas < 19% moisture content in-service conditions (relatively dry attic space)	=	1
Temperature Factor (C_t) in areas with experience sustained exposured to elevated temperatures 125 °F < T < 150 °F	=	0.7
Adjusted Allowable Embedment Withdraw Design Value - W' (lbs)	=	859.6
Lag Screw Center to Center Spacing (ft)	=	4
Approximate Module Length (ft)	=	5.6525
Effective Wind Area of Attachment Spacing	=	11.31
Worst Case Scenario Partial Pressure Considered (psf)	=	21.21
Tributary Area pullout load onto roof anchor (wind only) (lbs)	=	239.77905
Tribuary Area pullout load (dead load consideration - ASD design)	=	229.60455
Acceptable Design Value Check	=	OK

EXPOSED CONNECTION CALCULATION

Required Lag Bolt Size and Length to Wood Truss		
Per 2018 Edition ASD NDS for Wood Construction		
$W' = W^*(C_d)^*(C_m)^*(C_t)$		
Southern Pine Wood Truss Specific Gravity - G	=	0.55
Withdraw Value for 5/16" Lag Bolt (lbs/in) and specified Specific Gravity	=	307
Embedment Depth (in)	=	2.5
Allowable Embedment Withdraw Design Value - W (lbs)	=	767.5
Load Duration Factor (C_d) for Wind Load (Ten Minute Intervals)	=	1.6
Wet Service Factor (C_m) in areas < 19% moisture content in-service conditions (relatively dry attic space)	=	1
Temperature Factor (C_t) in areas with experience sustained exposured to elevated temperatures 125 °F < T < 150 °F	=	0.7
Adjusted Allowable Embedment Withdraw Design Value - W' (lbs)	=	859.6
Lag Screw Center to Center Spacing (ft)	=	4
Approximate Module Length (ft)	=	5.6525
Effective Wind Area of Attachment Spacing	=	11.31
Worst Case Scenario Partial Pressure Considered (psf)	=	31.81
Tributary Area pullout load onto roof anchor (wind only) (lbs)	=	359.61205
Tribuary Area pullout load (dead load consideration - ASD design)	=	349.43755
Acceptable Design Value Check	=	OK

SOLAR ENERGY SPECIALIST

SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME

THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
STRUCTURAL CALCULATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
S-03

Signature with Seal

Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:48:45 -05'00'

JEFFREY A. TORRES, PE
FL PE #80379
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FL COA #35170
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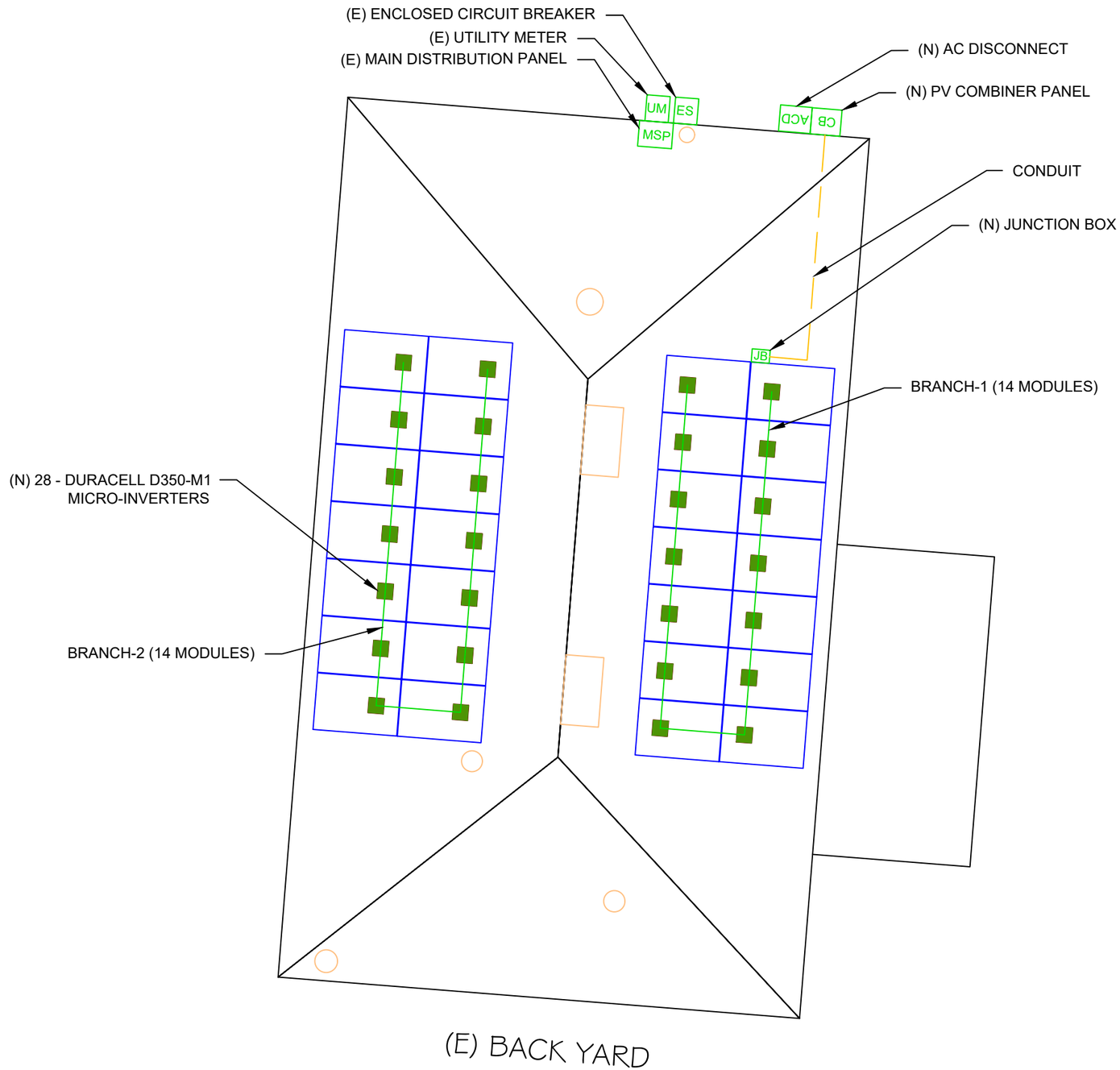
ALTAMONTE SPRINGS, FL 32714
(407) 710-1147

SOLAR ARRAY 11.2 kW-DC STC
(28) URECO SOLAR FBM400MFG-BB (400W) MODULES
(02) BRANCHES OF 14 MODULE

SW POPLAR LN.

(E) FRONT YARD

SOUTHWEST MCFARLANE AVE.



(E) BACK YARD

1 ELECTRICAL PLAN
E-01 SCALE: 1/8"=1'-0"

LEGEND

- UM - UTILITY METER
- CB - PV COMBINER PANEL
- ES - ENCLOSED CIRCUIT BREAKER
- JB - JUNCTION BOX
- ACD - AC DISCONNECT
- MSP - MAIN DISTRIBUTION PANEL
- ROOF OBSTRUCTION
- CONDUIT

SOLAR ENERGY SPECIALIST

SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME

THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ELECTRICAL SITE PLAN

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
E-01

Signature with Seal

Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:48:55 -05'00'

JEFFREY A. TORRES, PE
FL PE #80379
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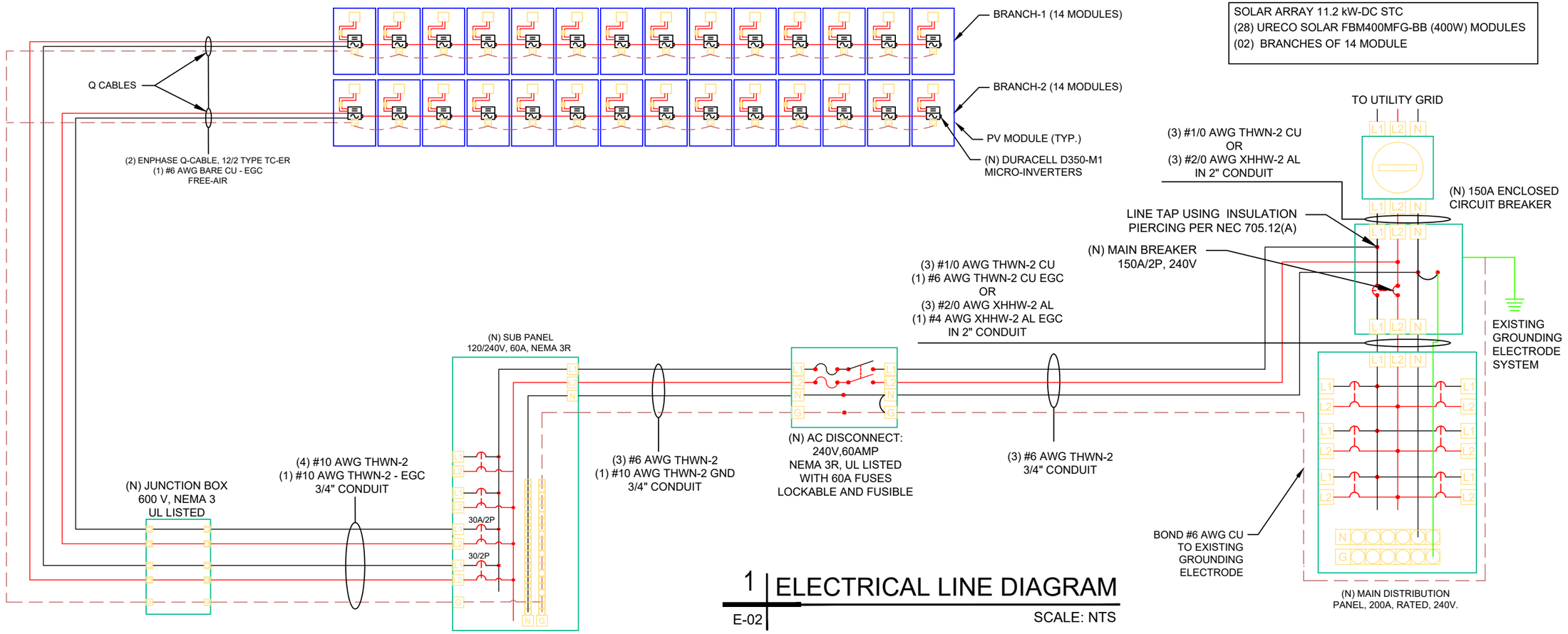

1 | ELECTRICAL LINE DIAGRAM

E-02 | SCALE: NTS

SOLAR MODULE SPECIFICATIONS	
MANUFACTURER / MODEL #	URECO SOLAR FBM400MFG-BB (400W) MODULES
VMP	31.17V
IMP	12.84A
VOC	37.20V
ISC	13.68A
MODULE DIMENSION	67.83"L x 44.61"W x 1.38"D (In Inch)

INVERTER SPECIFICATIONS	
MANUFACTURER / MODEL #	DURACELL D350-M1 MICRO-INVERTERS
MPPT VOLTAGE RANGE	16-60V
MAXIMUM INPUT VOLTAGE	60V
MAXIMUM UNIT PER BRANCH	16
MAXIMUM OUTPUT CURRENT	1.45A
CEC WEIGHTED EFFICIENCY	97%

AMBIENT TEMPERATURE SPECS	
RECORD LOW TEMP	-5°
AMBIENT TEMP (HIGH TEMP 2%)	34°
CONDUIT MINIMUM HEIGHT FROM ROOF	0.5"
CONDUCTOR TEMPERATURE RATING	90°
MODULE TEMPERATURE COEFFICIENT OF Voc	-0.28%/°C

AC CONDUCTOR AMPACITY CALCULATIONS: ARRAY TO JUNCTION BOX

EXPECTED WIRE TEMP (In Celsius)	34°
TEMP. CORRECTION PER TABLE (310.15)(B)(2)(a)	0.96
# OF CURRENT CARRYING CONDUCTORS	N/A
# OF C.C. CONDUCTORS CORRECTION PER NEC 310.15(B)(3)(a)	1.00
CIRCUIT CONDUCTOR SIZE	12 AWG
CIRCUIT CONDUCTOR AMPACITY	30A
REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A) & (B)	
1.25 x MAX AC OUTPUT x MAX # OF MICROINVERTERS/CIRCUIT	25.38A
DERATED CIRCUIT CONDUCTOR AMPACITY	28.80A
Result should be greater than (25.38A)	

AC CONDUCTOR AMPACITY CALCULATIONS: FROM JUNCTION BOX TO PV COMBINER PANEL

EXPECTED WIRE TEMP (In Celsius)	34°
TEMP. CORRECTION PER TABLE (310.15)(B)(2)(a)	0.96
# OF CURRENT CARRYING CONDUCTORS	4
# OF C.C. CONDUCTORS CORRECTION PER NEC 310.15(B)(3)(a)	0.80
CIRCUIT CONDUCTOR SIZE	10 AWG
CIRCUIT CONDUCTOR AMPACITY	40A
REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A) & (B)	
1.25 x MAX AC OUTPUT x MAX # OF MICROINVERTERS/CIRCUIT	25.38A
DERATED CIRCUIT CONDUCTOR AMPACITY	30.72A
Result should be greater than (25.38A)	

AC CONDUCTOR AMPACITY CALCULATIONS: FROM PV COMBINER PANEL TO ACDS

EXPECTED WIRE TEMP (In Celsius)	34°
TEMP. CORRECTION PER TABLE (310.15)(B)(2)(a)	0.96
# OF CURRENT CARRYING CONDUCTORS	3
# OF C.C. CONDUCTORS CORRECTION PER NEC 310.15(B)(3)(a)	1.00
CIRCUIT CONDUCTOR SIZE	8 AWG
CIRCUIT CONDUCTOR AMPACITY	55A
REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A) & (B)	
1.25 x MAX AC OUTPUT x TOTAL # OF MICROINVERTERS	50.75A
DERATED CIRCUIT CONDUCTOR AMPACITY	52.80A
Result should be greater than (50.75A)	

ELECTRICAL NOTES

1.) ALL EQUIPMENT SHALL BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
2.) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90°C WET ENVIRONMENT.
3.) 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.
4.) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
5.) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEM. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS , AND ACCESSORIES TO MEET APPLICABLE CODES AND STANDARDS.
6.) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
7.) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND ACCESSIBLE.
8.) INSTALL MODULE AND RACKING GROUNDING HARDWARE PER MANUFACTURER'S INSTRUCTION.

2 | WIRING CALCULATIONS

E-02 | SCALE: NTS

SOLAR ENERGY SPECIALIST

SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME

THOMAS & KATHY MCKINLEY

369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ELECTRICAL LINE DIAGRAM & WIRING CALCULATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
E-02

Signature with Seal

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Date: 2023.01.23 14:49:02 -05'00'

JEFFREY A. TORRES, PE
FL PE #80379
SUNSMART ENGINEERING LLC
FL COA #35170
925 SUNSHINE LANE, STE 1010
ALTAMONTE SPRINGS, FL 32714
(407) 710-1147

PHOTOVOLTAIC SYSTEM AC DISCONNECT
MAXIMUM AC OPERATING CURRENT 40.6 AMPS
MAXIMUM AC OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:
AC DISCONNECT(S)
PER NEC 690.54

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL LOCATION:
RAPID SHUTDOWN INITIATION DEVICE
PER NEC 690.56(C)(3)

WARNING

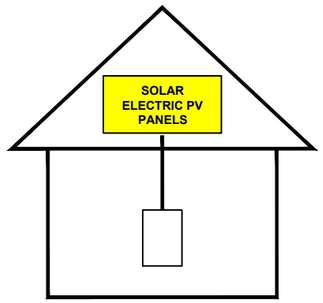
POWER SOURCE OUTPUT CONNECTION

DO NOT RELOCATE THIS OVERCURRENT DEVICE

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

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:
AT SERVICE DISCONNECTING MEANS
PER NEC 690.56(C)(1)(a)

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SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

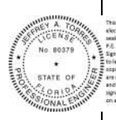
PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
SYSTEM LABELING

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
E-03

Signature with Seal



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ALTAMONTE SPRINGS, FL 32714
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URECO
United Renewable Energy Co., Ltd.

EN

PEACH

FBM_MFG-BB / 108 cells
390W - 405 W
Mono-Crystalline PV Module

URE Peach module uses URE state-of -the art cell cutting technology, and advanced module manufacturing experiences.

Key Features

- Positive power tolerance
  +0 ~ +5 watt
- 100% EL inline inspection
  Better module reliability
- Withstand heavy loading
  front load 5400 Pa & rear load 2400 Pa
- Design for 1000 VDC
  Reduce the system BOS effectively
- Excellent low light performance
  3.5% relative eff. Reduction at low (200W/m²)

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#URECO
For more information, please visit us at **www.urecorp.com**

URECO
United Renewable Energy Co., Ltd.

EN

Electrical Data

Model - STC		FBM390MFG-BB	FBM395MFG-BB	FBM400MFG-BB	FBM405MFG-BB
Maximum Rating Pcwer (Pmax)	[W]	390	395	400	405
Module Efficiency	[%]	19.98	20.23	20.49	20.75
Open Circuit Voltage (Voc)	[V]	36.84	37.03	37.20	37.36
Maximum Power Voltage	[V]	30.82	31.00	31.17	31.36
Short Circuit Current (Isc)	[A]	13.50	13.59	13.68	13.78
Maximum Power Current	[A]	12.66	12.75	12.84	12.92

*Standard Test Condition (STC): Cell Temperature 25 °C, Irradiance 1000 W/m², AM 1.5
*Values without tolerance are typical numbers.Measurement tolerance: ± 3%

Mechanical Data

Item	Specification
Dimensions	1723 mm (L)[1] x 1133 mm (W)[1] x 35 mm (D)[2] / 67.83" (L)[1] x 44.61" (W)[1] x 1.38" (D)[2]
Weight	21.7 kg / 47.84 lbs
Solar Cell	12x9 pieces monocrystalline solar cells series strings
Front Glass	White toughened safety glass, 3.2mm thickness
Cell Encapsulation	EVA (Ethylene-Viny-Acetate)
Frame	Black anodized aluminum profile
Junction Box	IP≥ 68, 3 diodes
Cable & Connector	Potrait : 500 mm (cable length can be customized), 1 x 4 mm² compatible with MC4
Package Configuration	31 pcs Per Pallet, 806 pcs per 40' HQ container

[1] : With assembly tolerance of ± 2 mm [± 0.08"]
[2] : With assembly tolerance of ± 0.8 mm [± 0.03"]

Operating Conditions

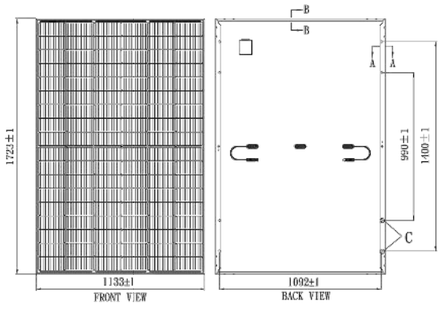
Item	Specification
Mechanical Load	5400 Pa
Maximum System Voltage	1000V
Series Fuse Rating	30 A
Operating Temperature	-40 to 85 °C

Temperature Characteristics

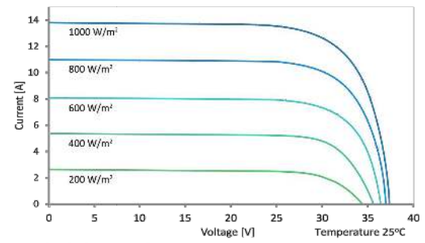
Item	Specification
Nominal Module Operating Temperature	45°C ± 2°C
Temperature Coefficient of Isc	0.048 % / °C
Temperature Coefficient of Voc	-0.27 % / °C
Temperature Coefficient of Pmax	-0.32 % / °C

*Nominal module operating temperature (NMOT): Air mass AM 1.5, irradiance 800W/m², temperature 20°C, windspeed 1 m/s.
*Reduction in efficiency from 1000W/m² to 200W/m² at 25°C: 3.5 ± 2%.

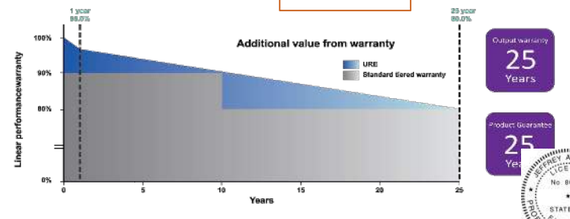
Engineering Drawing (mm)



Dependence on Irradiance



Reliability with Warranty



For more information, please visit us at **www.urecorp.com**

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SOLAR ENERGY SPECIALIST
SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
MODULE DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-01

Signature with Seal
Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:49:18 -05'00'

JEFFREY A. TORRES, PE
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SUNSMART ENGINEERING LLC
FL COA #35170
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ALTAMONTE SPRINGS, FL 32714
(407) 710-1147

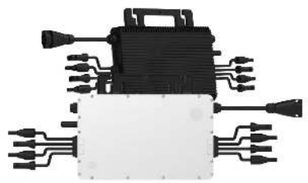
DURACELL
POWER CENTER

Solar PV Microinverters
D350-M1 / D700-M2 / D1500-M4

Single

Dual

Quad



Fast, Easy & Flexible Installation

Duracell Power Center's family of single, dual, and quad microinverters delivers the lowest cost, highest yield per panel PV installation.

The AC trunk cable format permits any combination of the three models to optimize even the most complex rooftop installations.

Reactive Power Control
CA Rule 21 compliant

Compliant with U.S.
NEC-2017 & NEC-2020
690.12 rapid shutdown

High reliability: NEMA 6
(IP67) enclosure, 6000V
surge protection

Become a Duracell Partner Today

sales@duracellpowercenter.com

DURACELL
POWER CENTER

Solar PV Microinverters
D350-M1 / D700-M2 / D1500-M4

Technical Data

Model	D350-M1		D700-M2		D1500-M4	
Input Data (DC)						
Number of PV inputs	1		2		4	
Module power range, typical (W)	280 to 470+		280 to 470+		300 to 505+	
Maximum input voltage (V)	60					
MPPT voltage range (V)	16-60					
Start-up voltage (V)	22					
Maximum input current (A)	11.5					
Output Data (AC)						
Peak output power (VA)	350		700		1500	1350
Maximum continuous output power (VA)	349		696		1438	1246
Maximum continuous output current (A)	1.45	1.68	2.9	3.35	5.99	5.99
Nominal output voltage(V)	240	208	240	208	240	208
Nominal output voltage range1 (V)	211-264	183-228	211-264	183-228	211-264	183-228
Nominal frequency/range1 (Hz)	60/55-65					
Power factor (adjustable)	>0.99 default (0.8 lead to 0.8 lag)					
Total harmonic distortion	<3%					
Maximum units per branch2 (10 AWG)	16	14	8	7	4	4
Efficiency						
CEC peck efficiency (%)	96.7					
CEC weighted efficiency (%)	96.5					
Nominal MPPT efficiency (%)	99.8					
Nighttime power consumption (mW)	<50					
Mechanical Data						
Ambient temperature range (°C)	-40 to +65					
Dimensions (W × H × D) mm	182 x 164 x 29.5		250 x 170 x 28		280 x 176 x 33	
Weight (kg)	1.75		2.6		3.35	
Enclosure rating	Outdoor NEMA 6					
Cooling	Natural convection - no fans					
Features						
Communication	2.4 GHz proprietary RF (Nordic)					
Monitoring	Yes					
Warranty	Up to 25 years					
Complicnce	UL 1741, IEEE 1547, UL 1741 SA (240 Vac), CA Rule 21 (240 Vac), CSA C22.2 No. 107.1-16, FCC Part 15B, FCC Part 15C					
PV Rapid Shutdown	Conforms with NEC-2017 and NEC-2020 Article 690.12 and CEC-2021 Sec 64-218 Rapid Shutdown of PV Systems					

*1. Nominal voltage/frequency range can vary depending on local requirements.
*2. Refer to local requirements for exact number of microinverters per branch.

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SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
MICROINVERTER DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-02

Signature with Seal

Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:49:27 -05'00'

JEFFREY A. TORRES, PE
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(407) 710-1147

Tech Brief

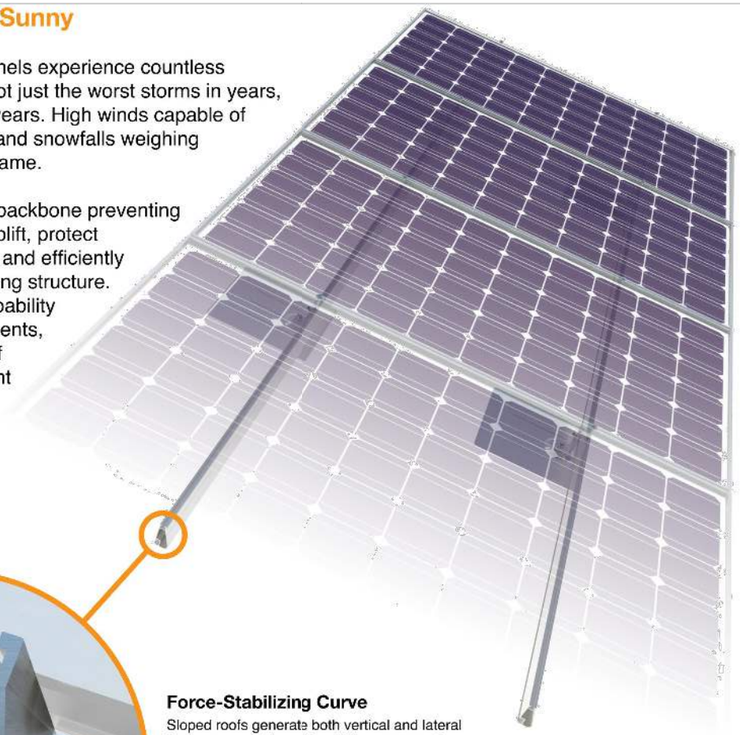
IRONRIDGE

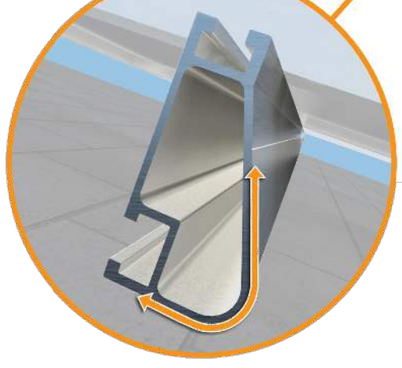
XR Rail Family

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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REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME

THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
RAIL DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-03

Signature with Seal

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(407) 710-1147

Tech Brief

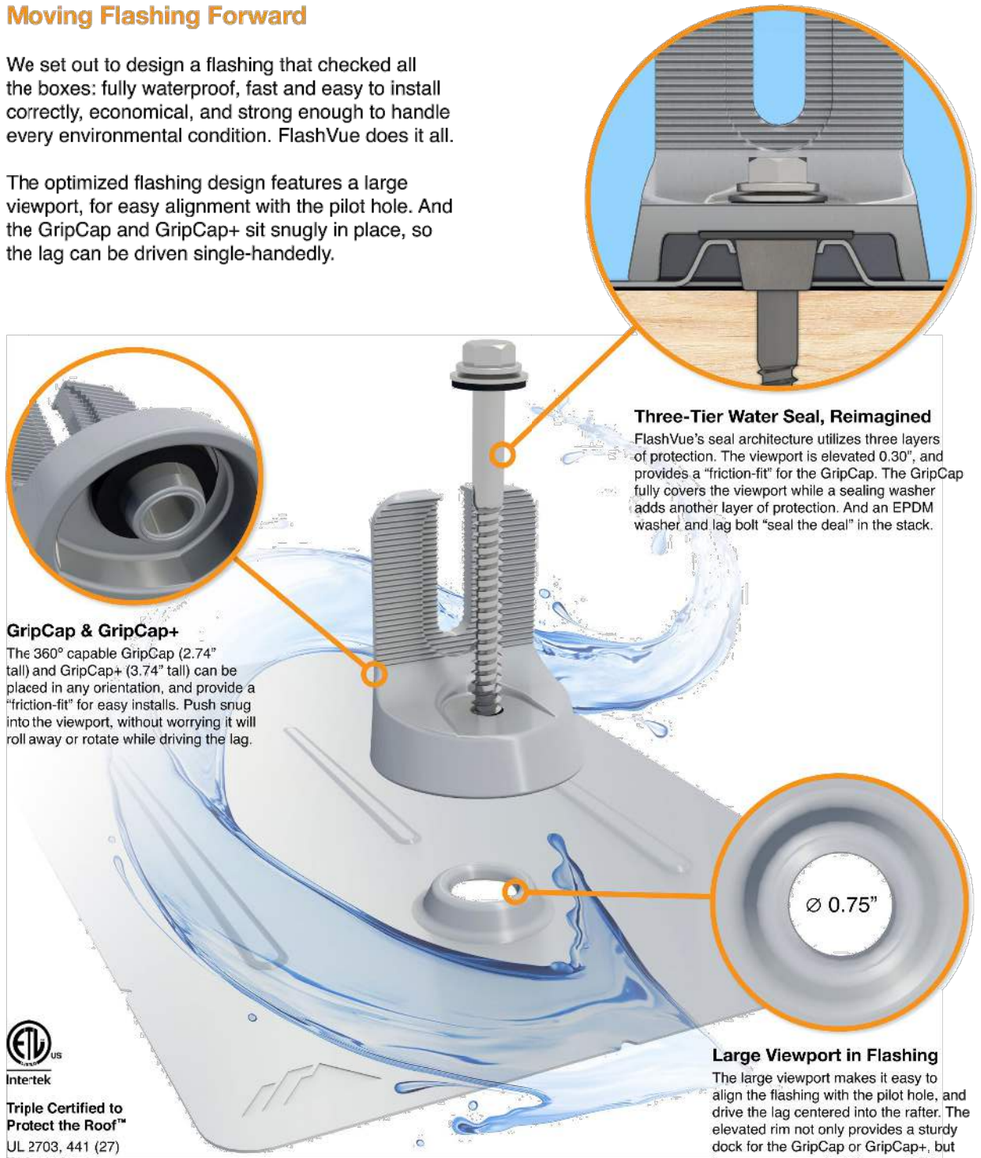
IRONRIDGE

FlashVue™

Moving Flashing Forward

We set out to design a flashing that checked all the boxes: fully waterproof, fast and easy to install correctly, economical, and strong enough to handle every environmental condition. FlashVue does it all.

The optimized flashing design features a large viewport, for easy alignment with the pilot hole. And the GripCap and GripCap+ sit snugly in place, so the lag can be driven single-handedly.



Three-Tier Water Seal, Reimagined
FlashVue’s seal architecture utilizes three layers of protection. The viewport is elevated 0.30”, and provides a “friction-fit” for the GripCap. The GripCap fully covers the viewport while a sealing washer adds another layer of protection. And an EPDM washer and lag bolt “seal the deal” in the stack.

GripCap & GripCap+
The 360° capable GripCap (2.74” tall) and GripCap+ (3.74” tall) can be placed in any orientation, and provide a “friction-fit” for easy installs. Push snug into the viewport, without worrying it will roll away or rotate while driving the lag.

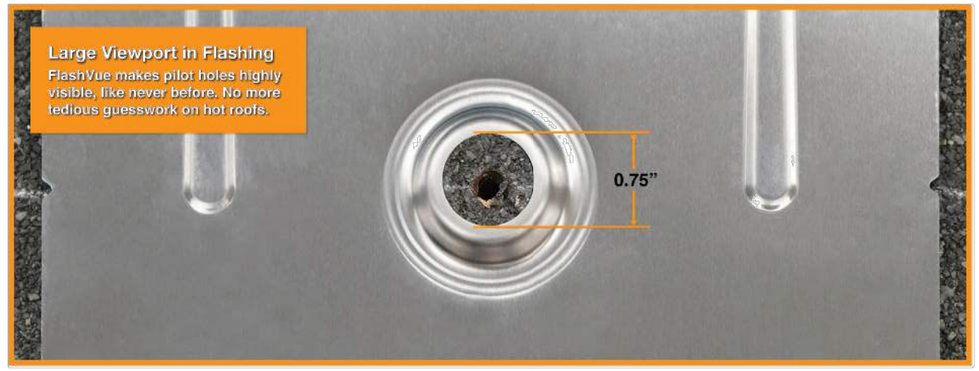
Intertek

Triple Certified to Protect the Roof™
UL 2703, 441 (27)
TAS 100(A)-95

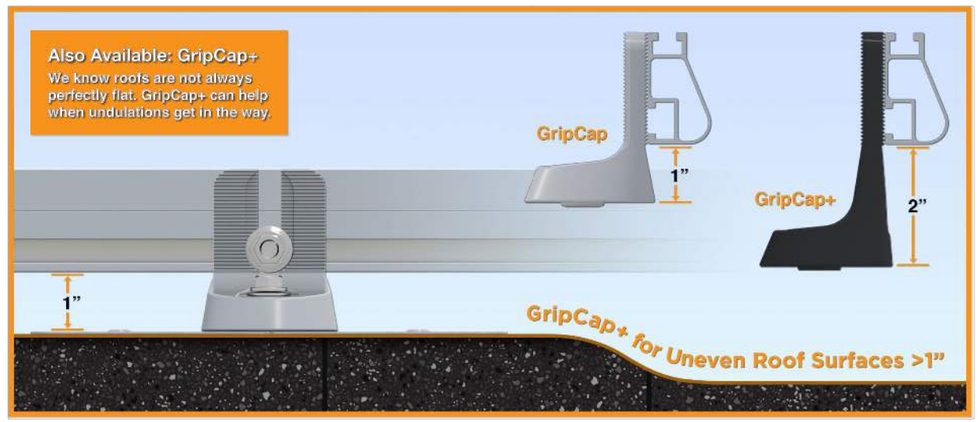
Large Viewport in Flashing
The large viewport makes it easy to align the flashing with the pilot hole, and drive the lag centered into the rafter. The elevated rim not only provides a sturdy dock for the GripCap or GripCap+, but increases water-shedding capabilities.

Tech Brief

See Your Pilot Holes



Solve Roof Undulations



Trusted Strength & Certification

Attachment Loading
FlashVue has been tested and rated to support 1161 (lbs) of uplift and 353 (lbs) of lateral load.

Structural Certification
Designed and certified for compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings
Passed both the UL 441 Section 27 “Rain Test” and TAS 100-95 “Wind Driven Rain Test” by Intertek.

UL 2703 Listed System
Conforms to UL 2703 mechanical and bonding requirements. See Flush Mount Manual for more info.

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SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS

DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ATTACHMENT DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-04

Signature with Seal

JEFFREY A. TORRES LICENSE No 80379 STATE OF FLORIDA PROFESSIONAL ENGINEER

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SUNSMART ENGINEERING LLC
FL COA #35170
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(407) 710-1147

Tech Brief

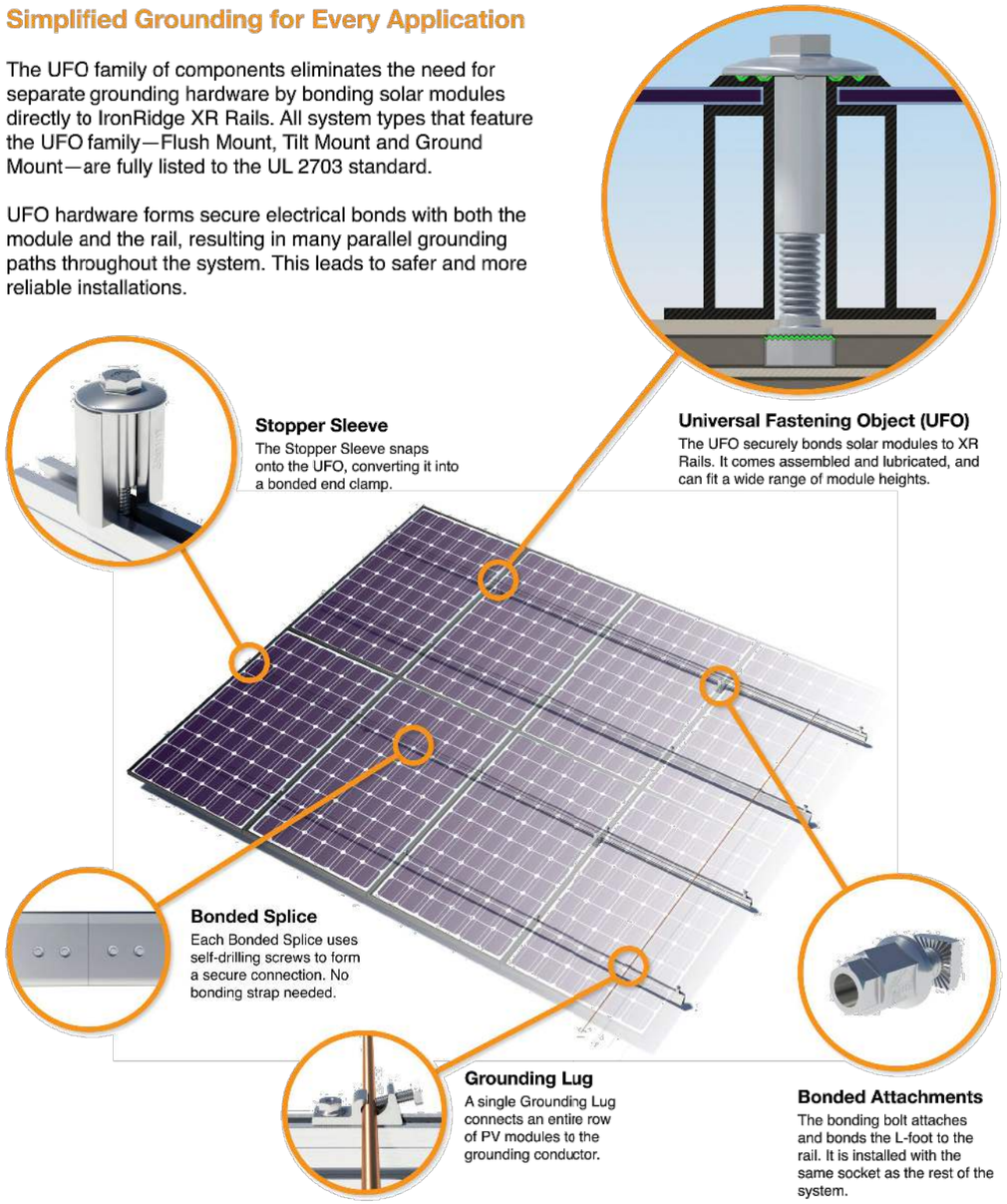
IRONRIDGE

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.

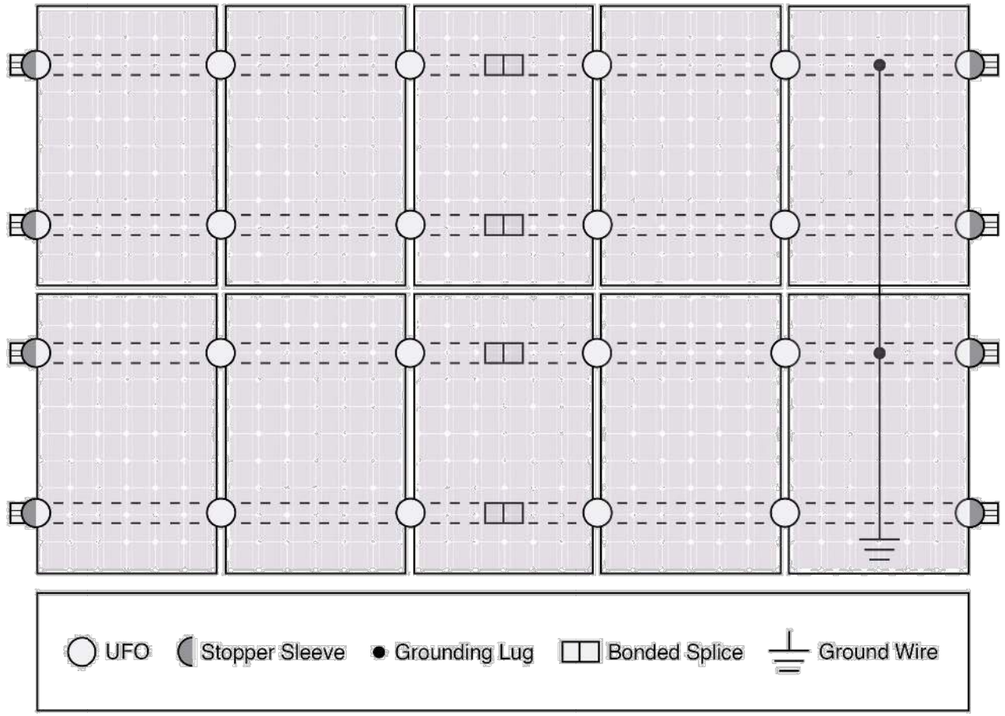
Bonded Splice
Each Bonded Splice uses self-drilling screws to form a secure connection. No bonding strap needed.

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	✔	✔	✔
Bonded Splice	✔	✔	N/A
Grounding Lugs	1 per Row	1 per Row	1 per Array
Microinverters & Power Optimizers	Enphase - M250-72, M250-60, M215-60, C250-72 Darfon - MIG240, MIG300, G320, G640 SolarEdge - P300, P320, P400, P405, P600, P700, P730		
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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SOLAR ENERGY SPECIALIST

SOLAR ENERGY SPECIALISTS
6418 HOFFNER AVE #100
ORLANDO, FL 32822

REVISIONS		
DESCRIPTION	DATE	REV
INITIAL	01-20-2023	01

PROJECT NAME
THOMAS & KATHY MCKINLEY
369 SOUTHWEST MCFARLANE AVE
LAKE CITY, FL 32025

SHEET NAME
ATTACHMENT DATA SHEET

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
DS-05

Signature with Seal

Digitally signed by Jeffrey A Torres
Date: 2023.01.23 14:49:54 -05'00'

JEFFREY A. TORRES, PE
FL PE #80379
SUNSMART ENGINEERING LLC
FL COA #35170
925 SUNSHINE LANE, STE 1010
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