11/17/2023

RE: Structural Certification for Installation of Residential Solar
KARI TRAVIS:194 SW LOGSTON CT, FORT WHITE, FL, 32038

Attn: To Whom It May Concern

This Letter is for the existing roof framing which supports the new PV modules as well as the attachment of the PV system to existing roof framing. From the field observation report, the roof is made of Metal roofing over 1/2 inch plywood supported by 2X4 Trusses at 24 inches .The slope of the roof was approximated to be 18 degrees.

After review of the field observation data and based on our structural capacity calculation, **the existing roof framing has been determined to be adequate to support the imposed loads without structural upgrades.** Contractor shall verify that existing framing is consistent with the described above before install. Should they find any discrepancies, a written approval from SEOR is mandatory before proceeding with install. Capacity calculations were done in accordance with applicable building codes.

Code	2020 Florida Building Code (ASCE 7-16)				
Risk category		II	Wind Load	(component and Cladding)	
Roof Dead Load	Dr	10 psf		V	120 mph
PV Dead Load	DPV	3 psf		Exposure	C
Roof Live Load	Lr	20 psf			
Ground Snow	S	0 psf			

If you have any questions on the above, please do not hesitate to call.

Sincerely,

Vincent Mwumvaneza, P.E
EV Engineering LLC

VINCENT MWUMVANEZA LICENSE No. 86986 STATE OF FLORIDA PROFESSIONAL ENGINEER

This item has been electronically signed and sealed by Vincent Mwumvaneza using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Vincent Mwumvaneza
Digitally signed by Vincent Mwumvaneza
Date: 2023.11.17 16:02:50 -05'00'

projects@evengineersnet.com
http://www.evengineersnet.com

Structural Letter for PV Installation

Date: 11/17/2023
Job Address: **194 SW LOGSTON CT**
FORT WHITE, FL, 32038
Job Name: **KARI TRAVIS**
Job Number: **231117KT**

Scope of Work

This Letter is for the existing roof framing which supports the new PV modules as well as the attachment of the PV system to existing roof framing. All PV mounting equipment shall be designed and installed per manufacturer's approved installation specifications.

Table of Content

Engineering Calculations Summary

Code	2020 Florida Building Code (ASCE 7-16)		
Risk category		II	
Roof Dead Load	Dr	10	psf
PV Dead Load	DPV	3	psf
Roof Live Load	Lr	20	psf
Ground Snow	S	0	psf
Wind Load	(component and Cladding)		
	V	120	mph
	Exposure	C	

References

NDS for Wood Construction

Sincerely,

Vincent Mwumvaneza, P.E
EV Engineering LLC

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Wind Load Cont.

Risk Category =	II		
V=	**120**	**mph**	**ASCE 7-16 Figure 26.5-1B**
Exposure =	**C**		
K_{zt} =	1.0		ASCE 7-16 Sec 26.8.2
K_Z =	0.85		ASCE 7-16 Table 26.10-1
K_d =	0.85		ASCE 7-16 Table 26.6-1
K_e =	1.00		ASCE 7-16 Table 26.9-1
$q_h = 0.00256K_zK_{zt}K_dK_eV^2$ =	26.55	psf	
Pitch =	18.0	Degrees	
γ_E =	1.0		
γ_a =	0.6	considering 1 module	

Uplift (W)		**Zone(1,2e)**	**Zone(2r, 2n)**	**Zone(3e)**	**Zone(3r)**
Fig. 30-3-2	GC_p=	-1.1	-2	-2	-2.4
Eq. 29.4-7	$P=q_h(GC_p)(\gamma_E)(\gamma_a)$=	-17.52	-31.86	-31.86	-38.23

GC_p=	0.5	Figure 30.3-2
$P=q_h(GC_p)(\gamma_E)(\gamma_a)$=	7.97	Equation 29.4-7

Rafter Attachments: 0.6D+0.6W (CD=1.6)

Connection Check

RTMini-(2) SS304x60mm Withdrawal Value=	894	lbs	Manufacturer Test
Lag Screw Penetration (Minimum)	2	in	
Safety Factor	2		
Allowable Capacity=	447	lbs	

Zone	**Average Trib Width**	**Area (ft)**	**Uplift (lbs)**	**Down (lbs)**
Zone(1,2e)	4	10.2	123.5	110.0
Zone(2r, 2n)	4	10.2	209.8	110.0
Zone(3e)	2	5.1	104.9	110.0
Zone(3r)	2	5.1	124.1	110.0

Conservative Max= 209.8 < 447

CONNECTION IS OK

1. Pv seismic dead weight is negligible to result in significant seismic uplift, therefore the wind uplift governs

Vertical Load Resisting System Design

Trusses

Max Length, L =	**8.0** ft	(Beam maximum Allowable Horizontal Span)	
Tributary Width, W_T =	**24** in		
Dr =	**10** psf	20 plf	
L_r =	20 psf		
W_{down}=	7.97 psf	15.9 plf	
Pv=	**3 psf**	6 plf	

Load Case: DL+0.6W (CD=1.6)

Pv max Shear=	110.0 lbs		
Max Moment, M_u =	173 lb-ft	Conservative	
Max Shear, V_u=wL/2+Pv Point Load =	214 lb		

Note: Proposed loading will add less than 5% of the existing loads.

Member Capacity

DF-L No.2

2X4	Design Value	C_L	C_F	C_i	C_r	K_F	ϕ	λ	Adjusted Value
F_b =	900 psi	1.0	1.5	1.0	1.15	2.54	0.85	0.8	1553 psi
F_v =	180 psi	N/A	N/A	1.0	N/A	2.88	0.75	0.8	180 psi
E =	1600000 psi	N/A	N/A	1.0	N/A	N/A	N/A	N/A	psi
E_{min} =	580000 psi	N/A	N/A	1.0	N/A	1.76	0.85	N/A	580000 psi

Depth, d =	3.5 in			
Width, b =	1.5 in			
Cross-Sectonal Area, A =	5.25 in^2			
Moment of Inertia, I_{xx} =	5.35938 in^4			
Section Modulus, S_{xx} =	3.0625 in^3			
Allowable Moment, $M_{all} = F_b'S_{xx}$ =	396.2 lb-ft	DCR=M_u/M_{all} =	0.44 < 1	**Satisfactory**
Allowable Shear, $V_{all} = 2/3F_v'A$ =	630.0 lb	DCR=V_u/V_{all} =	0.34 < 1	**Satisfactory**

Siesmic Loads Check

Roof Dead Load	10	psf
% or Roof with Pv	29.4%	
Dpv and Racking	3	psf
Average Total Dead Load	10.9	psf
Increase in Dead Load	3.5%	**OK**

The increase in seismic Dead weight as a result of the solar system is less than 10% of the existing structure and therefore no further seismic analysis is required.

Limits of Scope of Work and Liability

We have based our structural capacity determination on information in pictures and a drawing set titled PV plans - KARI TRAVIS. The analysis was according to applicable building codes, professional engineering and design experience, opinions and judgments. The calculations produced for this structure's assessment are only for the proposed solar panel installation referenced in the stamped plan set and were made according to generally recognized structural analysis standards and procedures.

KARI TRAVIS
NEW GRID-INTERACTIVE PHOTOVOLTAIC SYSTEM WITH BATTERY BACKUP SYSTEM DC SYSTEM SIZE (11.2 KW)

Columbia County Building Department — Plans Reviewed for Code Compliance — State of Florida

SYSTEM DETAILS

DESCRIPTION	NEW GRID-INTERACTIVE PHOTOVOLTAIC SYSTEM WITH BATTERY STORAGE
DC RATING OF SYSTEM	SYSTEM SIZE :11.2 KW DC STC
AC RATING OF SYSTEM	15 KW
AC OUTPUT CURRENT	62.5 A
NO. OF MODULES	(28) CS6R-400MS-HL (400W) CANADIAN SOLAR MODULES
NO. OF INVERTERS	(1) SOL-ARK-15K-2P INVERTER
NO.OF BATTERIES	(6) EG4-LL 48V BATTERIES
NO.OF OPTIMIZER	(28) TS4-A-O TIGO OPTIMIZER
ARRAY STRINGING	(01) BRANCH OF 10 MODULES (02) BRANCHES OF 09 MODULES

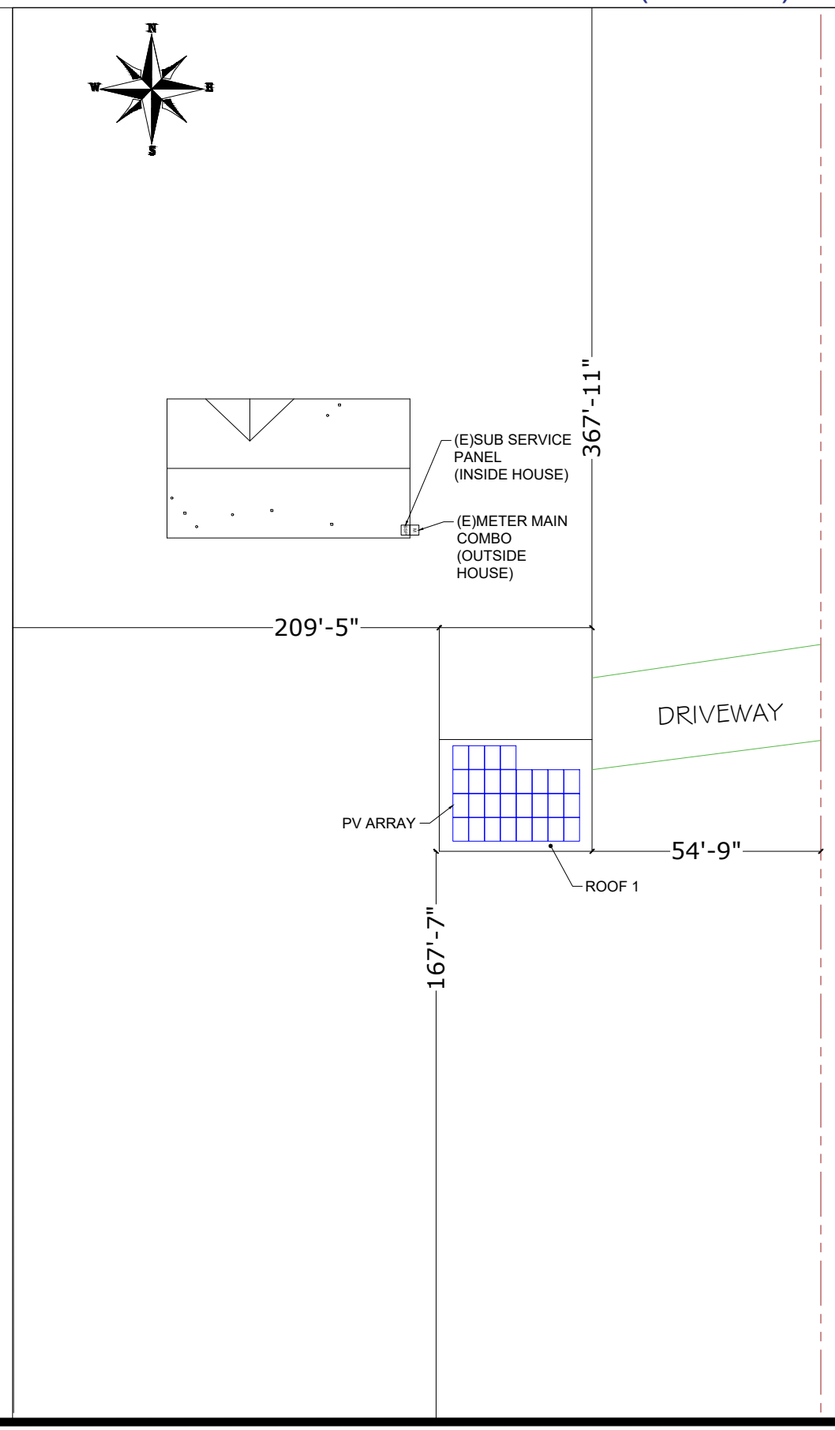
SITE DETAILS

ASHRAE EXTREME LOW	-5°C
ASHRAE 2% HIGH	34 °C
GROUND SNOW LOAD	0 PSF
WIND SPEED	120 MPH (ASCE 7-16)
RISK CATEGORY	II
WIND EXPOSURE CATEGORY	C

GOVERNING CODES

FLORIDA RESIDENTIAL CODE, 7TH EDITION 2020 (FRC)
FLORIDA BUILDING CODE, 7TH EDITION 2020 (FBC)
FLORIDA FIRE PREVENTION CODE, (FFPC)7TH EDITION, NFPA 1, 2018
NATIONAL ELECTRICAL CODE, NEC 2017 CODE BOOK, NFPA 70

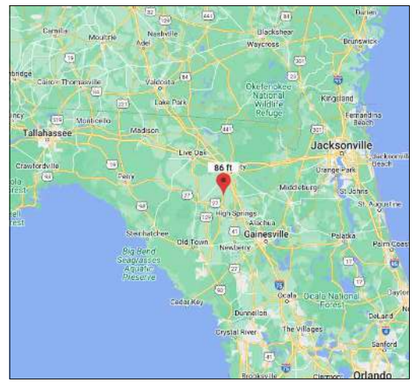
SHEET INDEX



SITE MAP (N.T.S)

VICINITY MAP

WIND FLOW MAP



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32210 JACKSONVILLE,
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Signature with Seal

VINCENT MWUMVANEZA — LICENSE No. 66682 — STATE OF FLORIDA — PROFESSIONAL ENGINEER — Exp:02/28/2025 STRUCTURAL ONLY

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Vincent Mwumvaneza — Digitally signed by Vincent Mwumvaneza Date: 2023.11.17 15:59:42 -05'00'

KARI TRAVIS

194 SW LOGSTON CT,
FORT WHITE, FL, 32038

REVISIONS	DESCRIPTION	DATE
REV	ENGG.	

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
SITE MAP & VICINITY MAP

SHEET NUMBER
A-00

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 ..... — 00 Module with Source Circuit number

Combiner Panel ..... CP

DC Disconnect ..... DCD

Main Service Panel ..... MSP

Fuse .....

Overcurrent Breaker ..

Inverter .....

Transformer .....

Automatic ..... Transfer Switch ATS

ABBREVIATIONS:

AC	Alternating Current
APPROX	Approximate
AWG	American Wire Gauge
CP	Combiner Panel
DC	Direct Current
DCD	Direct Current Disconnect
DISC	Disconnect
(E)	Existing
EL	Elevation
EQ	Equal
JB	Junction Box
MCP	Main Combiner Panel
MFR	Manufacturer
MIN	Minimum
MISC	Miscellaneous
(N)	New
OCPD	OverCurrent Protection Device
POCC	Point Of Common Coupling
PV	Photovoltaic
SF	Squarefoot/feet
STC	Standard Test Conditions
TBD	To Be Determined
TYP	Typical
VIF	Verify In Field
WP	Weather Proof

SYSTEM DESCRIPTION

This system is a grid-tied PV system, with PV generation consisting of 28 CS6R-400MS-HL (400W) CANADIAN SOLAR MODULES with a combined STC rated dc output power of 11.2 KW. The modules are connected into 1 SOL-ARK-15K-2P INVERTER. The inverter has electronic maximum power point tracking to maximize energy captured by the PV modules. The inverter also has an internal ground fault detection and interruption device that is set to disconnect the array in the event that a ground fault that exceeds one ampere should occur. The inverter has DC and AC disconnect integrated system and labels are provided as required by the National Electrical Code.

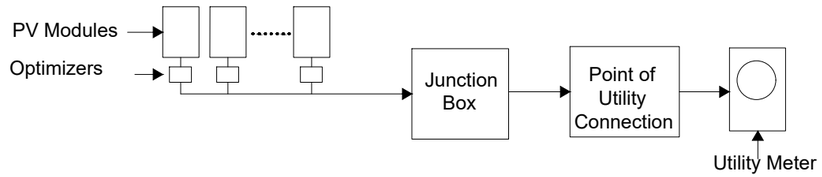

Figure 1: PV System Block Diagram

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.

The inverter meets the requirements of IEEE 1547 and UL 1741. This means that if it detects a loss of utility power, it will automatically disconnect from the utility. When utility voltage is restored, the inverter automatically reconnects to the utility grid after verifying utility voltage and frequency stability.

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Signature with Seal

KARI TRAVIS

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FORT WHITE, FL, 32038

REVISIONS	DATE	DESCRIPTION	ENGG.	REV

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
SYMBOLS & SYSTEM DESCRIPTION

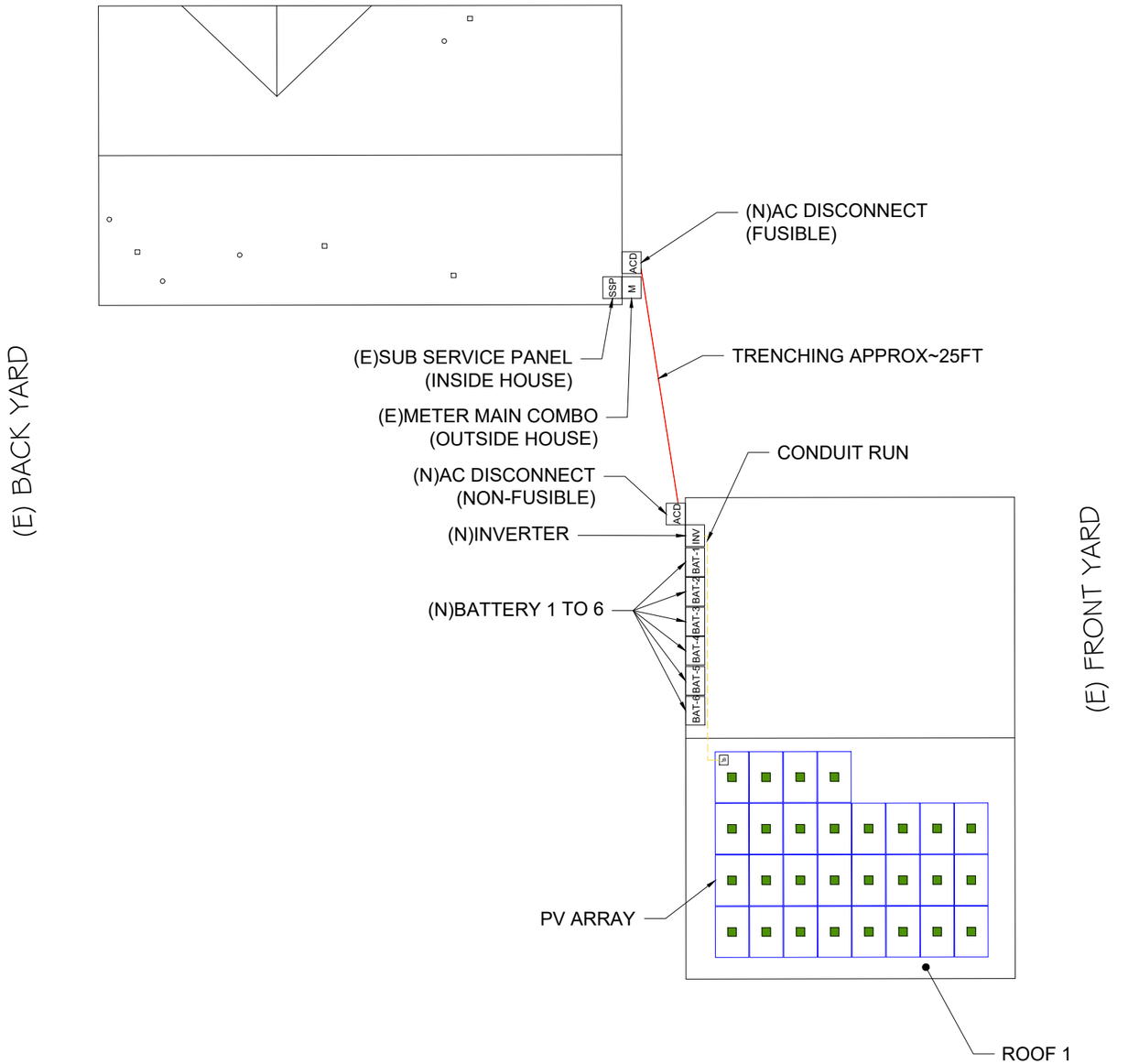
SHEET NUMBER
S-01

MODULE TYPE, DIMENSIONS & WEIGHT

NUMBER OF MODULES = 28 MODULES
MODULE TYPE = CS6R-400MS-HL (400W) CANADIAN SOLAR MODULES
MODULE WEIGHT = 49.4 LBS/22.4 KG.
MODULE DIMENSIONS = 67.8 " X 44.6" = 21.00 SF

NUMBER OF INVERTER = 1 STRING INVERTER
INVERTER TYPE = SOL-ARK-15K-2P INVERTER

DC SYSTEM SIZE: 11.2 KW
AC SYSTEM SIZE: 15 KW



GENERAL INSTALLATION PLAN NOTES:

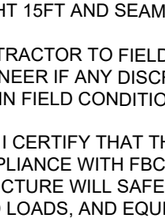
1) ROOF ATTACHMENTS TO TRUSSES SHALL BE INSTALLED AS SHOWN IN SHEET S-03 AND AS FOLLOWS FOR EACH WIND ZONE:.

WIND ZONE 1: MAX SPAN 4'-0"
O.C. WIND ZONE 2: MAX SPAN 4'-0"
O.C. WIND ZONE 3: MAX SPAN 2'-0"
O.C.

2) EXISTING RESIDENTIAL BUILDING ROOF WITH MEAN ROOF HEIGHT 15FT AND SEAMS SPACED 9" O.C.

CONTRACTOR TO FIELD VERIFY AND SHALL REPORT TO THE ENGINEER IF ANY DISCREPANCIES EXIST BETWEEN PLANS AND IN FIELD CONDITIONS.

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



CS6R-400MS-HL
(400W) CANADIAN
SOLAR MODULES

LEGENDS

- M - METER MAIN COMBO
- SSP - SUB SERVICE PANEL
- JB - JUNCTION BOX
- BAT - BATTERY
- ACD - AC DISCONNECT
- INV - INVERTER
- FIRE SETBACK
- ROOF ACCESS POINT
- OPTIMIZERS
- VENT, ATTIC FAN (ROOF OBSTRUCTION)
- CONDUIT

SYNERGY

SYNERGY SOLLAR
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Exp:02/28/2025
STRUCTURAL ONLY

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KARI TRAVIS

194 SW LOGSTON CT,
FORT WHITE, FL, 32038

REVISIONS	DATE	DESCRIPTION	ENGG.
REV			

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
ROOF PLAN & MODULES

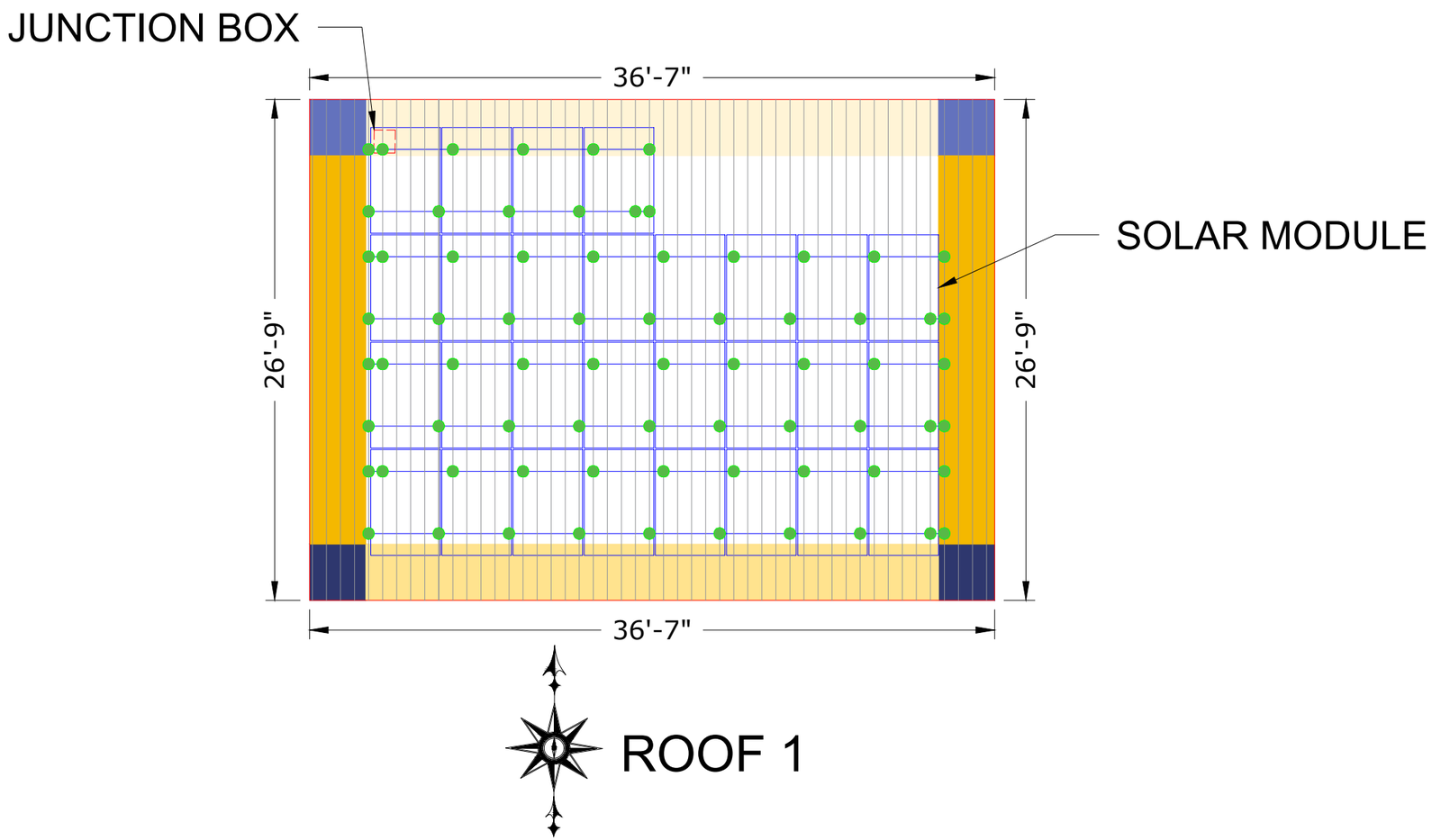
SHEET NUMBER
S-02

ROOF DESCRIPTION:

(ROOF #1)

MODULES - 28
ROOF TILT - 18°
ROOF AZIMUTH - 180°
SEAMS SPACING - @ 9" O.C.

WIND LOAD INFORMATION:
THIS SYSTEM HAS BEEN DESIGN TO MEET THE REQUIREMENTS OF THE 7TH EDITION OF THE FLORIDA BUILDING CODE AND USED THE FOLLOWING DESIGN PARAMETERS:
ULTIMATE WIND SPEED: 120 MPH
EXPOSURE CATEGORY: C
RISK CATEGORY: II
MEAN ROOF HEIGHT: 15FT
ROOF SLOPE: 7°-20°
TOTAL NO. OF ATTACHMENT: 72



LEGENDS

- JUNCTION BOX
- FIRE SETBACK
- VENT, ATTIC FAN (ROOF OBSTRUCTION)
- PV ROOF ATTACHMENT
- COUPLING
- METAL SEAM
- RAIL

WIND ZONE 1
- WIND ZONE 1
- WIND ZONE 1'

WIND ZONE 2
- WIND ZONE (2)
- WIND ZONE (2r)
- WIND ZONE (2e)
- WIND ZONE (2n)

WIND ZONE 3
- WIND ZONE (3)
- WIND ZONE (3r)
- WIND ZONE (3e)

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VINCENT MWUMVANEZA LICENSE No. 86582 STATE OF FLORIDA PROFESSIONAL ENGINEER
Exp:02/28/2025
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REVISIONS	DESCRIPTION	DATE
REV	ENGG.	

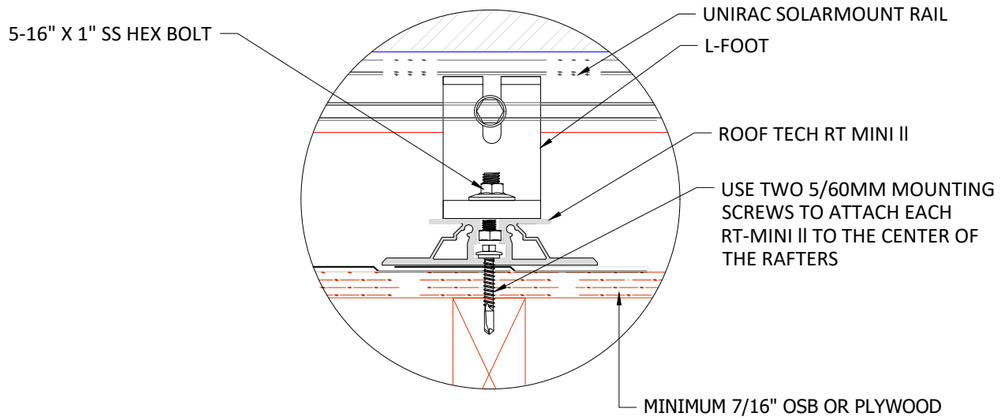
PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

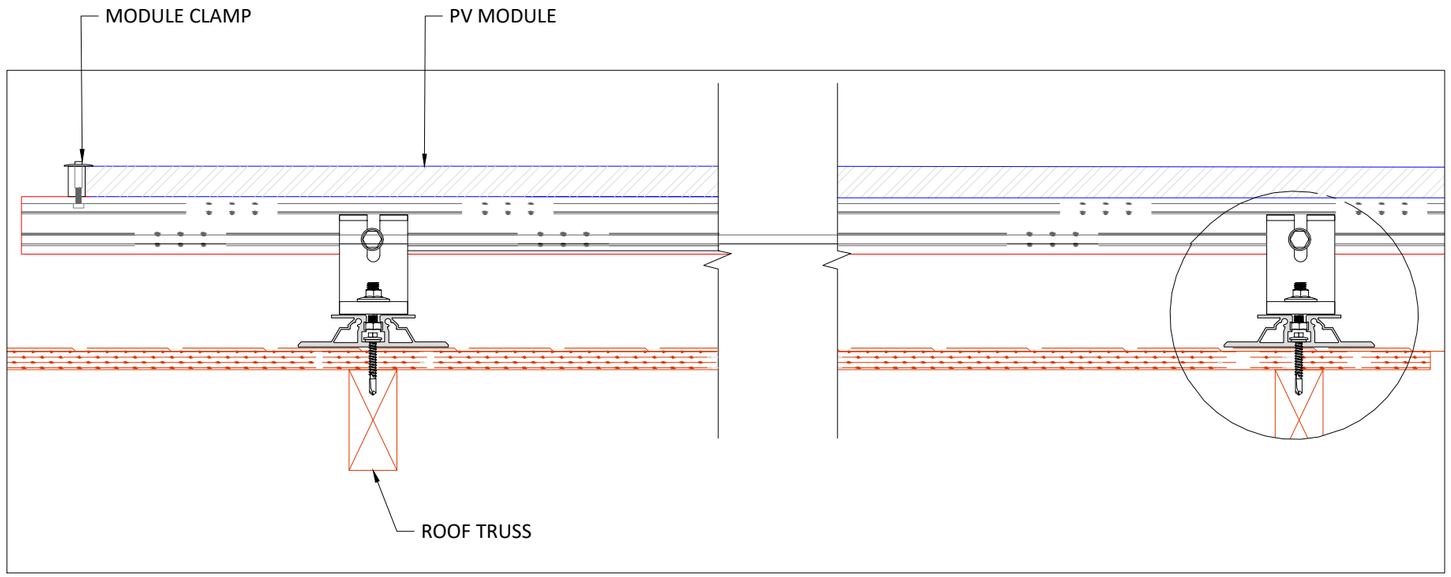
SHEET NAME
ARRAY LAYOUT

SHEET NUMBER
S-03

PHOTOVOLTAIC MODULE GENERAL NOTES:

1. APPLICABLE CODE: 2020 FLORIDA BUILDING CODE 7th ED. & ASCE 7-16 MINIMUM DESIGN LOADS FOR BUILDING AND OTHER STRUCTURES
2. BOLT DIAMETER AND EMBEDMENT LENGTHS ARE DESIGNED PER NDS(2012) REQUIREMENTS. ALL BOLT CAPACITIES ARE BASED ON A DOUG-FIR#2 WOOD ROOF TRUSS AS EMBEDMENT MATERIAL.
3. ALL WIND DESIGN CRITERIA AND PARAMETERS ARE FOR HIP AND GABLE RESIDENTIAL ROOFS, CONSIDERING FROM A 4° TO A MAXIMUM 27° (1/12 TO A MAXIMUM 6/12 PITCH) ROOF IN SCHEDULE. ALL RESIDENTIAL ROOFS SHALL NOT EXCEED 15'-0" MEAN ROOF HEIGHT.
4. ROOF SEALANTS SHALL CONFIRM TO ASTM C920 AND ASTM 6511.
5. THIS SHEET REFLECTS STRUCTURAL CONNECTIONS ONLY. REFER TO MANUFACTURERS' MANUAL FOR ALL ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND SOLAR SPECS.
6. ALL ALUMINUM COMPONENTS SHALL BE ANODIZED ALUMINUM 6105-T5 UNLESS OTHERWISE NOTED.
7. LAG BOLTS SHALL BE ASTM A276 STAINLESS STEEL UNLESS OTHERWISE NOTED.
8. ALL RAILING AND MODULES SHALL BE INSTALLED PER MANUFACTURERS' INSTRUCTIONS.
9. I CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC:BUILDING CHAPTER 16 AND FRC:RESIDENTIAL CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE CALCULATED WIND LATERAL AND UPLIFT FORCES, AND EQUIPMENT DEAD LOADS.





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VINCENT MWUMVANEZA LICENSE No. 86688 STATE OF FLORIDA PROFESSIONAL ENGINEER

Exp:02/28/2025
STRUCTURAL ONLY

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FORT WHITE, FL, 32038

REVISIONS	DESCRIPTION	DATE	REV. ENGG.

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

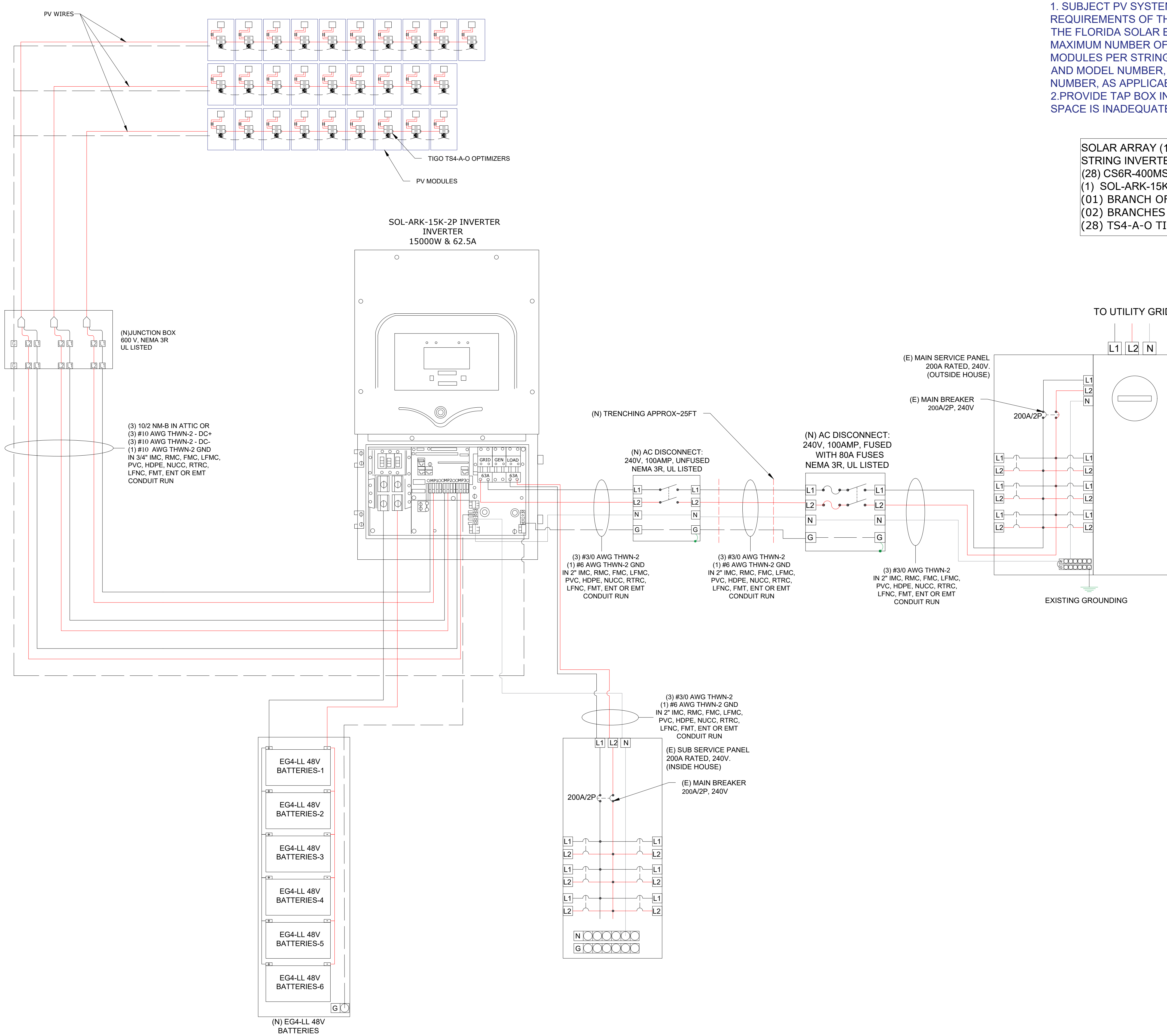
SHEET NAME
STRUCTURAL ATTACHMENT DETAILS

SHEET NUMBER
S-04

NOTE:

1. SUBJECT PV SYSTEMS HAS BEEN DESIGNED TO MEET THE REQUIREMENTS OF THE NEC 2017, NFPA 70 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 312.8 IF PANEL GUTTER SPACE IS INADEQUATE.

SOLAR ARRAY (11.2 KW-DC STC)
STRING INVERTER (15 KW - AC RATING OF SYSTEM)
(28) CS6R-400MS-HL (400W) CANADIAN SOLAR MODULES
(1) SOL-ARK-15K-2P INVERTER (290 VA)
(01) BRANCH OF 10 MODULES
(02) BRANCHES OF 09 MODULES
(28) TS4-A-O TIGO OPTIMIZER



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FORT WHITE, FL, 32038

REVISIONS

REV	ENGG.	DESCRIPTION	DATE

PERMIT DEVELOPER

DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME

ELECTRICAL LINE DIAGRAM

SHEET NUMBER

E-01

ELECTRICAL CALCULATIONS:

1. CURRENT CARRYING CONDUCTOR

(A) BEFORE IQ COMBINER PANEL

AMBIENT TEMPERATURE = 34°C
CONDUIT INSTALLED AT MINIMUM DISTANCE OF 7/8 INCHES ABOVE ROOF .....NEC 310.15(B)(3)(c)
TEMPERATURE DERATE FACTOR - 0.96 ...NEC 310.15(B)(2)(a)
GROUPING FACTOR - 0.8...NEC 310.15(B)(3)(a)

CONDUCTOR AMPACITY
= (OPTIMIZER CURRENT) x 1.56 / A.T.F / G.F ...NEC 690.8(B)
= [15 x 1.56] / 0.96 / 0.8
= 30.47 A
SELECTED CONDUCTOR - #10 THWN-2 ...NEC 310.15(B)(16)

(B) AFTER IQ COMBINER PANEL

TEMPERATURE DERATE FACTOR - 0.96
GROUPING FACTOR - 1

CONDUCTOR AMPACITY
=(TOTAL INV O/P CURRENT) x 1.25 / 0.96 / 1 ...NEC 690.8(B)
=[(1 x 62.5) x 1.25] /0.96 / 1
= 81.38 A
SELECTED CONDUCTOR - #4 THWN-2 ...NEC 310.15(B)(16)

2. PV OVER CURRENT PROTECTION ..NEC 690.9(B)

=TOTAL INVERTER O/P CURRENT x 1.25
=(1 x 62.5) x 1.25 = 78.13 A
SELECTED OCPD = 80A

SELECTED EQUIPMENT GROUND CONDUCTOR (EGC) = #8 THWN-2 ... NEC 250.122(A)

MAX VOLTAGE DROP CALCULATION

CABLE SIZE	CABLE DESCRIPTION	ONE WAY DISTANCE IN FEET (D)	BRANCH CURRENT (I)	RESISTANCE OF CONDUCTOR(R)	VOLTAGE (V)	% VOLTAGE DROP=(0.2*D*I*R)/V
3/0 THWN-2	AC-DISCONNECT-1 TO AC-DISCONNECT-2	25	62.5	0.0766	240	0.099

BATTERY SPECIFICATIONS	
NAME	EG4-LL
MAX VOLATGE	51.2 V
MAX CAPACITY	100 AH

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. CONDUCTOR TERMINATION AND SPLICING AS PER 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).

MODULE SPECIFICATION	
MODEL NO.	CS6R-400MS-HL (400W) CANADIAN SOLAR MODULES
PEAK POWER	400 W
RATED VOLTAGE (Vmpp)	30.8 V
RATED CURRENT (Impp)	12.99 A
OPEN CIRCUIT VOLTAGE (Voc)	36.8 V
SHORT CIRCUIT CURRENT (Isc)	13.85 A

INVERTER SPECIFICATIONS	
MANUFACTURER	SOLARK INVERTER SOL-ARK-15K-2P
OUPUT POWER	15000W
MAX DC VOLTAGE	500V
MAX OUTPUT POWER	15000W
CONTINIOUS OUTPUT CURRENT	62.5 A

OPTIMIZER SPECIFICATIONS	
MANUFACTURER	TS4-A-0 TIGO OPTIMIZER
MAX POWER	700W
MAX CURRENT	15 A

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Signature with Seal

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REVISIONS	DATE	DESCRIPTION	ENGG.	REV

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
WIRING CALCULATIONS

SHEET NUMBER
E-02

⚠ WARNING

ELECTRIC SHOCK HAZARD
DO NOT TOUCH TERMINALS
TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

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

WARNING PHOTOVOLTAIC POWER SOURCE

LABEL LOCATION:
CONDUIT RUNWAY
(PER CODE: NEC690.31(G)(3)(4))

⚠ WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:
MAIN SERVICE DISCONNECT
(NEC 705.12(B)(3-4) & NEC 690.59)

ADHESIVE FASTENED SIGNS:

·ANSI Z535.4-2011 PRODUCT SAFETY SIGNS AND LABELS, PROVIDES GUIDELINES FOR SUITABLE FONT SIZES, WORDS, COLORS, SYMBOLS, AND LOCATION REQUIREMENTS FOR LABELS. NEC 110.21(B)(1)
·THE LABEL SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED. NEC 110.21(B)(3)
·ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT. IFC 605.11.1.3

PHOTOVOLTAIC SYSTEM AC DISCONNECT
RATED AC OPERATING CURRENT 62.50 AMPS
AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:
AC DISCONNECT, INVERTER
(PER CODE: NEC 690.54)

WARNING
INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:
POINT OF INTERCONNECTION, MAIN SERVICE DISCONNECT
(PER CODE: NEC 705.12 (B)(2)(c))
[Not required if panelboard is rated not less than sum of ampere ratings of all overcurrent devices supplying it]

⚠ CAUTION
TRI POWER SOURCES
SECOND SOURCE IS PV SYSTEM
THIRD SOURCE IS DC BATTERY

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

LABEL LOCATION:
AC DISCONNECT, DC DISCONNECT, POINT OF INTERCONNECTION
(PER CODE: NEC 690.56(C)(3))

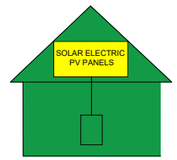
⚠ WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS
OVERCURRENT DEVICE

EMERGENCY CONTACT
3609100892

⚠ WARNING
DEDICATED SOLAR PANELS DO NOT CONNECT ANY OTHER LOADS

EMERGENCY RESPONDER
THIS SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUT DOWN

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



NEC 690.56(C)(1) AND NFPA 111.12.2.1.1.1.1.11.12.2.1.4

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REVISIONS	DESCRIPTION	DATE
REV		
ENGG.		

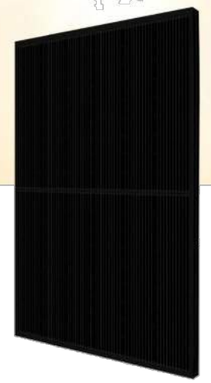
PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
SYSTEM LABELING

SHEET NUMBER
E-03

NEW

CanadianSolar



HiKu6 (All-Black)

ALL BLACK MONO PERC

380 W ~ 405 W

CS6R-380|385|390|395|400|405MS-HL

MORE POWER

- Module power up to 405 W
  Module efficiency up to 20.7 %
- Lower LCOE & system cost
- Comprehensive LID / LeTID mitigation technology, up to 50% lower degradation
- Better shading tolerance

MORE RELIABLE

- Minimizes micro-crack impacts
- Heavy snow load up to 8100 Pa, wind load up to 5000 Pa*

25 Years Industry Leading Product Warranty on Materials and Workmanship*

25 Years Linear Power Performance Warranty*

1st year power degradation no more than 2%
Subsequent annual power degradation no more than 0.55%

*Subject to the terms and conditions contained in the applicable Canadian Solar Limited Warranty Statement. Also this 25-year limited product warranty is available only for products installed and operating on residential rooftops in certain regions.

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
ISO 45001: 2018 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730 / CE
CEC listed (US California) / FSEC (US Florida)
UL 61730 / IEC 61701 / IEC 62716
Take-e-way

* The specific certificates applicable to different module types and markets will vary, and therefore not all of the certifications listed herein will simultaneously apply to the products you order or use. Please contact your local Canadian Solar sales representative to confirm the specific certificates available for your Product and applicable in the regions in which the products will be used.

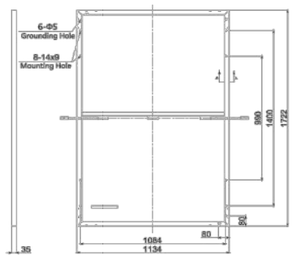
CSI SOLAR (USA) CO., LTD. is committed to providing high quality solar photovoltaic modules, solar energy and battery storage solutions to customers. The company was recognized as the No. 1 module supplier for quality and performance/price ratio in the IHS Module Customer Insight Survey. Over the past 20 years, it has successfully delivered over 70 GW of premium-quality solar modules across the world.

* For detailed information, please refer to the Installation Manual.

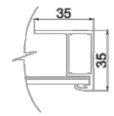
CSI SOLAR (USA) CO., LTD.
1350 Treat Blvd. Suite 500, Walnut Creek, CA 94598, USA | www.csisolar.com/na | service.ca@csisolar.com

ENGINEERING DRAWING (mm)

Rear View

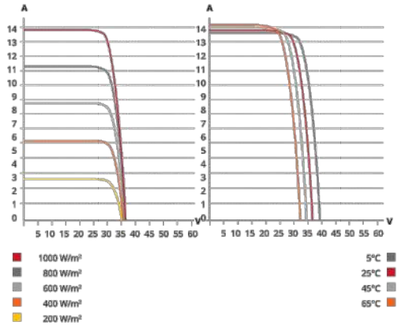


Frame Cross Section A-A



Mounting Hole

CS6R-400MS-HL / I-V CURVES



ELECTRICAL DATA | STC*

CS6R-380/385/390/395/400/405MS-HL

Nominal Max. Power (Pmax)	380 W	385 W	390 W	395 W	400 W	405 W
Opt. Operating Voltage (Vmp)	30.0 V	30.2 V	30.4 V	30.6 V	30.8 V	31.0 V
Opt. Operating Current (Imp)	12.69 A	12.77 A	12.84 A	12.91 A	12.99 A	13.07 A
Open Circuit Voltage (Voc)	36.0 V	36.2 V	36.4 V	36.6 V	36.8 V	37.0 V
Short Circuit Current (Isc)	13.55 A	13.63 A	13.70 A	13.77 A	13.85 A	13.93 A
Module Efficiency	19.5%	19.7%	20.0%	20.2%	20.5%	20.7%
Operating Temperature	-40°C ~ +85°C					
Max. System Voltage	1000V (IEC/UL)					
Module Fire Performance	TYPE 2 (UL 61730 1000V) or CLASS C (IEC 61730)					
Max. Series Fuse Rating	25 A					
Application Classification	Class A					
Power Tolerance	0 ~ + 10 W					

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline
Cell Arrangement	108 [2 X (9 X 6)]
Dimensions	1722 × 1134 × 35 mm (67.8 × 44.6 × 1.38 in)
Weight	22.4 kg (49.4 lbs)
Front Cover	3.2 mm tempered glass with anti-reflective coating
Frame	Anodized aluminium alloy,
J-Box	IP68, 3 bypass diodes
Cable	4 mm² (IEC), 12 AWG (UL)
Connector	T6, MC4, MC4-EVO2 or MC4-EVO2A
Cable Length (Including Connector)	1550 mm (61.0 in) (+) / 1100 mm (43.3 in) (-)*
Per Pallet	30 pieces
Per Container (40' HQ)	780 pieces

* For detailed information, please contact your local Canadian Solar sales and technical representatives.

ELECTRICAL DATA | NMOT*

CS6R-380/385/390/395/400/405MS-HL

Nominal Max. Power (Pmax)	284 W	288 W	291 W	295 W	299 W	303 W
Opt. Operating Voltage (Vmp)	28.1 V	28.3 V	28.4 V	28.6 V	28.8 V	29.0 V
Opt. Operating Current (Imp)	10.12 A	10.19 A	10.26 A	10.33 A	10.39 A	10.45 A
Open Circuit Voltage (Voc)	33.9 V	34.1 V	34.2 V	34.4 V	34.6 V	34.7 V
Short Circuit Current (Isc)	10.91 A	10.98 A	11.05 A	11.11 A	11.17 A	11.23 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m² spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.34 % / °C
Temperature Coefficient (Voc)	-0.26 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	42 ± 3°C

PARTNER SECTION

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. CSI Solar Co., Ltd. reserves the right to make necessary adjustment to the information described herein at any time without further notice.
Please be kindly advised that PV modules should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

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REVISIONS	DATE	DESCRIPTION	ENGG.
REV			

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
MODULE DATASHEET

SHEET NUMBER
DS-01

Sol-Ark

15K-2P
Spec Sheet

Solar	Input Power 19000W
Max Allowed PV Power	19000W
Max PV Power Delivered to Battery & AC Outputs	15000W
Max DC Voltage (Voc)	500V @ 26A
MPPT Voltage Range	150-425V
Starting Voltage	125V
Number of MPPT	3
Max Solar Strings Per MPPT	2
Max DC Current per MPPT (Self Limiting)	26A
Max AC Coupled Input (Micro/String Inverters)	19200W

AC	Output Power 15kW On-Grid & Off-Grid
Connections	120/240/208V Split Phase
Continuous AC Power with PV	15000W 62.5A-L (240V)
Continuous AC Power from Batteries	12000W 50A-L (240V)
Surge AC Power 10sec Surge AC Power 100ms	18000VA L-L (240V) 22500VA L-L (240V)
Total Harmonic Distortion (THD)	Less Than or Equal to 3%
Parallel Stacking	Yes - Up to 12
Frequency	60/50Hz
Continuous AC Power with Grid or Generator	48000W 200A L-L (240V) 24000W 200A L-N (120V)
CEC Efficiency	96.5% (Peak 97.5%)
Idle Consumption Typical—No Load	90W
Sell Back Power Modes	Limited to Household/Fully Grid-Tied
Design (DC to AC)	Transformerless DC
Response Time (Grid-Tied to Off-Grid)	5ms
Power Factor	+/- 0.9 - 1.0

Battery (optional)	Output Power 12000W
Type	Lead-Acid or Li-Ion
Nominal DC Input	48V
Capacity	50 — 9900Ah
Voltage Range	43.0 — 63.0V
Continuous Battery Charging Output	275A
Charging Curve	3-Stage w/ Equalization
Grid to Batt Charging Efficiency	96.0%
External Temperature Sensor	Included
Current Shunt for Accurate % SOC	Integrated
External Gen Start Based on Voltage or %SOC	Integrated
Communication to Lithium Battery	CanBus & RS485

General	
Dimensions (H x W x D)	31.8" x 18.3" x 10.9"
Weight	135 lbs
Enclosure	IP65 / NEMA 3R
Ambient Temperature	-40~60°C, >45°C Derating
Installation Style	Wall-Mounted
Wi-Fi & LAN Communication	Included
Standard Warranty (verified by HALT Testing)	10 Years

Protections & Certifications	
Electronics Certified Safety by SGS Labs to NEC & UL Specs - NEC 690.4B & NEC 705.4/6	Yes
Grid Sell Back — UL1741-2010/2018, IEEE-E1547a-2003/2014, FCC 15 Class B, UL1741SA, CA Rule 21, HECO Rule 14H	Yes
PV DC Disconnect Switch — NEC 240.15	Integrated
Ground Fault Detection — NEC 690.5	Integrated
PV Rapid Shutdown Control — NEC 690.12	Integrated
PV Arc Fault Detection — NEC 690.11	Integrated
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
AC Output Breakers - 200A	Integrated
2 x 200A Battery Breaker / Disconnect	Integrated
Surge Protection	DC Type II / AC Type II

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REVISIONS	DATE	DESCRIPTION	ENGG.	REV

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
INVERTER DATASHEET

SHEET NUMBER
DS-02

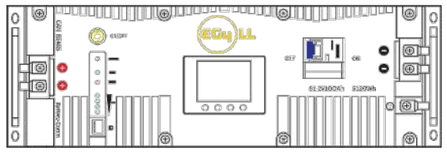
EG4®-LL 48V

100AH Battery

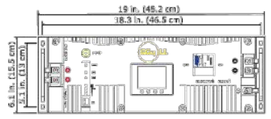
5.12 KWH Storage Capacity

10-Year Warranty

UL 1973 Listed ETL Conforms to UL 9540A

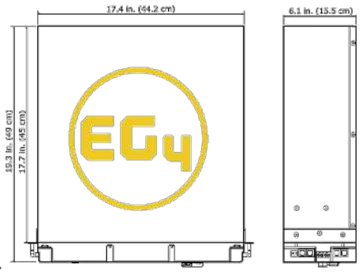


Our EG4-LL batteries offer second to none performance and longevity. Get peace of mind knowing our batteries are designed to last for more than 7000 deep charge and discharge cycles and have a life cycle of more than 15 years with an 80% depth of discharge daily.



On-board LCD Touch Screen

Easy to see BMS monitoring, and selectable closed-loop communications with EG4, Schneider, Sol-Ark, Victron, Growatt, Megarevo, Luxpower, and Deye inverters.



Dual On-board Fire Arrestors

Offer fail-safe operation in high-risk environments and protect against rare hardware failure on high voltage solar charge controllers.

Parallel up to 64 Batteries

For maximum power, our 6 DIP switch option allows you to have 327.6 kWh while preserving BMS communications.

EG4® Electronics | Specification Sheet

EG4®-LL 48V

100AH Battery

Module Operating Parameters		
Parameter	BMS	Recommended Setting on System
Voltage	51.2V	/
Capacity	100Ah	/
Charging Voltage (Bulk/Absorb)	56.8V	56.2V (+/-0.2V)
Float	/	54V (+/-0.2V)
Low DC Cutoff	44.8V	47-45.6V (start high, lower as needed)
Charging Current	100A (Max. continuous)	30-50A
Discharging Current	100A (Max. continuous)	90A
Environmental Parameters		
Charging Range	32° – 113°F (0°C to 45°C)	
Discharging Range	-4°F – 122°F (-20°C to 50°C)	
Storage Range	-4°F – 122°F (-20°C to 50°C)	
Ingress Protection	IP20	

Charging/ Discharging Parameters			
Charge	Spec	Delay	Recovery
Cell Voltage Protection	3.8V	1 sec	3.45V
Module Voltage Protection	60.0V	1 sec	55.2V
Over Charging Current 1	>102A	20 sec	/
Over Charging Current 2	≥120A	3 sec	/
Temperature Protection	<23°F or >158°F <-5°C or >70°C	1 sec	>32°F or <140°F >0°C or 60°C
Discharge	Spec	Delay	Recovery
Cell Voltage Protection	2.3V	1 sec	3.1V
Module Voltage Protection	44.8V	1 sec	48V
Over-Charging Current 1	>102A	30 sec	60 sec
Over-Charging Current 2	>150A	3 sec	60 sec
Short Circuit	>300A	<0.1 mS	
Temperature Protection	<-4°F or >167°F <-20°C or >75°C	1 sec	>14°F or <149°F >-10°C or <65°C
PCB Temp Protection	>221°F(>105°C)	1 sec	@ <176°F (<80°C)

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EG4® Electronics | Specification Sheet

EG4®-LL 48V

100AH Battery

General Specifications			
Parameter	Spec		Condition
Cell Balance	120mA	Passive Balance	Cell Voltage Difference >40mV
Temperature Accuracy	3%	Cycle Measurement	Measuring Range -40°F – 212°F (-40°C – 100°C)
Voltage Accuracy	0.5%	Cycle Measurement	For Cells & Module
Current Accuracy	3%	Cycle Measurement	Measuring Range -200A - 200A
SOC	5%	/	Integral Calculation
Power Consumption	Sleep & Off Mode	<300uA	Storage/Transport/Standby
Power Consumption	Operating Mode	<25mA	Charging/Discharging
Communication Ports	RS485/CAN		Can be customized
Maximum Modules in Series	1		
Maximum Modules in Parallel	64		
Physical Specifications			
Dimensions (H×W×D)	6.1 in.×19 in.×17.4 in. (15.5 cm×48.2 cm×44.2 cm)		
Weight	99.6 lbs. (45.2 kg)		
Standards and Certifications			
Module	ETL Listed to UL Standard 9540A:2019		
Cell	UL:1973		

Intertek

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REVISIONS

REV	ENGG.	DESCRIPTION	DATE

PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
BATTERY DATASHEET

SHEET NUMBER
DS-03

Tigo® Flex MLPE

TS4-A-O

Module-level PV Optimizer

The TS4-A-O (Optimization) is the advanced add-on optimization solution that brings smart module functionality to standard PV modules for higher reliability. Improve energy efficiency by upgrading underperforming PV systems or adding smart features to new installations.

Complies with 2017 and 2020 NEC rapid shutdown requirements.

The TS4-A-O add-on supports PV modules up to 700W.

Included Features

Module-level **optimization** for increased energy yield and greater design flexibility

Manual or automatic module-level **shutdown.** Complies with NEC 2017 and 2020.

Module-level **monitoring** for energy production tracking and system management

Easy Installation

Snap to standard module frame or remove brackets for rack mounting

Smart Commissioning

Configure and commission with your Android or iOS mobile device

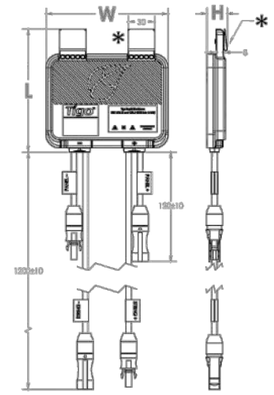
12/9/21

PSD-00015-00

TS4-A-O SPECIFICATIONS

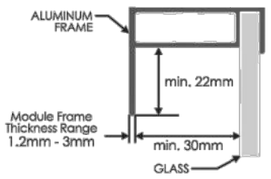
Environmental	
Operating Temperature Range	-40°C to +70°C (-40°F to +158°F)
Outdoor Rating	IP68, NEMA 3R
Maximum Elevation	2000m
Mechanical	
Dimensions	W=138.4mm, L= 139.7mm, H= 22.9mm
Weight	520g
Electrical	
Max Input Voltage (V_{OC} @ Lowest Temperature)	80V
Input Voltage Range	16 - 80V*
Maximum Current	15A
Maximum Power	700W
Cable Length (in/out)	0.12/1.2m (standard), 0.62/1.2m (optional)
Connectors	MC4 (standard), EVO2 (optional)
Communication Type	Wireless
Recommended Fuse Rating	30A

TAP required for module-level shutdown and CCA required for monitoring with TS4-A-O.
*Maximum output voltage of the TS4 is dependent on the PV module voltage. Refer to PV modules nameplate.



*Clips can be removed for rack mounting

Module frame specifications for mounting TS4-A



ORDERING INFORMATION

Standard	Description
461-00252-32	1500V UL / 1000V IEC, 0.12/1.2m cable, MC4
Options	**Description**
461-00252-62	1500V UL / 1000V IEC, 0.62/1.2m, MC4
461-00261-62	1500V UL / IEC, 0.62/1.2m, EVO2
461-00261-32	1500V UL / IEC, 0.12/1.2m cable, EVO2

For sales info:
sales@tigoenergy.com

For product info:
Visit tigoenergy.com/products

For technical info:
Visit support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at tigoenergy.com/design

Downloads

PV 2.0

Tigo Energy, Inc. | www.tigoenergy.com | sales@tigoenergy.com

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PERMIT DEVELOPER	
DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

SHEET NAME
OPTIMZER DATASHEET

SHEET NUMBER
DS-04

SOLARMOUNT

UNIRAC

SOLARMOUNT defined the standard in solar racking. Features are designed to get installers off the roof faster. Our grounding & bonding process eliminates copper wire and grounding straps to reduce costs. Systems can be configured with standard or light rail to meet your design requirements at the lowest cost possible. The superior aesthetics package provides a streamlined clean edge for enhanced curb appeal, with no special brackets required for installation.

Now Featuring:

THE NEW FACE OF SOLAR RACKING

Superior Aesthetics Package

LOSE ALL OF THE COPPER & LUGS

System grounding through Enphase microinverters and trunk cables

SMALL IS THE NEXT NEW BIG THING

Light Rail is Fully Compatible with all SM Components

ENHANCED DESIGN & LAYOUT TOOLS

Featuring Google Map Capabilities within U-Builder

FAST INSTALLATION. SUPERIOR AESTHETICS

OPTIMIZED COMPONENTS • VERSATILITY • DESIGN TOOLS • QUALITY PROVIDER

SOLARMOUNT

UNIRAC

OPTIMIZED COMPONENTS

INTEGRATED BONDING & PRE-ASSEMBLED PARTS

Components are pre-assembled and optimized to reduce installation steps and save labor time. Our new grounding & bonding process eliminates copper wire and grounding straps or bonding jumpers to reduce costs. Utilize the microinverter mount with a wire management clip for an easier installation.

VERSATILITY

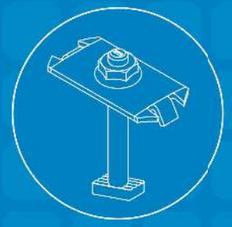
ONE PRODUCT - MANY APPLICATIONS

Quickly set modules flush to the roof or at a desired tilt angle. Change module orientation to portrait or landscape while securing a large variety of framed modules on flat, low slope or steep pitched roofs. Available in mill, clear and dark anodized finishes to outperform your projects financial and aesthetic aspirations.

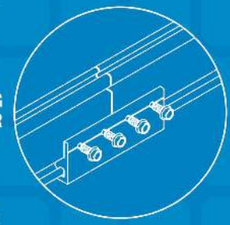
AUTOMATED DESIGN TOOL

DESIGN PLATFORM AT YOUR SERVICE

Creating a bill of materials is just a few clicks away with U-Builder, a powerful online tool that streamlines the process of designing a code compliant solar mounting system. Save time by creating a user profile, and recall preferences and projects automatically when you log in. You will enjoy the ability to share projects with customers; there's no need to print results and send to a distributor, just click and share.

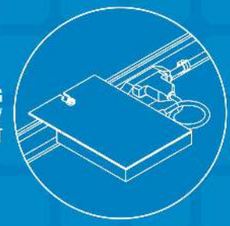


INTEGRATED BONDING MIDCLAMP



INTEGRATED BONDING SPLICE BAR

INTEGRATED BONDING L-FOOT w/ T-BOLT



INTEGRATED BONDING MICROINVERTER MOUNT w/ WIRE MANAGEMENT

LISTED **UL2703** BONDING & GROUNDING MECHANICAL LOADING SYSTEM FIRE CLASSIFICATION

UNIRAC CUSTOMER SERVICE MEANS THE HIGHEST LEVEL OF PRODUCT SUPPORT

UNMATCHED EXPERIENCE | CERTIFIED QUALITY | ENGINEERING EXCELLENCE | BANKABLE WARRANTY | DESIGN TOOLS | PERMIT DOCUMENTATION

TECHNICAL SUPPORT

Unirac's technical support team is dedicated to answering questions & addressing issues in real time. An online library of documents including engineering reports, stamped letters and technical data sheets greatly simplifies your permitting and project planning process.

CERTIFIED QUALITY PROVIDER

Unirac is the only PV mounting vendor with ISO certifications for 9001:2015, 14001:2015 and OHSAS 18001:2007, which means we deliver the highest standards for fit, form, and function. These certifications demonstrate our excellence and commitment to first class business practices.

BANKABLE WARRANTY

Don't leave your project to chance. Unirac has the financial strength to back our products and reduce your risk. Have peace of mind knowing you are receiving products of exceptional quality. SOLARMOUNT is covered by a twenty five (25) year limited product warranty and a five (5) year limited finish warranty.

PROTECT YOUR REPUTATION WITH QUALITY RACKING SOLUTIONS BACKED BY ENGINEERING EXCELLENCE AND A SUPERIOR SUPPLY CHAIN

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DATE	11/17/2023
DESIGNER	OSK
REVIEWER	

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RACKING DATASHEET

SHEET NUMBER

DS-05

RT-MINI II

A Self-flashing PV Mount Featuring Roof Tech's AlphaSeal™ Technology

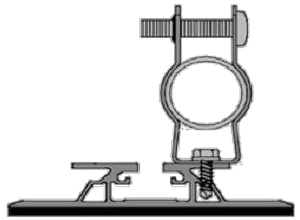
RT-MINI II is suitable for all systems with any L-Foot

- No Caulking or Pre-Drilling Required
- Universal Attachment to Any Slope
- Metal, EPDM, TPO, SBS, & Asphalt Roofs
- Wide Range of Applications & Ultimate Flexibility on the Roof
- No Need to Bend Rails
  1 5/8 North & South Adjustment

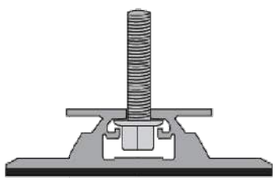
Installation Manual

ICC ESR 3575

Conduit Strap Installation



RT Serrated Hex Flange Bolt/Nut:
5/16-18 x 1"



Proven PV Mounting Since 1994 — 25 YEARS Warranty

Roof Tech
The Standard for Waterproof Flexible Flashing Since 1994
www.roof-tech.us info@roof-tech.us

North America's Most Trusted Sealant — AlphaSeal™ PV Mounting Technology — 100% Caulk-Free

RT-MINI II

Flexible Flashing Certified by the International Code Council (ICC)

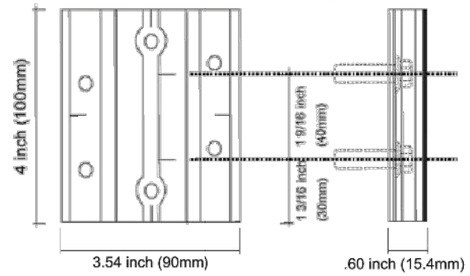
Components

RT2-00-MINIBK2

MINI II base : 20 ea.
Screw : 40 ea.
Extra RT-Butyl : 4 ea.

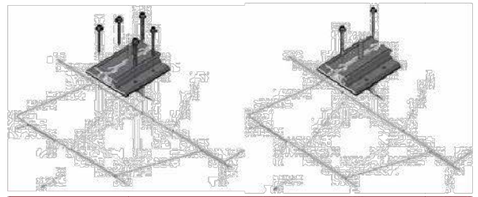
Optional Items:
5 x 60mm Mounting Screw (RT2-04-SD5-60) : 100 ea./Bag
5/16 X 25MM Flange Bolt & Nut (RT2-04-FBN25) : 100 ea./Bag
RT-Butyl (RT2-04-MNBUTYL) : 10 ea./Box

Dimensions in (mm)

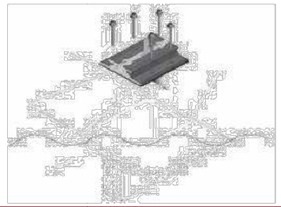


Deck Installation
OSB & PLY

Rafter Installation
Hybrid Mounting



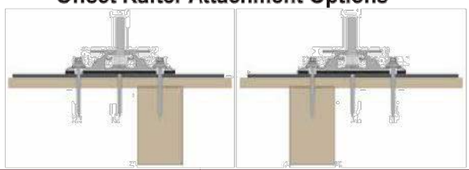
Offset Rafter Installation



Roof Tech Inc. AlphaSeal™ Technology has been used on over one million residential PV systems since 1994. It is the first PV mounting system with Flexible Flashing certified by the ICC, engineered to withstand wind speeds up to 180 mph and ground snow up to 90 psf.

Engineered to ASTM D 1761
(Standard Test Methods for Mechanical Fasteners in Wood)

Offset Rafter Attachment Options



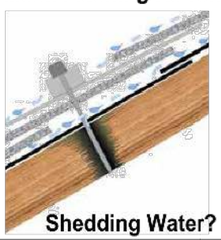
ICC ESR-3575

ASTM2140 Testing

P.E. Letters

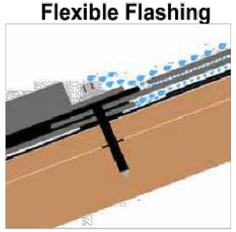
Support & Downloads

Metal Flashing Retrofit



Shedding Water?

Flexible Flashing



100% Waterproof

Roof Tech Inc.
www.roof-tech.us info@roof-tech.us
10620 Treena Street, Suite 230, San Diego, CA 92131
858.935.6064

August 2022

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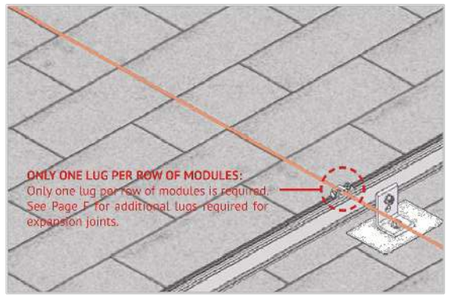
SHEET NUMBER
DS-06

SM SOLAR MOUNT — STANDARD SYSTEM GROUNDING INSTALLATION GUIDE — I-3 PAGE

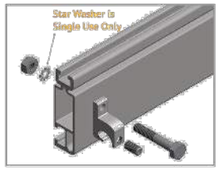


WEEBLUG CONDUCTOR - UNIRAC P/N 008002S:
Apply Anti Seize and insert a bolt in the aluminum rail and through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug.
TORQUE VALUE 10 ft lbs. (See Note on PG. A)
See product data sheet for more details, Model No. WEEB-LUG-6.7

GROUNDING LUG MOUNTING DETAILS:
Details are provided for both the WEEB and Ilsco products. The WEEBLug has a grounding symbol located on the lug assembly. The Ilsco lug has a green colored set screw for grounding indication purposes. Installation must be in accordance with NFPA NEC 70, however the electrical designer of record should refer to the latest revision of NEC for actual grounding conductor cable size.
Required if not using approved integrated grounding microinverters

GROUNDING LUG - BOLT SIZE & DRILL SIZE		
GROUND LUG	**BOLT SIZE**	**DRILL SIZE**
WEEBLug	1/4"	N/A - Place in Top SM Rail Slot
ILSCO Lug	#10-32	7/32"

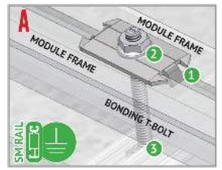
- Torque value depends on conductor size.
- See product data sheet for torque value.



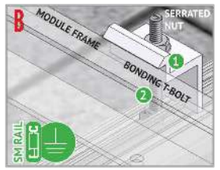
ILSCO LAY-IN LUG CONDUCTOR - UNIRAC P/N 008009P: Alternate Grounding Lug - Drill, deburr hole and bolt thru both rail walls per table.
TORQUE VALUE 5 ft lbs. (See Note on PG. A)
See ILSCO product data sheet for more details, Model No. GBL-4DBT.

NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION

SM SOLAR MOUNT — BONDING CONNECTION GROUND PATHS INSTALLATION GUIDE — M PAGE

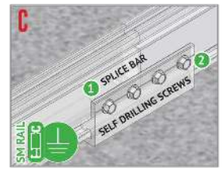


BONDING MIDCLAMP ASSEMBLY
1. Stainless steel Midclamp points, 2 per module, pierce module frame anodization to bond module to module through clamp.
2. Serrated flange nut bonds stainless steel clamp to stainless steel T-bolt
3. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to grounded SM rail.



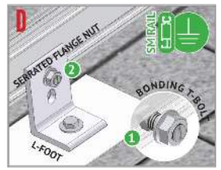
ENDCLAMP ASSEMBLY
1. Serrated flange nut bonds aluminum Endclamp to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and Endclamp to grounded SM rail

Note: End clamp does not bond to module frame.

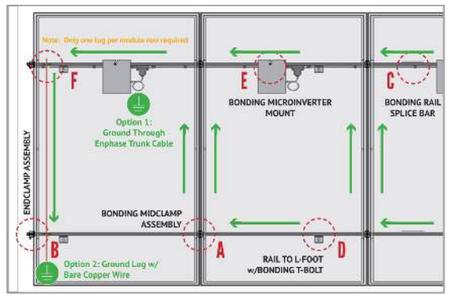


BONDING RAIL SPLICE BAR
1. Stainless steel self drilling screws drill and tap into splice bar and rail, creating bond between splice bar and each rail section
2. Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

Note: Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.

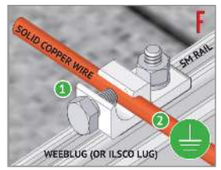


RAIL TO L-FOOT w/BONDING T-BOLT
1. Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail



BONDING MICROINVERTER MOUNT
1. Hex nut with captive lock washer bonds metal microinverter flange to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail

System ground including racking and modules may be achieved through the trunk cable of approved microinverter systems. See page 1 for details



RACK SYSTEM GROUND
1. WEEB washer dimples pierce anodized rail to create bond between rail and lug
2. Solid copper wire connected to lug is routed to provide final system ground connection.

NOTE: Ilsco lug can also be used when secured to the side of the rail. See page I-3 for details

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REVISIONS	DATE	DESCRIPTION	REV. ENGG.

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REVIEWER	

SHEET NAME
GROUNDING AND BONDING DATASHEET

SHEET NUMBER
DS-07