PRINCIPAL Engineering

1011 N Causeway Blvd, Suite 19 ♦ Mandeville, Louisiana 70471 ♦ Phone: 985.624.5001 ♦ Fax: 985.624.5303

July 2022

Property Owner: Rebecca Merrick

Property Address: 168 Southwest Stonehenge Lane, Lake City, FL 32024

RE: Photovoltaic System Roof Installations

I have reviewed the existing structure referenced above to determine the adequacy of the existing structure support the proposed installation of an array of solar panels on the roof.

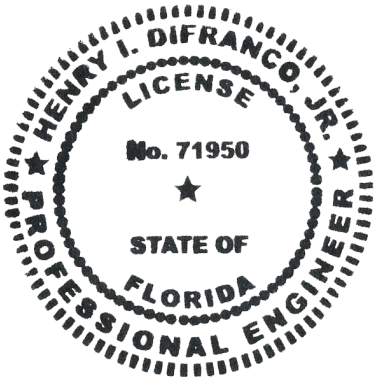
Based on my review, the existing structure is adequate to support the proposed solar panel installation. This assessment is based on recent on-site inspection by solar inspectors and photographs of the existing structure. The photovoltaic system is designed to withstand uplift and downward forces; our assessment is regarding the structure's support of the array. Stresses induced by the introduction of individual mount loads on the rafters or truss top chord are within acceptable limits as shown on the attached calculations. The structural considerations used in our review and assessment include the following:

Evaluation Criteria:

Applied Codes: ASCE 7-16 FBC 2020 NEC 2017
Risk Category: II
Design Wind Speed (3-second gust): 165 MPH
Wind Exposure Category: C
Ground Snow Load: 0 PSF
Seismic Design Category: D

Existing Structure:

Roof Material: Shingle
Roofing Structure: 2x Wood Rafters/Truss Top Chord
Roof Slope: 6/12



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FLORIDA FIRM NO. 30649

Effect of the Solar Array on Structure Loading:

Gravity Loads:

Per IBC Section 1607.12.5.1, the areas of the roof where solar panels are located are considered inaccessible, and therefore not subject to roof live loading. Live load in these areas is replaced by the dead load of the solar array, 3 psf. The total gravity load on the structure is therefore reduced and the structure may remain unaltered. Connections of the mounts to the underlying structure are to be installed in a staggered pattern, except at the array ends, to distribute the loading evenly to the roof structure. The stresses within the rafters or truss top chord due to the introduction of discrete mount loads are within acceptable l imits, as shown on the attached calculations.

Wind Load:

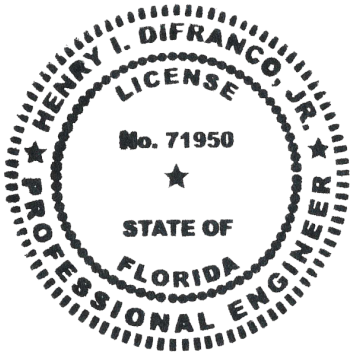
The solar panel array will be flush mounted (no more than 6" above the surrounding roof surface, and parallel to the roof surface. Any additional wind loading on the structure due to the presence of the array is negligible. The array structure is designed by the manufacturer to withstand uplift and downward forces resulting from wind and snow loads. The attached calculations verify the capacity of the connection of the solar array to the roof to resist uplift due to wind loads, the governing load case.

Snow Load:

The reduced friction of the glass surface of the solar panels allows for the lower slope factor (C_s) per Section 7.4 of ASCE 7-16 resulting in a reduced design snow load for the structure. This analysis conservatively considered the snow load to be unchanged.

Seismic Load:

Analysis shows that additional seismic loads due to the array installation will be small. Even conservatively neglecting the wall materials, the solar panel installation represents an increase in the total weight of the roof and corresponding seismic load of less than 10%. This magnitude of additional forces meets the requirements of the exception in Section 11B.4 of ASCE 7-16 . The existing lateral force resisting system of the structure is therefore allowed to remain unaltered.



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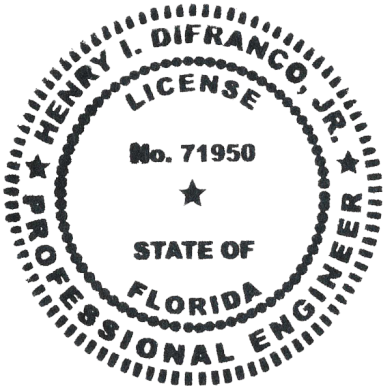
Conclusion:

To the best of my professional knowledge and belief, the subject construction and photovoltaic system installation will be in compliance with all state and local building codes and guidelines in effect at the time of our review.

Limitations:

Engineer's assessment of the existing structure is based on recent field reports and current photographs of the elements of the structure that were readily accessible at the time of inspection. The design of the solar panel racking (mounts, rails, connectors, etc.), connections between the racking and panels, and electrical engineering related to the installation are the responsibility of others. The photovoltaic system installation must be by competent personnel in accordance with manufacturer recommendations and specifications and should meet or exceed industry standards for quality. The contractor is responsible for ensuring that the solar array is installed according to the approved plans and must notify the engineer of any undocumented damage or deterioration of the structure, or of discrepancies between the conditions depicted in the approved plans and those discovered on site so that the project may be reevaluated and altered as required. Engineer does not assume any responsibility for improper installation of the proposed photovoltaic system.



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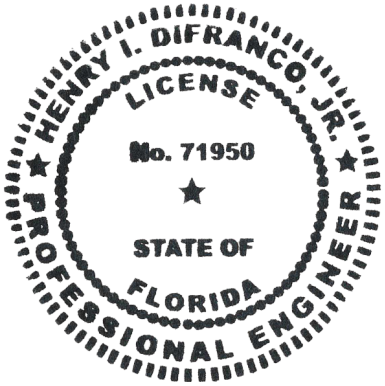
Uplift and Wind Downforce Calculation Summary (ASCE 7-16)
Mount, Rack, & Panel Proportioning
Point Load Check and Rafter Stress Analysis

Property Owner:	Rebecca Merrick	Max. Individual Panel Dimensions		
Project Address:	168 Southwest Stonehenge Lane	Length (in)	Width (in)	Area (sf)
City, State:	Lake City, FL 32024	77	39	20.85

Building Characteristics, Design Input, and Adjustment Factors				
Roof Dimensions:	Length:	69	Greater Dimension	69
	Width:	62	Least Dimension:	62
Roof Height (h):		15	Fig 30.4-1, valid under 60'	✓
Pitch: 6 on 12 =		26.6°	Must be less than 45°	✓
Roof Configuration		Hip		
Roof Structure		2x Truss Top Chord		
Roof Material		Plywood		
Risk Category:		II		
Basic Wind Speed:		165	From 26.5-1	
Exposure Category:		C	Fig. 26.7	
Topographic Factor (K_{zt})		1.21	Fig. 26.8-1	
Wind Pressure @ h=30, p_{net30}		See Table Below	Fig. 30.4-1	
Ht. & Exposure Adjustment (λ)		1.21	Fig. 30.4-1	
Adjusted Wind Pressures, p_{net}		See Table Below	Eq. 30.4-1	
Effective Wind Area (sf):		10.43	(Area per individual mount)	

Roof Zone Strip (a), in ft, Fig. 30.4-1, Note 5		
1 - Least Roof Horizontal Dimension (L or W) x 0.10		6.2
2 - Roof Height x 0.4		6
3 - Least Roof Horizontal Dimension (L or W) x 0.04		2.48
4 - Least of (1) and (2)		6
5 - Greater of (3) and (4)		6
6 - Greater of (5) and 3 feet	**a=**	6



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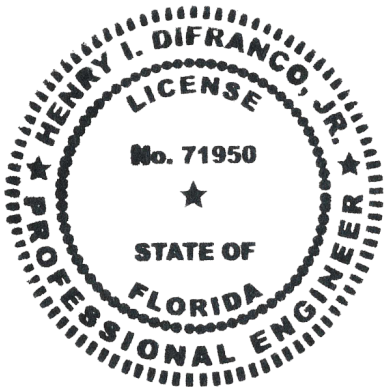
Net Design Pressures, p_{net} (Fig 30.4-1), Components & Cladding					
	Uplift (-psf)			Factored Pressure (0.6W, ASCE 7-16)	θ
		P_{30net}	$\|K_{zt}P_{30net}$		
gable /hip /flat					
Gable					
Hip					
	Zone 1	66.7	97.7	58.6	20° < θ ≤ 27°
	Zone 2e,2r,3	92.2	135.0	81.0	



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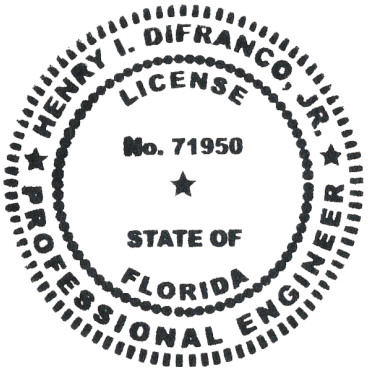
Snow Load		
Ground Snow Load, p_g	0.0	From ASCE 7 or AHJ
Terrain Category:	C	Para 6.5.6.3
Exposure	Fully	
Exposure FactorCe	0.9	Table 7-2
Thermal Factor, Ct	1.2	Table 7-3
Importance Factor, I_s	1.0	Table 1.5.2
Roof Configuration	Hip	
Roof Slope	26.6°	
Distance from Eave to Ridge	31.0	
p_m, Minimum required Snow Load	N/A	Para. 7.3.4
pf, Calculated Snow Load	0.00	Eq. 7.3-1
pf, Design Snow Load	0.00 psf	

Rail & Mount Selection		
Manufacturer:	Unirac	Allowable Mount Spacing by Uplift Pressure
Model:	Flashloc Comp Kit	< 37 psf : 2 rails, mounts @ 4 ft. o.c.
Substrate	Wood Rafters/Truss Top Chord	37 to 56 psf : 2 rails, mounts @ 2 ft. o.c.
Connector:	5/16" x 4" Lag Screw	56 to 75 psf : 3 rails, mounts @ 4 ft. o.c.
		75 to 112 psf : 3 rails, mounts @ 2 ft. o.c.
Allowable Uplift:	480 lb., max.	112 to 150 psf : 4 rails, mounts @ 2 ft. o.c.
		> 150 psf : Mount capacity exceeded

Rail & Mount Layout by Zone			
Zone 1:	3 rails, mounts @ 4 ft. o.c.	Zone 2r:	3 rails, mounts @ 2 ft. o.c.
Zone 1':	N/A	Zone 3:	3 rails, mounts @ 2 ft. o.c.
Zone 2:	N/A	Zone 3e:	N/A
Zone 2e:	3 rails, mounts @ 2 ft. o.c.	Zone 3r:	N/A
Zone 2n:	N/A		
(From rail analysis, allowable spacing and number of rails are controlled by individual mount pullout before rail bending)			



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PHOTOVOLTAIC ROOF MOUNT SYSTEM

34 MODULES-ROOF MOUNTED - 13.43 kW DC, 9.86 kW AC, 168 SW STONEHENGE LANE, LAKE CITY, FL 32024

PHOTOVOLTAIC SYSTEM SPECIFICATIONS:

SYSTEM SIZE:	13.43 KW DC 9.86 KW AC
MODULE TYPE & AMOUNT:	(34) CANADIAN SOLAR CS3N-395MS (395W) MODULES
MODULE DIMENSIONS:	(L/W/H) 76.40"/41.30"/1.38"
INVERTER:	(34) ENPHASE IQ8PLUS-72-2-US, 240V
INTERCONNECTION METHOD:	SUPPLY SIDE TAP

GOVERNING CODES

ALL WORK SHALL CONFORM TO THE FOLLOWING CODES
1. FLORIDA RESIDENTIAL CODE, 7TH EDITION 2018 (FRC)
2. FLORIDA BUILDING CODE, 7TH EDITION 2020 (FBC)
3. FLORIDA FIRE CODE, 7TH EDITION 2020 (FFC)
4. NATIONAL ELECTRICAL CODE 2017 (NEC) ASCE 7-16

GENERAL NOTES:

1) THIS PHOTOVOLTAIC (PV) SYSTEM SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 690, ALL MANUFACTURERS'S LISTING AND INSTALLATION INSTRUCTIONS, AND THE RELEVANT CODES AS SPECIFIED BY THE AUTHORITY HAVING JURISDICTION'S (AHJ) APPLICABLE CODES.

2) THE UTILITY INTERCONNECTION APPLICATION MUST BE APPROVED AND PV SYSTEM INSPECTED PRIOR TO PARALLEL OPERATION.

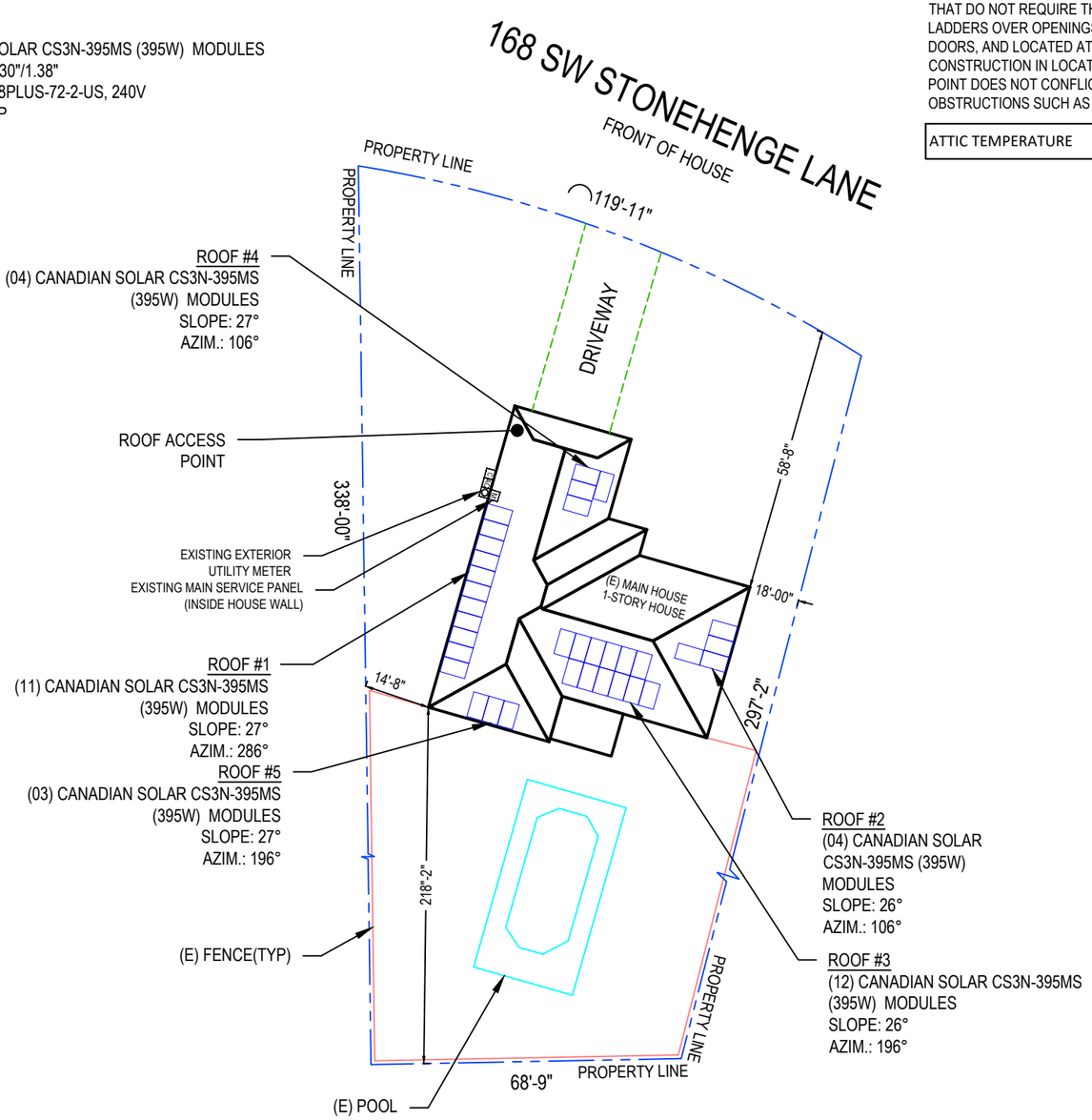
3) GROUND FAULT DETECTION AND INTERRUPTION (GFDI) DEVICE IS INTEGRATED WITH THE MICRO-INVERTER IN ACCORDANCE WITH NEC 690.41(B)

4) ALL PV SYSTEM COMPONENTS; MODULES, UTILITY-INTERACTIVE INVERTERS, AND SOURCE CIRCUIT COMBINER BOXES ARE IDENTIFIED AND LISTED FOR USE IN PHOTOVOLTAIC SYSTEMS AS REQUIRED BY NEC 690.4: PV MODULES: UL1703, IEC61730, AND IEC61215, AND NFPA 70 CLASS C FIRE INVERTERS: UL 1741 CERTIFIED, IEEE 1547, 929, 519 COMBINER BOX(ES): UL 1703 OR UL 1741 ACCESSORY

5) MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC. IF UNAVAILABLE, MAX DC VOLTAGE CALCULATED ACCORDING TO NEC 690.7.

6) ALL INVERTERS, PHOTOVOLTAIC MODULES,PHOTOVOLTAIC PANELS, AND SOURCE CIRCUIT COMBINERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER 690.4. SHALL BE INSTALLED ACCORDING TO ANY INSTRUCTIONS FROM LISTING OR LABELING [NEC 110.3].

7) ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE. IF EXPOSED TO SUNLIGHT, IT SHALL BE UV RESISTANT. ALL PLAQUES AND SIGNAGE WILL BE INSTALLED AS REQUIRED BY THE NEC AND AHJ.



1 PLOT PLAN (PV 0.0) SCALE: 1/32" = 1'-00"

ROOF ACCESS POINT

ROOF ACCESS POINT SHALL NOT BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES OR SIGNS.

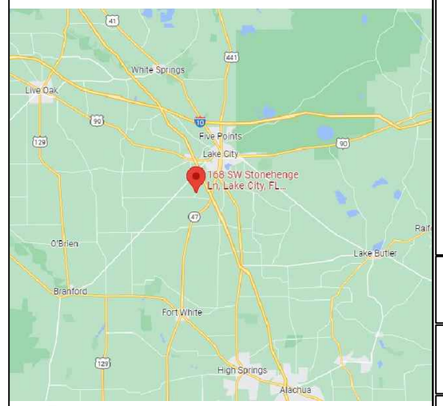
ATTIC TEMPERATURE	130 DEGREE

SHEET INDEX:

SYSTEM LEGEND

- M — EXISTING INTERIOR MAIN SERVICE PANEL & POINT OF INTERCONNECTION. TIED TO EXTERIOR EXISTING UTILITY METER.
- ◯ — EXISTING EXTERIOR UTILITY METER
- C — NEW DEDICATED PV SYSTEM COMBINER PANEL.
- AC — NEW ALTERNATIVE POWER SOURCE AC DISCONNECT/ RAPID SHUTDOWN: 240V, 60AMP RATED, NEMA 3R, UL LISTED LOCKABLE & FUSIBLE WITH (2) 60A FUSES

2 SATELLITE VIEW (PV 0.0) SCALE: NTS



3 VICINITY MAP (PV 0.0) SCALE: NTS

N

ADT Solar
ADT SOLAR LLC
22171 MCH RD MANDEVILLE, LA 70471
PHONE: 985-238-0864
ADT SOLAR BUSINESS LICENSE
FEIN: 26-0713358

Signature with Seal

HENRY I. DIFRANCO, JR. LICENSE No. 71950 STATE OF FLORIDA PROFESSIONAL ENGINEER

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FLORIDA FIRM NO. 30649

Project Name & Address

MERRICK RESIDENCE
168 SW STONEHENGE LANE,
LAKE CITY, FL 32024
COUNTY- COLUMBIA COUNTY

DRAWN BY
ENP
DATE: 07/25/2022

Sheet Name
COVER SHEET

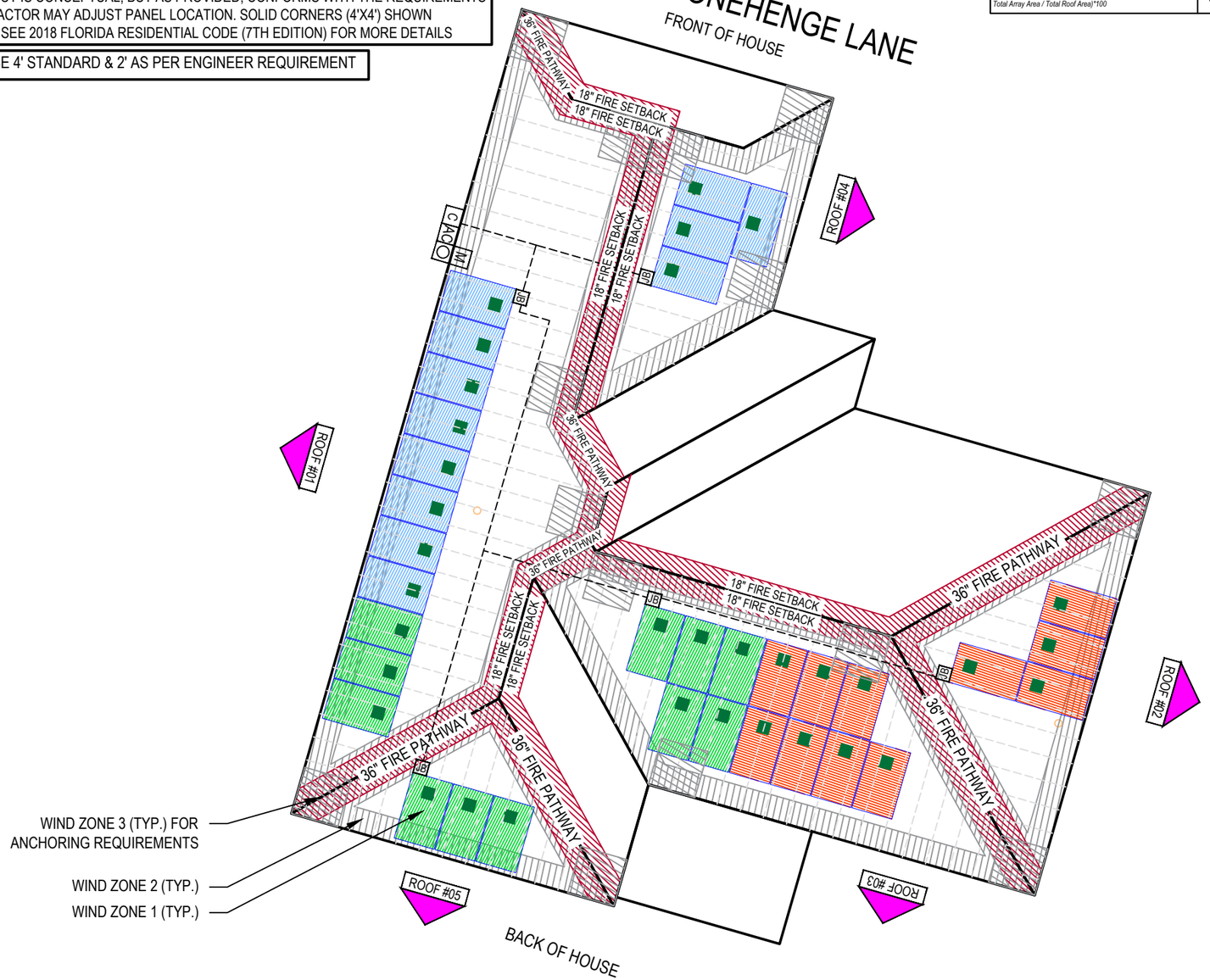
Sheet Number
PV 0.0

NOTE:
1" IMC, RMC, FMC, LFMC, PVC, HDPE, NUCC, RTRC, LFNC, FMT, ENT OR EMT CONDUIT RUN.

NOTE : SOLAR PANEL LAYOUT IS CONCEPTUAL, BUT AS PROVIDED, CONFORMS WITH THE REQUIREMENTS SET IN SHEET PV-2 CONTRACTOR MAY ADJUST PANEL LOCATION. SOLID CORNERS (4'X4') SHOWN THE PLAN IS WIND ZONE 3. SEE 2018 FLORIDA RESIDENTIAL CODE (7TH EDITION) FOR MORE DETAILS

NOTE: WIND ZONE WILL BE 4' STANDARD & 2' AS PER ENGINEER REQUIREMENT

Total Array Area	745.01	SqFt
Total Roof Area	3258.148	SqFt
Total Percentage or Roof Covered *Total Array Area / Total Roof Area)*100*	22.87%	



1. APPLICABLE CODE: 2020 FLORIDA BUILDING CODE (7TH EDITION) & ASCE 7-16 MINIMUM DESIGN LOADS FOR BUILDING AND OTHER STRUCTURES.
2. LAG SCREW DIAMETER AND EMBEDMENT LENGTHS ARE DESIGNED PER 2020 FLORIDA BUILDING CODE (7TH EDITION) REQUIREMENTS. ALL BOLT CAPACITIES ARE BASED ON A SOUTHER YELLOW PINE (SYP) RESIDENTIAL WOOD ROOF RAFTERS AS EMBEDMENT MATERIAL.
3. ALL WIND DESIGN CRITERIA AND PARAMETERS ARE FOR HIP AND GABLE RESIDENTIAL ROOFS, CONSIDERING FROM A 7° TO A MAXIMUM 26° (5/12 TO A MAXIMUM 7/12 PITCH) ROOF IN SCHEDULE. CONTRACTOR TO FIELD VERIFY THAT MEAN ROOF HEIGHT DOES NOT EXCEED 15'-0".
4. ROOF SEALANTS SHALL CONFORM TO ASTM C920 AND ASTM 6511, AND IS THE RESPONSIBILITY OF THE CONTRACTOR TO PILOT DRILL AND FILL ALL HOLES.
5. ALL DISSIMILAR MATERIALS SHALL BE SEPARATED WITH NEOPRENE WASHERS, PADS, ETC OR SIMILAR.
6. ALL ALUMINIUM COMPONENTS SHALL BE ANODIZED ALUMINIUM 6105-T5 UNLESS OTHERWISE NOTED.
7. ALL LAG SCREW SHALL BE ASTM A276 STAINLESS STEEL UNLESS OTHERWISE NOTED.
8. ALL SOLAR RAILING AND MODULES SHALL BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
9. CONTRACTOR SHALL ENSURE ALL ROOF PENETRATIONS TO BE INSTALLED AND SEALED PER 2020 FLORIDA BUILDING CODE (7TH EDITION) OR LOCAL GOVERNING CODE.

1 SITE PLAN
PV 1.0
SCALE: 3/32" = 1'-0"

SYSTEM LEGEND

- M — EXISTING INTERIOR MAIN SERVICE PANEL & POINT OF INTERCONNECTION. TIED TO EXTERIOR EXISTING UTILITY METER.
- EXISTING EXTERIOR UTILITY METER
- C — NEW DEDICATED PV SYSTEM COMBINER PANEL.
- AC — NEW ALTERNATIVE POWER SOURCE AC DISCONNECT/ RAPID SHUTDOWN: 240V, 60AMP RATED, NEMA 3R, UL LISTED LOCKABLE & FUSIBLE WITH (2) 60A FUSES
- 34 NEW CANADIAN SOLAR CS3N-395MS (395W) MODULES WITH NEW 34 - ENPHASE IQ8PLUS-72-2-US, 240V INVERTERS, MOUNTED ON THE BACK OF EACH MODULES.
- = ROOF OBSTRUCTIONS, VENT, DISH
- = EXTERIOR RUN
- = ATTIC RUN
- = CONDUIT ROOF TOP JUNCTION BOX
- = CONDUIT ATTIC RUN JUNCTION BOX
- = TRUSSES
- = WIND ZONE
- = FIRE SETBACK & PATHWAY

ROOF SECTIONS

ROOF #01
MODULE - 11
SLOPE - 27°
AZIMUTH - 286°
MATERIAL - ASPHALT SHINGLES
TRUSS SIZE & SPACING - 2"X4" @ 24" O.C.

ROOF #02
MODULE - 04
SLOPE - 26°
AZIMUTH - 106°
MATERIAL - ASPHALT SHINGLES
TRUSS SIZE & SPACING - 2"X4" @ 24" O.C.

ROOF #03
MODULE - 12
SLOPE - 26°
AZIMUTH - 196°
MATERIAL - ASPHALT SHINGLES
TRUSS SIZE & SPACING - 2"X4" @ 24" O.C.

ROOF #04
MODULE - 04
SLOPE - 27°
AZIMUTH - 106°
MATERIAL - ASPHALT SHINGLES
TRUSS SIZE & SPACING - 2"X4" @ 24" O.C.

ROOF #05
MODULE - 03
SLOPE - 27°
AZIMUTH - 196°
MATERIAL - ASPHALT SHINGLES
TRUSS SIZE & SPACING - 2"X4" @ 24" O.C.

CIRCUIT(S)

- CIRCUIT #1 - 12 MODULES
- CIRCUIT #2 - 11 MODULES
- CIRCUIT #3 - 11 MODULES

N

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DRAWN BY
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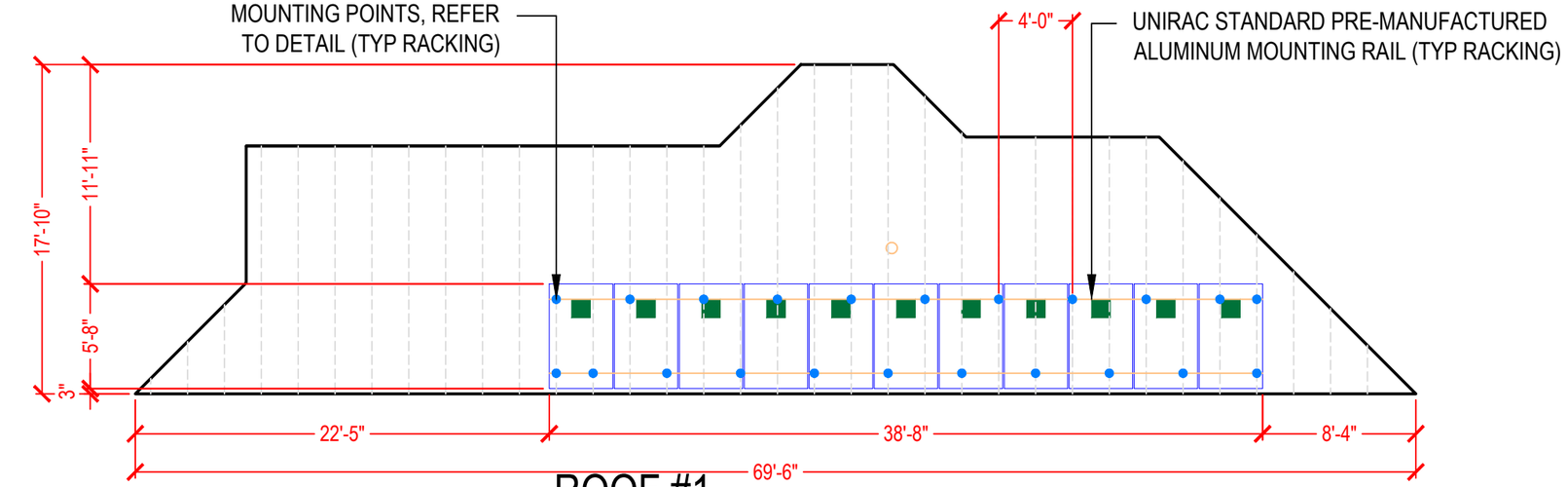
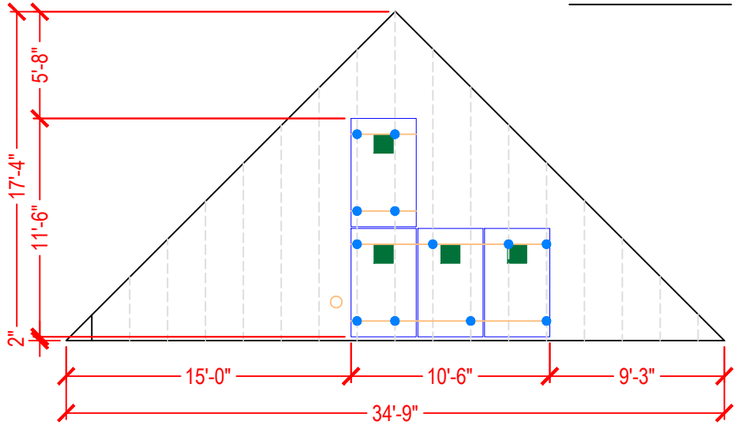
Sheet Name
SITE PLAN

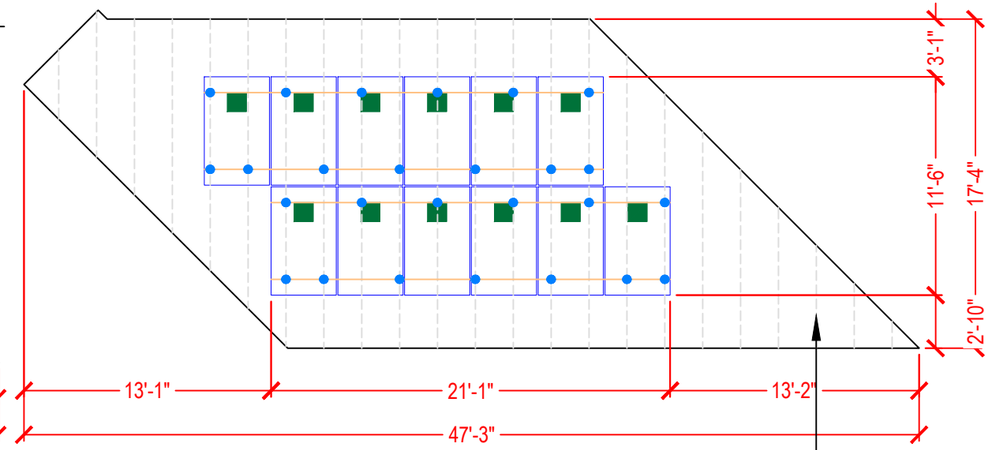
Sheet Number
PV 1.0



ROOF #1

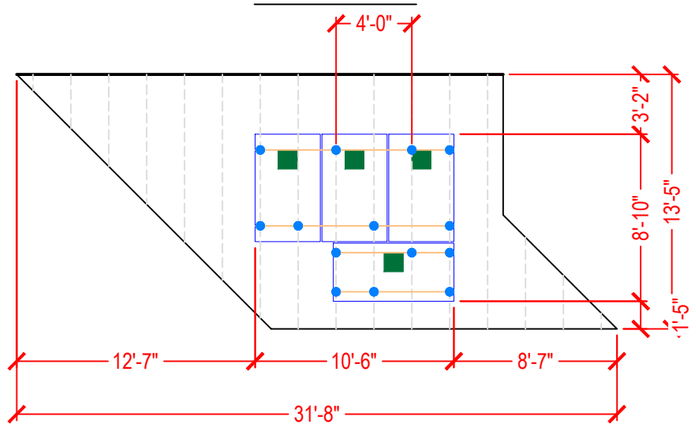


ROOF #2

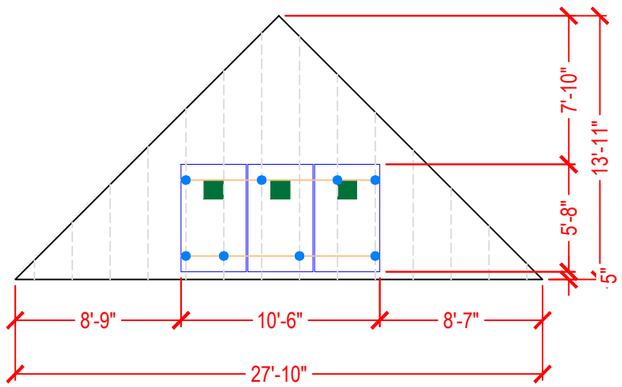


ROOF #3

2"X4" PRE-FAB TRUSSES @ 24" O.C., VERIFY LOCATIONS



ROOF #4



ROOF #5

1 ATTCHMENT PLAN
PV 1.1
SCALE: 1/8" = 1'-0"

MODULE, ARRAY WEIGHT (LOAD CALC'S)		
Number of Modules	34	
Module Weight	51.6	LBS
Total Module (Array) Weight	1754.40	LBS
Number of Attachment point	82	
Mounting System Weight *(Per Module)*	1.5	LBS
Mounting System Weight	123.00	LBS
Total System Weight *(Module Weight + Mounting System Weight)*	1877.40	LBS
Weight at Each Attachment Point *(Array Weight / Number of Attachment Point)*	21.40	LBS
Module Area (76.40"x41.30")	21.91	SqFt
Total Array Area	745.01	SqFt
Distributed Load *(Total System Weight / Total Array Area)*	2.42	Per SqFt
Total Roof Area	3258.148	SqFt
Total Percentage or Roof Covered *Total Array Area / Total Roof Area)*100*	22.87%	

ADT Solar
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Signature with Seal

HENRY I. DIFRANCO, JR. LICENSE No. 71950 STATE OF FLORIDA PROFESSIONAL ENGINEER

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Project Name & Address

MERRICK RESIDENCE
168 SW STONEHENGE LANE,
LAKE CITY, FL 32024
COUNTY- COLUMBIA COUNTY

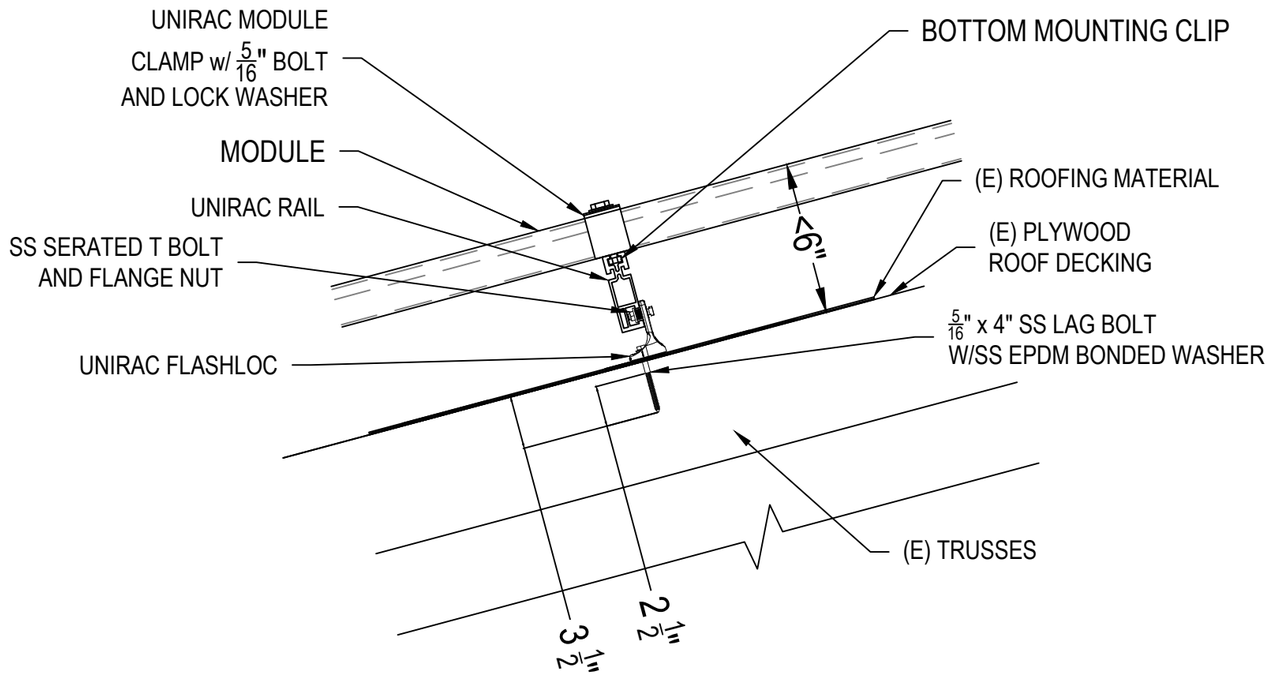
DRAWN BY
ENP
DATE: 07/25/2022

Sheet Name
ATTACHMENT PLAN

Sheet Number
PV 1.1

GENERAL STRUCTURAL NOTES:

1. THE SOLAR PANELS ARE TO BE MOUNTED TO THE ROOF FRAMING USING THE UNIRAC STANDARD PRE-MANUFACTURED ALUMINUM MOUNTING RAIL WITH FLASHLOC ATTACHMENT. THE MOUNTING FEET ARE TO BE SPACED AS SHOWN IN THE DETAILS, AND MUST BE STAGGERED TO ADJACENT FRAMING MEMBERS TO SPREAD OUT THE ADDITIONAL LOAD.
2. UNLESS NOTED OTHERWISE, MOUNTING ANCHORS SHALL BE 5/16" LAG SCREWS WITH A MINIMUM OF 2-1/2" PENETRATION INTO ROOF FRAMING.
3. THE PROPOSED PV SYSTEM ADDS 2.6 PSF TO THE ROOF FRAMING SYSTEM.
4. ROOF LIVE LOAD = 20 PSF TYPICAL, 0 PSF UNDER NEW PV SYSTEM.
5. SNOW LOAD = 0 PSF
6. WIND SPEED = 165 MPH
7. EXPOSURE CATEGORY = C
8. MAX SPACING BETWEEN ATTACHMENTS (INCHES) = 48"



1 ATTACHMENT DETAIL (SIDE VIEW)

PV 2.0

SCALE: NTS

Note 1: Windspeed value is design 3-sec gust in accordance with ASCE 7-16

Note 2: a)Lag bolt shall be mounted into rafters
b)Notify Engineer immediately if conditions differ or prevent installation per plan.

Note 3: These drawings were prepared under my supervison. I have researched the code and to the best of my knowledge And belief, these drawings comply with the 2020 Florida Building Code.

Note 4: Installer shall adjust mount spacing by zone to match prescribed values on engineer's calculation letter

Note 5: Maximum rail cantilever distance beyond outermost mount is One-third the zone-specific mount spacing.

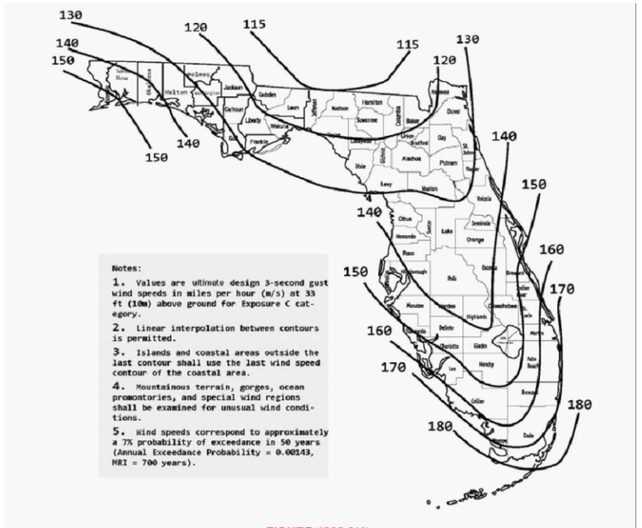


FIGURE 1609.3(1)
ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

DESIGN SPECIFICATION:

WIND SPEED : 165 MPH
RISK CATEGORY : II
EXPOSURE CATEGORY : C
ROOF HEIGHT : 15FT
ROOF SLOPE : 27°& 26°

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DATE: 07/25/2022

Sheet Name
ATTACHMENT DETAIL

Sheet Number
PV 2.0

MODULE TYPE & AMOUNT: (34) CANADIAN SOLAR CS3N-395MS (395W) MODULES
MICRO-INVERTER: (34) ENPHASE IQ8PLUS-72-2-US, 240V
(01) CIRCUIT OF 12 MODULES CONNECTED IN PARALLEL
(02)CIRCUITS OF 11 MODULES CONNECTED IN PARALLEL
SYSTEM SIZE: 13.43 KW DC
9.86 KW AC

1.) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
2.) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600V AND 90 DEGREE 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 SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL 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 READILY VISIBLE.
8.) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
9.) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
10.) IN 1" IMC, RMC, FMC, PVC, LFMC, HDPE, NUCC, RTRC, LFNC, EMT, FMT, EMT CONDUIT RUN

EXISTING INTERIOR 240V/200A BUS BAR RATING, MAIN SERVICE PANEL, SINGLE PHASE WITH 200A MAIN BREAKER

EXISTING CLAY ELECTRIC COOPERATIVE UTILITY METER METER NO- 156 215 782

M

SUPPLY SIDE TAP (705.12A)

(3) ENPHASE Q CABLES

(N) (34) ENPHASE IQ8PLUS-72-2-US, 240V, MICRO-INVERTERS, 240V, 1.21A MAX CEC WEIGHTED EFFICIENCY 97.0% NEMA 4R, UL LISTED, INTERNAL GFDI

12 MICRO-INVERTERS IN BRANCH CIRCUIT #1

TERMINATOR CAP ON LAST CABLE CONNECTOR AC TRUNK CABLE (TYP)

11 MICRO-INVERTERS IN BRANCH CIRCUIT #2

TERMINATOR CAP ON LAST CABLE CONNECTOR AC TRUNK CABLE (TYP)

11 MICRO-INVERTERS IN BRANCH CIRCUIT #3

TERMINATOR CAP ON LAST CABLE CONNECTOR AC TRUNK CABLE (TYP)

PER MANUFACTURER SPECIFICATIONS, EITHER 10A OR 15A BREAKER IS SUITABLE FOR USE

(N) 125A COMBINER PANEL ENPHASE IQ COMBINER X-IQ-AM1-240-4 64A/240V CONTINUOUS, PROTECTION MAX 80A BREAKER ON SOLAR OUTPUT; WITH 10 KAIC CIRCUIT BREAKERS

(N) JUNCTION BOX 600 V, NEMA 4 UL LISTED

20A 15A 20A 20A

L1 L2 N G

M* IQ Envoy

PRODUCTION CT

(N) ALTERNATIVE POWER SOURCE AC DISCONNECT/ RAPID SHUTDOWN: 240V, 60AMP RATED, NEMA 3R, UL LISTED LOCKABLE & FUSIBLE WITH (2) 60A FUSES

(2) 60A FUSES

(E) 200A/2P

(E) LOADS

(E) LOADS

(E) LOADS

N

G

GEC

GROUNDING ELECTRODE SYSTEM

EXISTING GROUNDING ELECTRODE SYSTEM TO EARTH REF. NEC 250.52, 250.53(A)

LINE SIDE INTERCONNECTION AT MAIN PANEL PER ART. 705.12(A)

BOND THE NEUTRALS AND GROUNDS IN THE AC DISCONNECT.

1 2 3 4

* IF CONDUIT IS USED ON EXTERIOR - RUNS SHALL BE MIN. 7/8" ABOVE ROOF
* EXPOSED CONDUIT RUN ON EXTERIOR OR ROMEX RUN INSIDE ATTIC

(GN) GENERAL CONDUIT NOTE :
CONDUIT TO BE UL LISTED FOR WET LOCATIONS AND UV PROTECTED (EX. -EMT,SCH 80 PVC OR RMC)*FMC MAYBE USED IN INDOOR APPLICATIONS WHERE PERMITTED BY NEC ART .348

WIRE TAG #	WIRE FROM - -	CONDUIT	WIRE QTY	WIRE GAUGE:	WIRE TYPE ENPHASE TRUNK CABLE INCLUDES #12 GROUND	TEMP RATING: NEC 310. 15(B)(3)(c)	WIRE AMP	TEMP DE-RATE: NEC 310.15 (B)(2)(a)	CONDUIT FILL: NEC 310.15 (B)(3)(a)	WIRE OCP:	TERMINAL 75°C RATING:	INVERTER QTY:	NOC:	NEC:	STRING AMPS NEC 690.8(B)	GRND SIZE	GRND WIRE TYPE
1	ARRAY TO JUNCTION BOX	PV WIRE	3	#12	TRUNK CABLE	90°	30A x	0.96 x	1.00	=28.80A	25A	12 x	1.21 x	1.25	=18.15A	#10	SBC
2	JUNCTION BOX TO COMBINER PANEL	REF-10	6	#10	THWN-2	90°	40A x	0.96 x	0.80	=30.72A	35A	12 x	1.21 x	1.25	=18.15A	#10	THWN-2
3	COMBINER PANEL TO ACD	REF-10	3	#6	THWN-2	90°	75A x	0.96 x	1.00	=72.00A	65A	34 x	1.21 x	1.25	=51.43A	#10	THWN-2
4	ACD TO MSP	REF-10	3	#6	THWN-2	90°	75A x	0.96 x	1.00	=72.00A	65A	34 x	1.21 x	1.25	=51.43A	-	-

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COUNTY- COLUMBIA COUNTY

DRAWN BY
ENP
DATE: 07/25/2022

Sheet Name
3-LINE DIAGRAM

Sheet Number
E 1.1

Rooftop conductor ampacities designed in compliance with art. 690.8, Tables 310.15(B)(2)(a), 310.15(B)(3)(a), 310.15(B)(3)(c), 310.15(B)(16), Chapter 9 Table 4, 5, & 9. Location specific temperature obtained from ASHRAE 2017 data tables

RECORD LOW TEMP	3°
AMBIENT TEMP (HIGH TEMP 2%)	33°
CONDUIT HEIGHT	7/8"
CONDUCTOR TEMPERATURE RATE	90°

SOLAR MODULE PER MANUFACTURER SPECIFICATIONS	
MANUFACTURER	CANADIAN CS3N-395MS
MAX. POWER-POINT CURRENT (IMP)	10.68 AMPS
MAX. POWER-POINT VOLTAGE (VMP)	37.0 VOLTS
OPEN-CIRCUIT VOLTAGE (VOC)	44.30 VOLTS
SHORT-CIRCUIT CURRENT (ISC)	11.44 AMPS
NOM. MAX. POWER AT STC (PMAX)	395 WATT
VOC TEMPERATURE COEFFICIENT	-0.26° %/°C

MICRO-INVERTER PER MANUFACTURER SPECIFICATIONS	
MANUFACTURER	ENPHASE ENERGY IQ8PLUS-72-2-US
MAX. DC VOLT RATING	60 VOLTS
MAX. POWER AT 40 C	290 WATTS
NOMINAL AC VOLTAGE	240 VOLTS
MAX. AC CURRENT	1.21 AMPS
MAX. OCPD RATING	20 AMPS
MAX. PANELS/CIRCUIT	13
SHORT CIRCUIT CURRENT	15 AMPS

THIS PANEL IS FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)	
AC OUTPUT CURRENT	41.14A
NOMINAL AC VOLTAGE	240V

ENPHASE Q CABLE TO BE ATTACHED TO RAIL MIN. 3-1/2" ABOVE ROOF SURFACE

SYSTEM NOTES:

1. ENPHASE IQ8PLUS-72-2-US, (240V) MICROINVERTERS DO NOT REQUIRE GROUNDING ELECTRODE CONDUCTORS OR EQUIPMENT GROUNDING CONDUCTORS. THE MICROINVERTERS ITSELF HAS CLASS II DOUBLE-INSULATED RATING, WHICH INCLUDES GROUND FAULT PROTECTION.
2. ENPHASE Q CABLE HAS NO NEUTRAL WIRE - (2 WIRE DOUBLE INSULATED CABLING)
3. MODULES ARE BONDED TO RAIL USING IRONRIDGE INTEGRATED GROUNDING.
4. RAILS ARE BONDED WITH UL 2703 RATED LAY-IN LUGS
5. SYSTEM IS UNGROUNDED
6. BARE COPPER IS TRANSITIONED TO THHN/THWN-2 VIA IRREVERSIBLE CRIMP; GEC TO BE CONTINUOUS PER CEC 250.64(C)
7. SUB-BRANCHES ARE CENTER-FED AT JBOX TO MAKE ONE TOTAL BRANCH CIRCUIT.
8. ENPHASE IQ ENVOY INSIDE IQ COMBINER REQUIRES A NEUTRAL TO BE LANDED AT THE NEUTRAL BUSS AT MAIN PANEL PER ENPHASE INSTALLATION INSTRUCTIONS.
9. ENPHASE MICROINVERTERS ARE ALL RAPID SHUTDOWN READY PER NEC 690.12

NOTES

1. ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
2. ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT. THE TERMINALS ARE RATED FOR 75 DEGREE C.
3. THE WIRES ARE SIZED ACCORDING TO NEC 110.14.
4. WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
5. WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
6. DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
7. WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
8. ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
9. MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
10. MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
11. THE POLARITY OF THE GROUNDED CONDUCTORS IS NEGATIVE .
12. UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE. 13. MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
14. RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
15. CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.10 (D).
16. CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).
17. THIS SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN OF PV CONDUCTORS IN COMPLIANCE WITH NEC 690.12.
18. LABELING IN COMPLIANCE WITH NEC 690.12 AND 690.56(C) IS SHOWN ON SHEET E-03.
19. ALL CONDUITS TO BE INSTALLED A MIN OF 7/8" ABOVE THE ROOF SURFACE.

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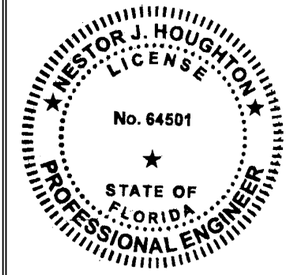

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DRAWN BY
ENP
DATE: 07/25/2022

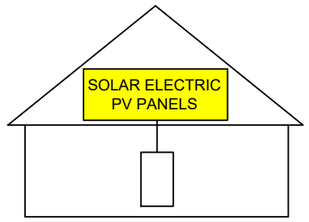
Sheet Name
NOTES

Sheet Number
E 1.2

WARNING: PHOTOVOLTAIC POWER SOURCE

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



AC DISCONNECT

AC COMBINER BOX

PHOTOVOLTAIC MICROINVERTERS LOCATED UNDER EACH PV MODULE IN ROOFTOP ARRAY

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

RATED AC OUTPUT CURRENT: 41.14A
NOM. OPERATING VOLTAGE: 240 V

WARNING
INVERTER OUTPUT CONNCTION

DO NOT RELOCATE THIS OVERCURRENT DEVICE

SOLAR CONECTION BACKFEED BREAKER

WARNING
ELECTRIC SHOCK HAZARD

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

WARNING
DUAL POWER SUPPLY

SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

SOLAR BREAKER

_____KW SOLAR DISCONNECT LOCATED

PHOTOVOLTAIC SYSTEM
AC DISCONNECT

OPERATING VOLTAGE: 240 VOLTS
OPERATING CURRENT: 41.14 AMPS

___ FT ←

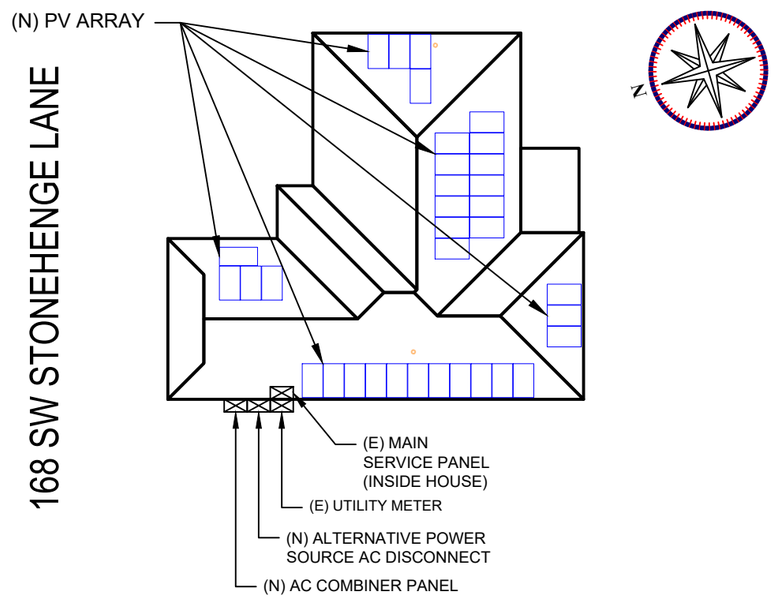
→ FT ___

ELECTRICAL NOTES :

1). UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
2). WORKING CLEARANCES AROUND THE EXISTING AND NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC ARTICLE 110.26.
3). ALL EQUIPMENT INSTALLED SHALL BE LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) PER NEC ARTICLE 110.3.
4). RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
5). ALL LABELS OR MARKINGS SHALL BE VISIBLE AFTER INSTALLATION. THE LABELS SHALL BE REFLECTIVE, AND ALL LETTERS SHALL BE CAPITALIZED AND SHALL BE A MINIMUM HEIGHT OF 9.5 MM (3/8 IN) IN WHITE ON A RED BACKGROUND.
6). CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.8 (D).
7). CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.8 (C)

CAUTION:

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS LOCATED AS SHOWN



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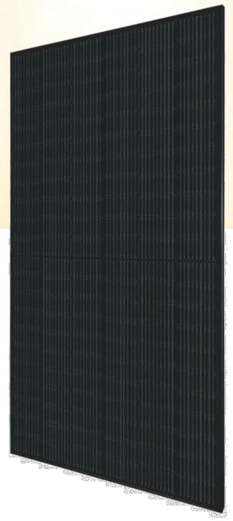
DATE: 07/25/2022

Sheet Name
WARNING LABELS

Sheet Number
E 1.3

NEW

CanadianSolar



HiKuBlack Mono PERC

BLACK FRAME ON BLACK BACKSHEET

F23 Frame

380 W ~ 405 W

CS3N-380|385|390|395|400|405MS

MORE POWER

- Module power up to 405 W
  Module efficiency up to 19.9 %
- Lower LCOE & BOS 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, enhanced wind load up to 6000 Pa*

* For detailed information, please refer to Installation Manual.

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
FSEC (US Florida) / UL 61730 / IEC 61701 / IEC 62716

* 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 63 GW of premium-quality solar modules across the world.

CSI SOLAR (USA) CO., LTD.
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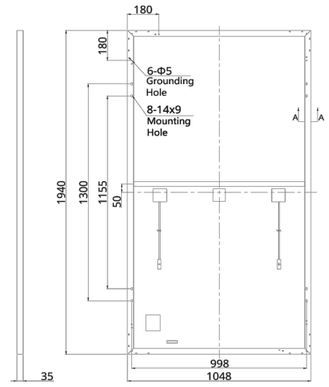
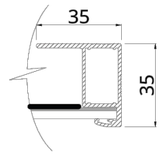
ENGINEERING DRAWING (mm)

Rear View

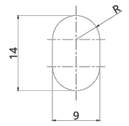


Frame Cross Section

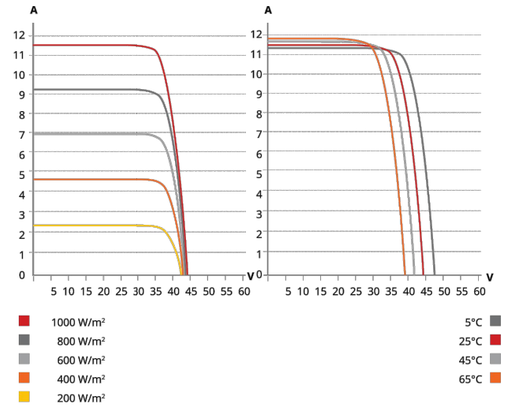
A - A



Mounting Hole



CS3N-400MS / I-V CURVES



ELECTRICAL DATA | STC*

CS3N	380MS	385MS	390MS	395MS	400MS	405MS
Nominal Max. Power (Pmax)	380 W	385 W	390 W	395 W	400 W	405 W
Opt. Operating Voltage (Vmp)	36.4 V	36.6 V	36.8 V	37.0 V	37.2 V	37.4 V
Opt. Operating Current (Imp)	10.44 A	10.52 A	10.60 A	10.68 A	10.76 A	10.83 A
Open Circuit Voltage (Voc)	43.7 V	43.9 V	44.1 V	44.3 V	44.5 V	44.7 V
Short Circuit Current (Isc)	11.26 A	11.32 A	11.38 A	11.44 A	11.50 A	11.56 A
Module Efficiency	18.7%	18.9%	19.2%	19.4%	19.7%	19.9%
Operating Temperature	-40°C ~ +85°C					
Max. System Voltage	1000V (UL)					
Module Fire Performance	TYPE 2 (UL 61730 1000V)					
Max. Series Fuse Rating	20 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.

ELECTRICAL DATA | NMOT*

CS3N	380MS	385MS	390MS	395MS	400MS	405MS
Nominal Max. Power (Pmax)	284 W	288 W	291 W	295 W	299 W	303 W
Opt. Operating Voltage (Vmp)	34.0 V	34.2 V	34.4 V	34.6 V	34.7 V	34.9 V
Opt. Operating Current (Imp)	8.35 A	8.42 A	8.48 A	8.54 A	8.60 A	8.66 A
Open Circuit Voltage (Voc)	41.2 V	41.4 V	41.6 V	41.8 V	41.9 V	42.1 V
Short Circuit Current (Isc)	9.08 A	9.13 A	9.18 A	9.23 A	9.28 A	9.33 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.

MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline
Cell Arrangement	132 [2 X (11 X 6)]
Dimensions	1940 X 1048 X 35 mm (76.4 X 41.3 X 1.38 in)
Weight	23.4 kg (51.6 lbs)
Front Cover	3.2 mm tempered glass
Frame	Anodized aluminium alloy
J-Box	IP68, 3 bypass diodes
Cable	12 AWG (UL)
Cable Length (Including Connector)	Portrait: 400 mm (15.7 in) (+) / 280 mm (11.0 in) (-) (supply additional cable jumper: 2 lines/pallet); landscape: 1250 mm (49.2 in)*
Connector	T4 or MC4 series
Per Pallet	30 pieces
Per Container (40' HQ)	720 pieces

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

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

* 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.

PARTNER SECTION

ENPHASE.

DATA SHEET

IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.

Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.

Enphase 25 year limited warranty

IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.

Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.

UL CERTIFIED SAFETY

IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer's instructions.

Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produce power even when the grid is down*
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support**
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

IQ8SP-DS-0002-01-EN-US-2022-03-17

* Only when installed with IQ System Controller 2, meets UL 1741.
** IQ8 and IQ8Plus supports split phase, 240V installations only.

IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings[1]	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell, 66-cell/132 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current[2] [module Isc]	A	15	
Overvoltage class DC port		II	
DC port backfeed current	mA	0	
PV array configuration		1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)		**IQ8-60-2-US**	**IQ8PLUS-72-2-US**
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range[3]	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
AC short circuit fault current over 3 cycles	Arms	2	
Max units per 20 A (L-L) branch circuit[4]		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.5	97.6
CEC weighted efficiency	%	97	97
Night-time power consumption	mW	60	
MECHANICAL DATA			
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)	
Relative humidity range		4% to 100% (condensing)	
DC Connector type		MC4	
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight		1.08 kg (2.38 lbs)	
Cooling		Natural convection – no fans	
Approved for wet locations		Yes	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) No enforced DC/AC ratio. See the compatibility calculator at https://link.enphase.com/module-compatibility
(2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8SP-DS-0002-01-EN-US-2022-03-17

Data Sheet
Enphase Networking

Enphase IQ Combiner 4/4C

X-IQ-AM1-240-4
X-IQ-AM1-240-4C

X-IQ-AM1-240-4C

X-IQ-AM1-240-4

The **Enphase IQ Combiner 4/4C** with Enphase IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure and streamlines IQ microinverters and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

Smart

- Includes IQ Gateway for communication and control
- Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), included only with IQ Combiner 4C
- Includes solar shield to match Enphase IQ Battery aesthetics and deflect heat
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

Simple

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

Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the IQ Combiner SKU's
- UL listed

UL LISTED

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

ENPHASE

Enphase IQ Combiner 4/4C

MODEL NUMBER	
IQ Combiner 4 (X-IQ-AM1-240-4)	IQ Combiner 4 with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery system and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C (X-IQ-AM1-240-4C)	IQ Combiner 4C with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.
ACCESSORIES AND REPLACEMENT PARTS	(not included, order separately)
Ensemble Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support
EPLC-01	Power line carrier (communication bridge pair), quantity - one pair
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 4/4C
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01)
XA-ENV-PCBA-3	Replacement IQ Gateway printed circuit board (PCB) for Combiner 4/4C
X-IQ-NA-HD-125A	Hold down kit for Eaton circuit breaker with screws.
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating	65 A
Max. continuous current rating (input from PV/storage)	64 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation / 95A with IQ Gateway breaker included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-SPLIT)	A pair of 200 A split core current transformers
MECHANICAL DATA	
Dimensions (WxHxD)	37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"). Height is 21.06" (53.5 cm) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing.
Altitude	To 2000 meters (6,560 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)
COMPLIANCE	
Compliance, IQ Combiner	UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

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

ENPHASE

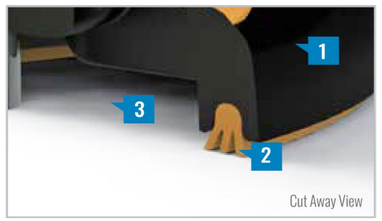
FLASH LOC

UNIRAC
BETTER SOLAR STARTS HERE

FLASHLOC is the ultimate attachment for composition shingle and rolled comp roofs. The all-in-one mount installs fast — no kneeling on hot roofs to install flashing, no prying or cutting shingles, no pulling nails. Simply drive the lag bolt and inject sealant into the base. **FLASH**LOC's patented TRIPLE SEAL technology preserves the roof and protects the penetration with a permanent pressure seal. Kitted with lag bolts, sealant, and hardware for maximum convenience. Don't just divert water, **LOC it out!**

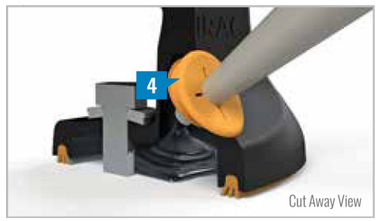
PROTECT THE ROOF

Install a high-strength waterproof attachment without lifting, prying or damaging shingles.



LOC OUT WATER

With an outer shield 1 contour-conforming gasket 2 and pressurized sealant chamber 3 the Triple Seal technology delivers a 100% waterproof connection.



HIGH-SPEED INSTALL

Simply drive lag bolt and inject sealant into the port 4 to create a permanent pressure seal.

FLASH LOC

INSTALLATION GUIDE

UNIRAC
BETTER SOLAR STARTS HERE

PRE-INSTALL

Snap chalk lines for attachment rows. On shingle roofs, snap lines 1-3/4" below upslope edge of shingle course. Locate rafters and mark attachment locations.

At each location, drill a 7/32" pilot hole. Clean roof surface of dirt, debris, snow, and ice. Next, BACKFILL ALL PILOT HOLES WITH SEALANT.

NOTE: Space mounts per racking system install specifications.

STEP 1: SECURE

Place **FLASH**LOC over pilot hole with lag on down-slope side. Align indicator marks on sides of mount with chalk line. Pass included lag bolt and sealing washer through **FLASH**LOC into pilot hole. Drive lag bolt until mount is held firmly in place.

NOTE: The EPDM in the sealing washer will expand beyond the edge of the metal washer when proper torque is applied.

STEP 2: SEAL

Insert tip of UNIRAC provided sealant into port. Inject until sealant exits both vents.

Continue array installation, attaching rails to mounts with provided T-bolts.

NOTE: When **FLASH**LOC is installed over gap between shingle tabs or vertical joints, fill gap/joint with sealant between mount and upslope edge of shingle course.

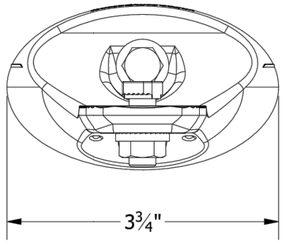
NOTE: When installing included rail attachment hardware, torque nut to 30 ft/lbs.

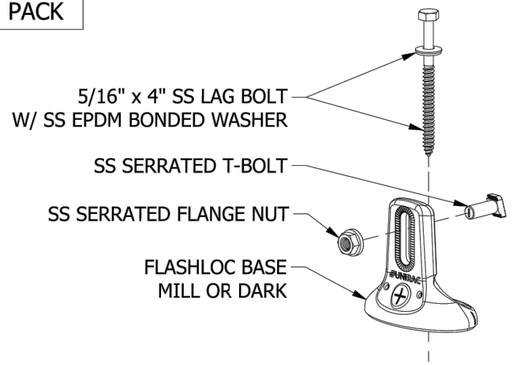
USE ONLY UNIRAC APPROVED SEALANTS: Chemlink Duralink 50 (included in kit) or Chemlink M-1

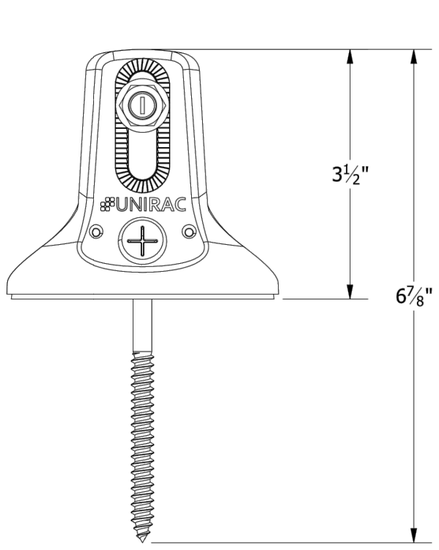
FASTER INSTALLATION. 25-YEAR WARRANTY.

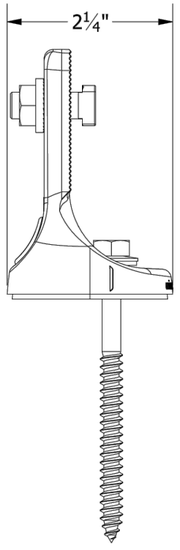
FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR CALL (505) 248-2702

PART TABLE	
P/N	DESCRIPTION
004085M	FLASHLOC COMP KIT MILL, 20 PACK
004085D	FLASHLOC COMP KIT DARK, 20 PACK









UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DRAWING
DESCRIPTION:	FLASHLOC COMP KIT
REVISION DATE:	4/28/2020

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

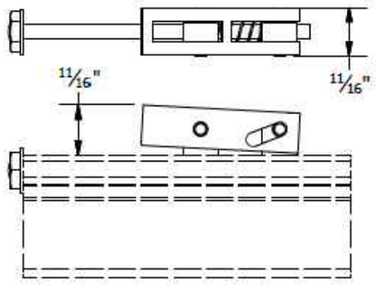
PRODUCT PROTECTED BY ONE OR MORE US PATENTS

LEGAL NOTICE

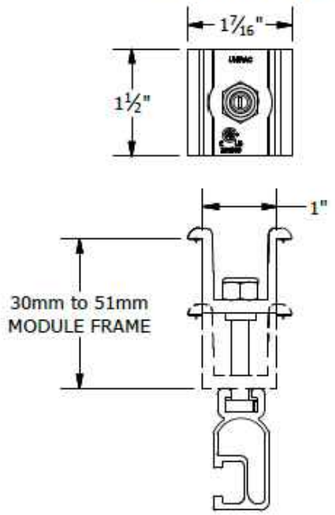
FL-A01

SHEET

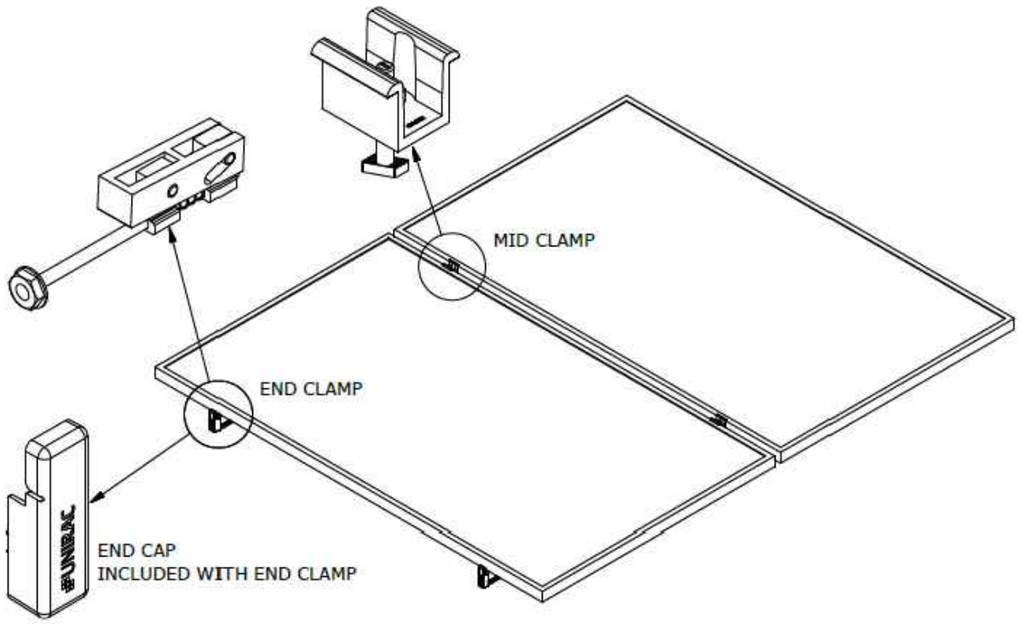
PRO SERIES END CLAMP



PRO SERIES MID CLAMP



PART # TABLE	
P/N	DESCRIPTION
302035M	ENDCLAMP PRO
302030M	MIDCLAMP PRO - MILL
302030D	MIDCLAMP PRO - DRK



UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	PRO SERIES BONDING CLAMPS
REVISION DATE:	10/26/2017

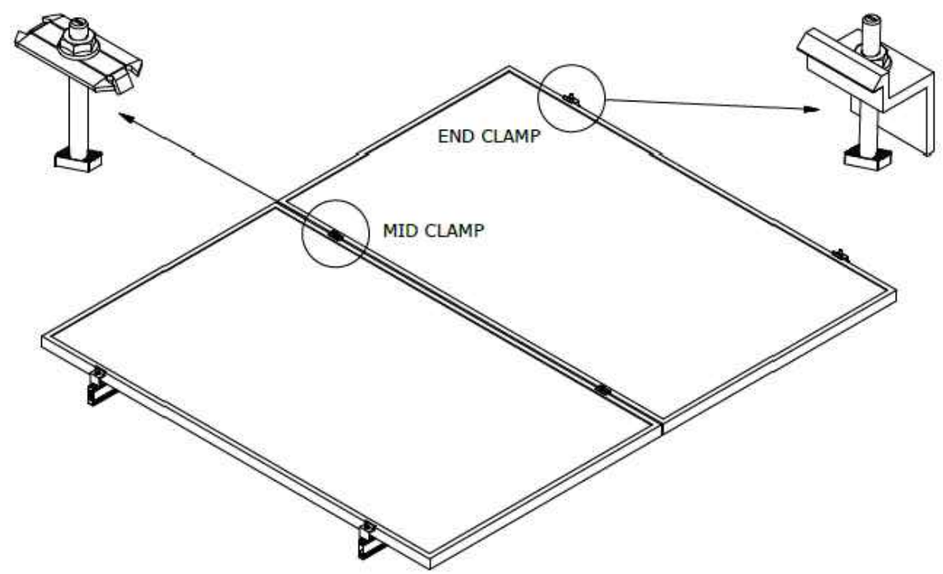
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS

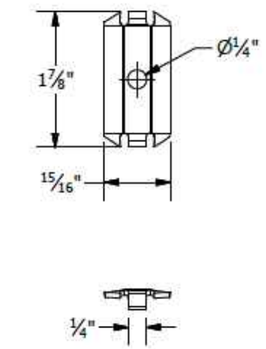
LEGAL NOTICE

SM-A01

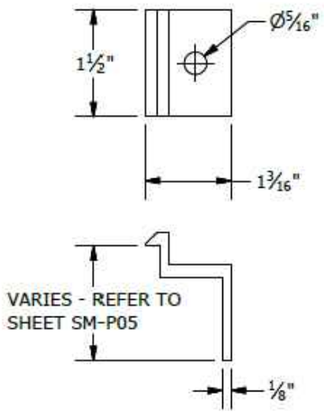
SHEET



PART # TABLE	
P/N	DESCRIPTION
302027C	SM BND MIDCLAMP BC SS
302027D	SM BND MIDCLAMP BC DRK SS
302028C	SM BND MIDCLAMP EF SS
302028D	SM BND MIDCLAMP EF DRK SS
302029C	SM BND MIDCLAMP DK SS
302029D	SM BND MIDCLAMP DK DRK SS
	FOR BONDING END CLAMP REFER TO SHEET SM-P05



BONDING SM MID CLAMP



BONDING SM END CLAMP

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	BONDING TOP CLAMPS
REVISION DATE:	10/26/2017

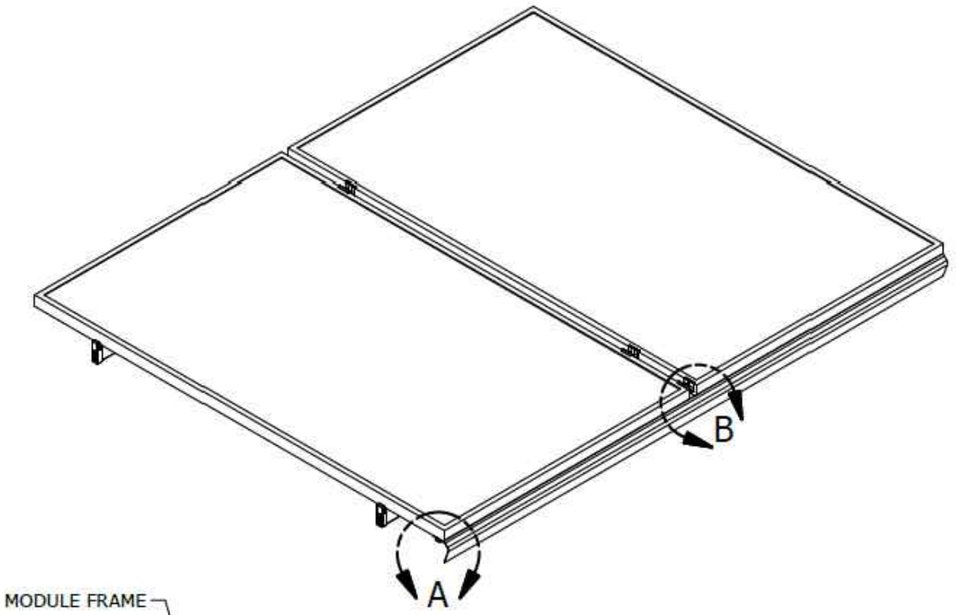
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS

LEGAL NOTICE

SM-A01A

SHEET



DETAIL A
TRIM END CLIP

TRIM

DETAIL B
MID CLAMP TRIM CONNECTION

PART # TABLE		
P/N	DESCRIPTION	LENGTH
206072D-B	SM TRIM DRK	168"
008025S	SM TRIM END CLIP	-

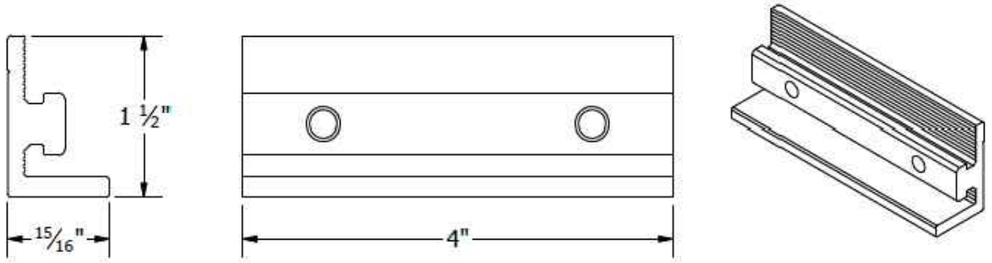
UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

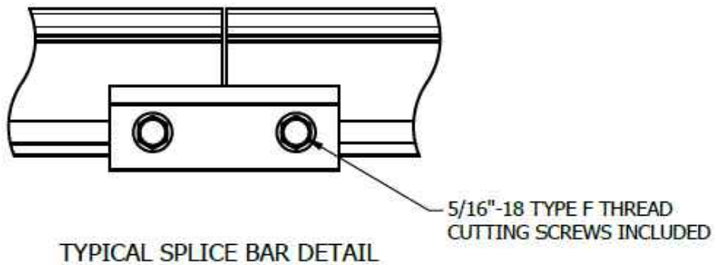
PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	SM TRIM END CLIP
REVISION DATE:	9/27/2017

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

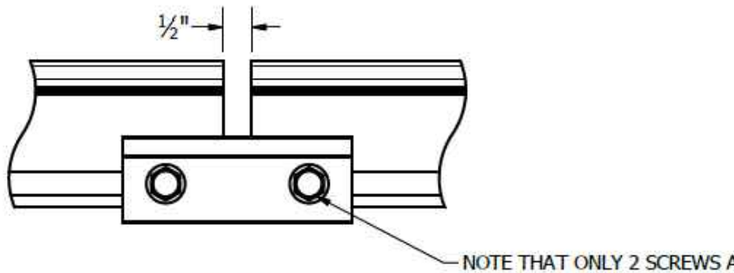
SM-A02
SHEET

BONDING SPLICE BAR





TYPICAL SPLICE BAR DETAIL



TYPICAL EXPANSION JOINT DETAIL

PART # TABLE	
P/N	DESCRIPTION
303019M	BND SPLICE BAR PRO SERIES MILL
303019D	BND SPLICE BAR PRO SERIES DRK

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	BONDING SPLICE BAR PRO SERIES
REVISION DATE:	8/23/2018

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

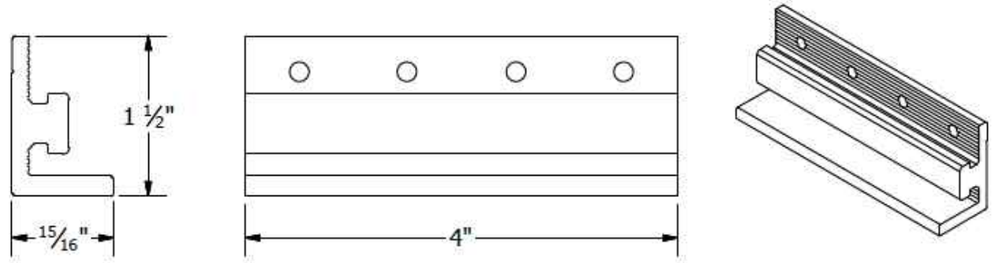
PRODUCT PROTECTED BY ONE OR MORE US PATENTS

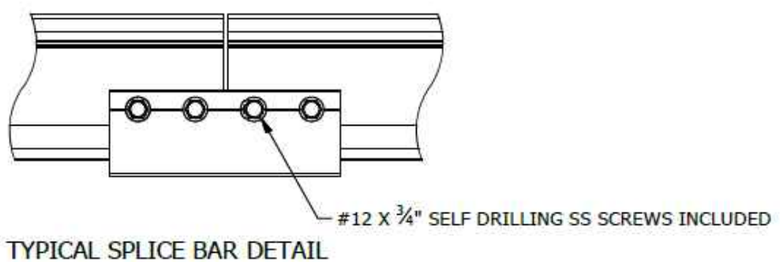
LEGAL NOTICE

SM-A05

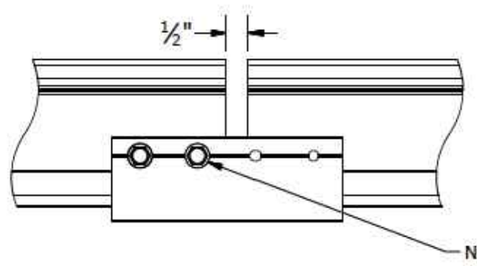
SHEET

BONDING SPLICE BAR





TYPICAL SPLICE BAR DETAIL



TYPICAL EXPANSION JOINT DETAIL

PART # TABLE	
P/N	DESCRIPTION
303018C	BND SPLICE BAR SERRATED CLR
303018D	BND SPLICE BAR SERRATED DRK

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	BONDING SPLICE BAR
REVISION DATE:	9/27/2017

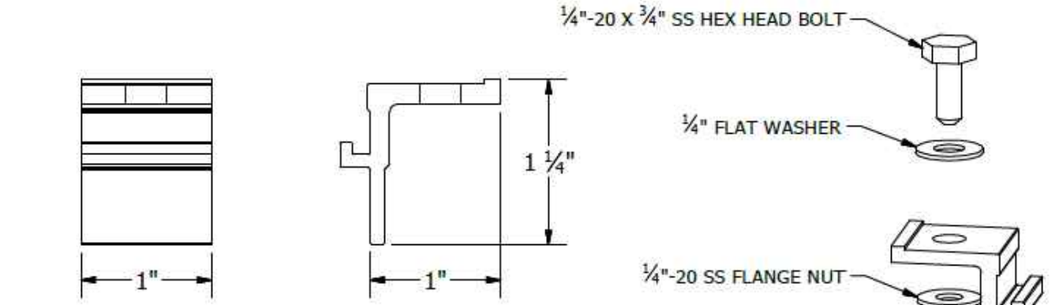
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS

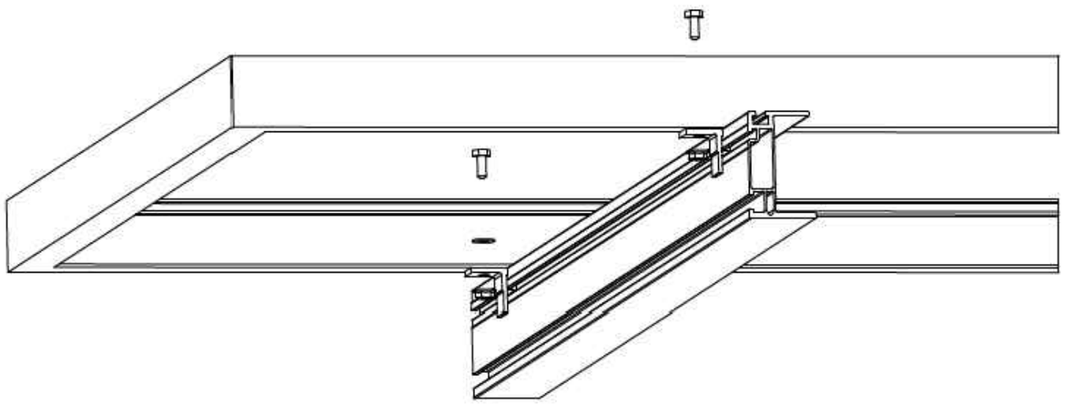
LEGAL NOTICE

SM-A05

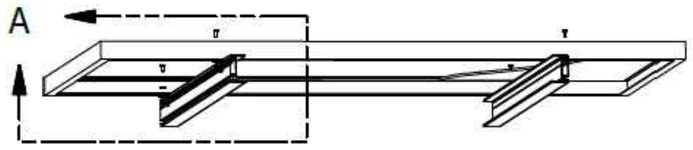
SHEET



BOTTOM CLIP



DETAIL A



PART # TABLE	
P/N	DESCRIPTION
302000C	SMHD BOTTOM CLIPS W/HDW CLR

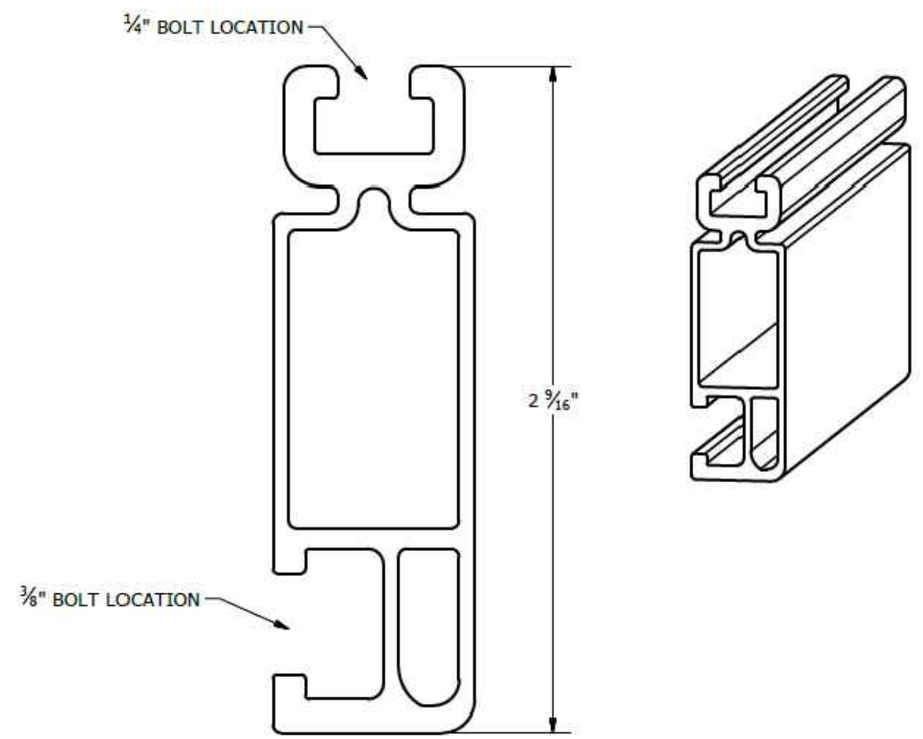
UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT HD
DRAWING TYPE:	PART & ASSEMBLY
DESCRIPTION:	BOTTOM CLIP
REVISION DATE:	9/27/2017

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

SM-A10
SHEET



PART # TABLE		
P/N	DESCRIPTION	LENGTH
320132M	SM RAIL 132" MILL	132"
310132C	SM RAIL 132" CLR	132"
320168M	SM RAIL 168" MILL	168"
310168C	SM RAIL 168" CLR	168"
320168D	SM RAIL 168" DRK	168"
320208M	SM RAIL 208" MILL	208"
310208C	SM RAIL 208" CLR	208"
320240M	SM RAIL 240" MILL	240"
310240C	SM RAIL 240" CLR	240"
310240D	SM RAIL 240" DRK	240"

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1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
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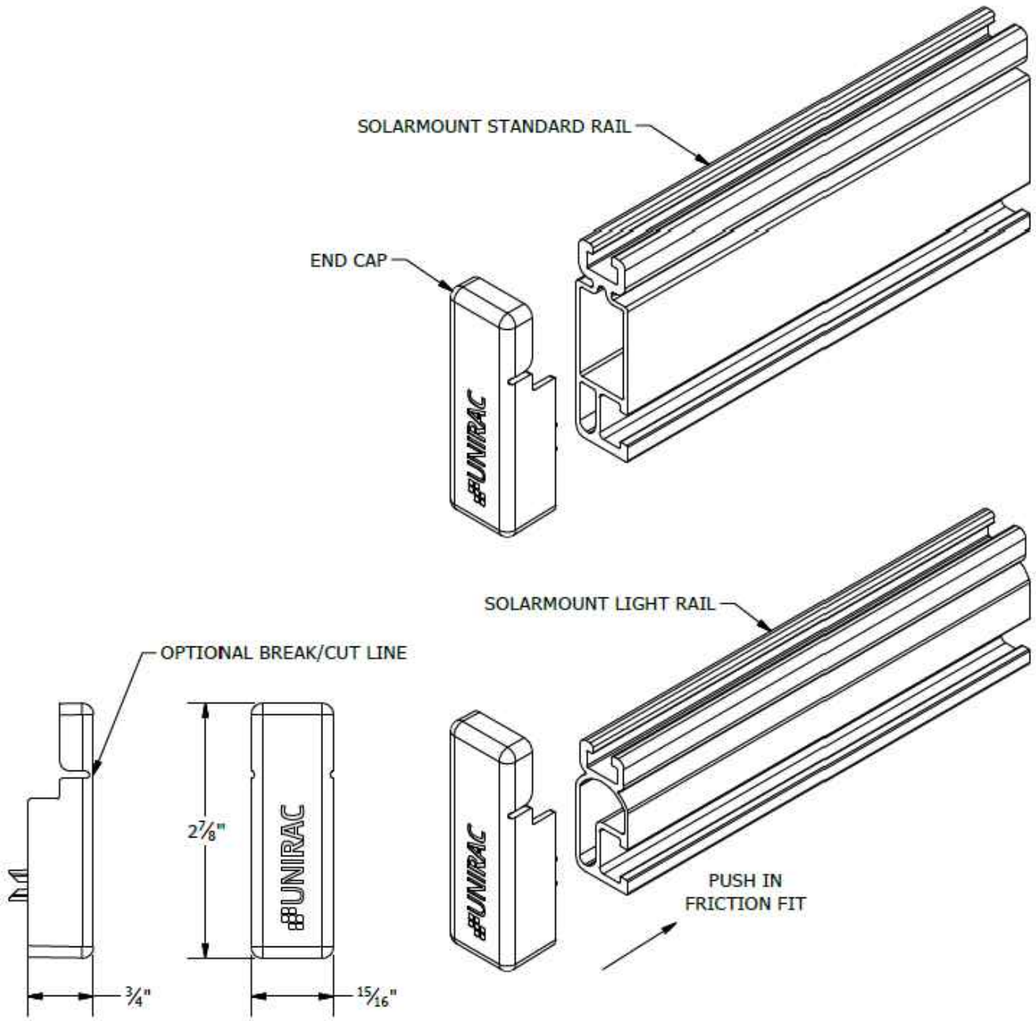
PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	STANDARD RAIL
REVISION DATE:	9/11/2017

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

SM-P01
SHEET

NOTES:
1. END CAP INCLUDED WITH EVERY END CLAMP.
2. END CAP FITS SOLARMOUNT LIGHT AND STANDARD RAIL PROFILES.



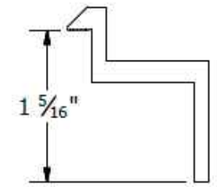
UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	END CAPS
REVISION DATE:	9/27/2017

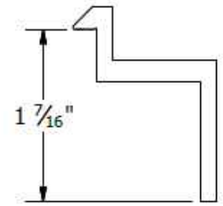
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

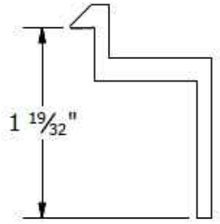
SM-P04
SHEET



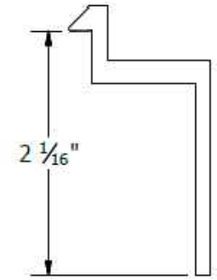
B CLAMP
30mm to 32mm Module Thickness
(1.18" to 1.26")



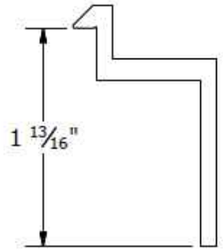
C CLAMP
33mm to 36mm Module Thickness
(1.30" to 1.42")



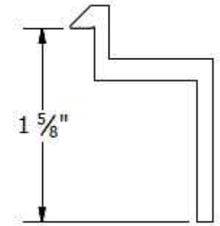
D CLAMP
38mm to 40mm Module Thickness
(1.50" to 1.57")



E CLAMP
50mm to 51mm Module Thickness
(1.97" to 2.00")

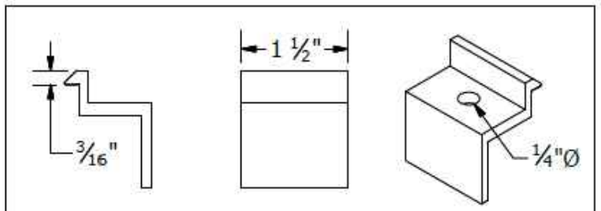


F CLAMP
45mm to 47mm Module Thickness
(1.77" to 1.85")



K CLAMP
39mm to 41mm Module Thickness
(1.54" to 1.61")

PART # TABLE	
P/N	DESCRIPTION
302021C	SM ENDCLAMP B CLR AL
302021D	SM ENDCLAMP B DRK AL
302022C	SM ENDCLAMP C CLR AL
302022D	SM ENDCLAMP C DRK AL
302023C	SM ENDCLAMP D CLR AL
302023D	SM ENDCLAMP D DRK AL
303024C	SM ENDCLAMP E CLR AL
302024D	SM ENDCLAMP E DRK AL
302025C	SM ENDCLAMP F CLR AL
302025D	SM ENDCLAMP F DRK AL
302026C	SM ENDCLAMP K CLR AL
302026D	SM ENDCLAMP K DRK AL



TYPICAL END CLAMP DETAILS

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	SOLARMOUNT
DRAWING TYPE:	PART DETAIL
DESCRIPTION:	END CLAMPS - TOP MOUNTING
REVISION DATE:	9/27/2017

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

SM-P05
SHEET

Table 310.15(B)(2)(a) Ambient Temperature Correction Factors Based on 30°C (86°F)

For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor			Ambient Temperature (°F)
	60°C	75°C	90°C	
10 or less	1.29	1.20	1.15	50 or less
11–15	1.22	1.15	1.12	51–59
16–20	1.15	1.11	1.08	60–68
21–25	1.08	1.05	1.04	69–77
26–30	1.00	1.00	1.00	78–86
31–35	0.91	0.94	0.96	87–95
36–40	0.82	0.88	0.91	96–104
41–45	0.71	0.82	0.87	105–113
46–50	0.58	0.75	0.82	114–122
51–55	0.41	0.67	0.76	123–131
56–60	—	0.58	0.71	132–140
61–65	—	0.47	0.65	141–149
66–70	—	0.33	0.58	150–158
71–75	—	—	0.50	159–167
76–80	—	—	0.41	168–176
81–85	—	—	0.29	177–185

Table B.310.15(B)(2)(11) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable with Load Diversity

Number of Conductors*	Percent of Values in Tables as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–24	70**
25–42	60**
43–85	50**

*Number of conductors is the total number of conductors in the raceway or cable adjusted in accordance with 310.15(B)(4) and (5).
**These factors include the effects of a load diversity of 50 percent.