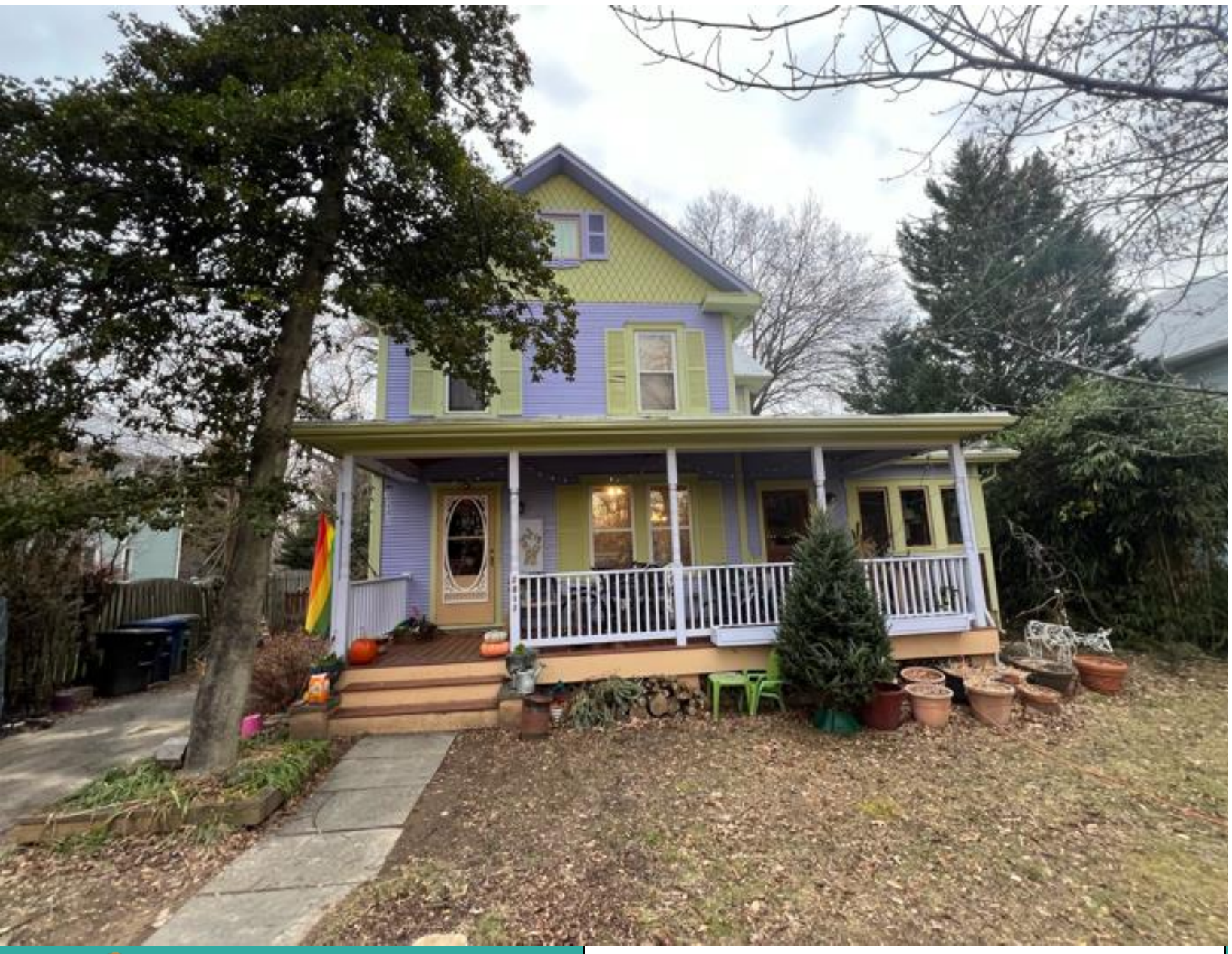
Historical Affairs and Landmark Review Board

Arlington County, Virginia

HALRB Meeting March 20, 2024, CoA 24-07

3511 22nd St. N.: Request to install multiple solar panels on main and secondary slopes of the roof.



SOLAR SME

SUBJECT MATTER EXPERT

DECEMBER 27, 2023

MERRICK HOBEN AND DIANA BERMUDEZ

SOLAR SITE INSPECTION REPORT

General Information

Location Details:

BUILDING ADDRESS	**3511 22nd Street North**
CITY/TOWN	**Arlington**
STATE	**VA**
ZIP CODE	**22207**

Proposed System Details:

System Size	**9.13 KW (DC)**
Inverter Make and Model	**Hoymiles Micro inverters x (6)**
PV Panels	**Seraphim Panels x (22)**
Panel Model	**SRP-BMD-BG-415 Black**

ROOF MOUNT INSTALLATION OF 9.20-KWp SOLAR SYSTEM

PROJECT ADDRESS	3511, 22ND STREET NORTH ARLINGTON, VA 22207	
OWNER	**MERRICK HOBEN AND DIANA BERMUDEZ**	
SCOPE OF WORK	SYSTEM SIZE	9.20 KWp
	23 X LUXEN 400W	**LUXEN SOLAR LNVB-400M**
	06 X HOYMILES	**HM-1500NT**
ELECTRICAL EQUIPMENTS	MSP BUSBAR RATING	200A
	MSP BREAKER RATING	200A
BUILDING INFORMATION	ZONING	RESIDENTIAL
	CONSTRUCTION TYPE	TWO STORY BUILDING
	ROOF TYPE	METAL
	UTILITY METER	DOMINION
	RAFTER SIZE	2" X 4" @ 24"
RACKING INFORMATION	S-5 SOLAR FOOT , S-5 S CLAMP , XR-100	
AHJ	ARLINGTON COUNTY	
PARCEL #	05051069	
LOT AREA	6500 SQFT	
LIVING AREA	1,342 SQFT	
PROJECT MANAGER	EROL SHAMS	
CONTACT DETAILS	984-263-3006	

CODE REFERENCES

NATIONAL ELECTRIC CODE (NEC), 2017

INTERNATIONAL RESIDENTIAL CODE (IRC), 2018

INTERNATIONAL BUILDING CODE (IBC), 2018

GENERAL NOTES

1. ALL PV MODULES & WIRING SHALL BE PROTECTED FROM ANY PHYSICAL DAMAGE.
2. ALL METALLIC COMPONENTS MUST BE GROUNDED FOR SAFETY PURPOSES.
3. ALL EQUIPMENTS MUST MEET SETBACKS REQUIREMENTS AS REQUIRED BY NEC.
4. ALL OCPDS RATINGS & TYPES SPECIFY ACCORDING TO NEC.
5. LOAD SIDE INTERCONNECTION & SUPPLY SIDE TAP INTERCONNECTION ACCORDING TO NEC.
6. PV SYSTEM CIRCUIT INSTALLED IN BUILDING MUST INCLUDE A RAPID SHUTDOWN FUNCTION TO REDUCE SHOCK HAZARDS .
7. EQUIPMENT GROUNDING CONDUCTOR ON AC & DC SIDE SIZED ACCORDING TO NEC.

SYSTEM SUMMARY

INVERTER	HOYMILES	PV MODULES	LUXEN
MAX AC OUTPUT CURRENT PER MICROINVERTER	5.99A	PANELS WATTAGE	400 W
SYSTEM AC SIZE	8.62KW	MAX AC CURRENT	35.94A

PANELS PER BRANCH	BRANCH-A	BRANCH-B
	12	11
MAX CURRENT	17.97A	16.47A
MAX AC OUTPUT POWER	4,312W	3,953W

UNIT INDEX

MSP	MAIN SERVICE PANEL	IN	INVERTER
UM	UTILITY METER	PV	PV LOAD CENTER
PM	PRODUCTION METER	DB	DISTRIBUTION BOX
ACD	AC DISCONNECT	IQ	IQ COMBINER BOX
JB	JUNCTION BOX	SSP	SERVICE SUB PANEL
RSC	RAPID SHUTDOWN CONT	RSB	RAPID SHUTDOWN BOX

PV MODULE

MICROINVERTER

SETBACK

SATELLITE VIEW

VICINITY MAP

SHEET INDEX

SHEET NUMBER	SHEET TITLE
T-001	COVER PAGE
A-101	SITE PLAN
A-102	ELECTRCIAL PLAN
A-103	SOLAR ATTACHMENT PLAN
E-601	LINE DIAGRAM
E-602	DESIGN TABLE
E-603	PLACARDS
S-501	ASSEMBLY DETAILS
S-502	ASSEMBLY DETAILS-2
R-002	RESOURCE DOCUMENT

SolarSME
Subject Matter Expert

CONTRACTOR

SOLAR SME,INC

PHONE: 832 - 626 - 2337

ADDRESS:
2630 AERO DR GRAND PRAIRIE, TX 75052

LIC.NO:
HIC.NO:
ELE.NO:

(N) PV SYSTEM: 9.20 KW_P

MERRICK HOBEN AND DIANA BERMUDEZ

3511, 22ND STREET, NORTH ARLINGTON, VA 22207

ENGINEER OF DESIGN

NABCEP CERTIFIED

PV Installation Professional

MUHAMMAD ARSHAD
PV-050220-029071

DocuSigned by:
Muhammad Arshad
739E883FB5DC491...

PAGE SIZE : 17" X 11" (ANSI B)

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T-001
SHEET-1

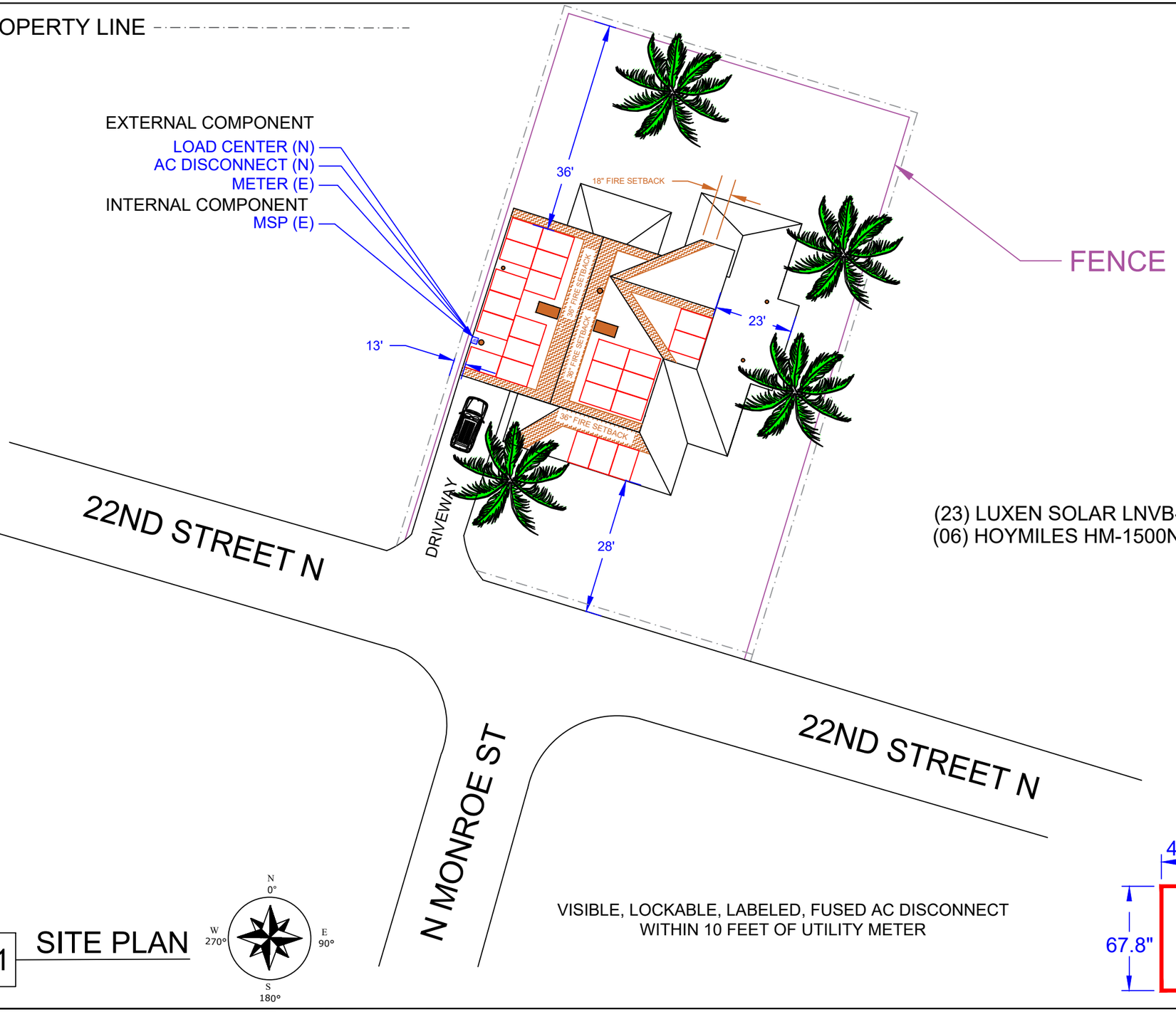
PROPERTY LINE

EXTERNAL COMPONENT

LOAD CENTER (N)
AC DISCONNECT (N)
METER (E)

INTERNAL COMPONENT

MSP (E)



(23) LUXEN SOLAR LNVB-400M
(06) HOYMILES HM-1500NT [240V]

VISIBLE, LOCKABLE, LABELED, FUSED AC DISCONNECT
WITHIN 10 FEET OF UTILITY METER

01 SITE PLAN

MODULE:
LUXEN SOLAR
LNVB-400M

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Subject Matter Expert

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ENGINEER OF DESIGN

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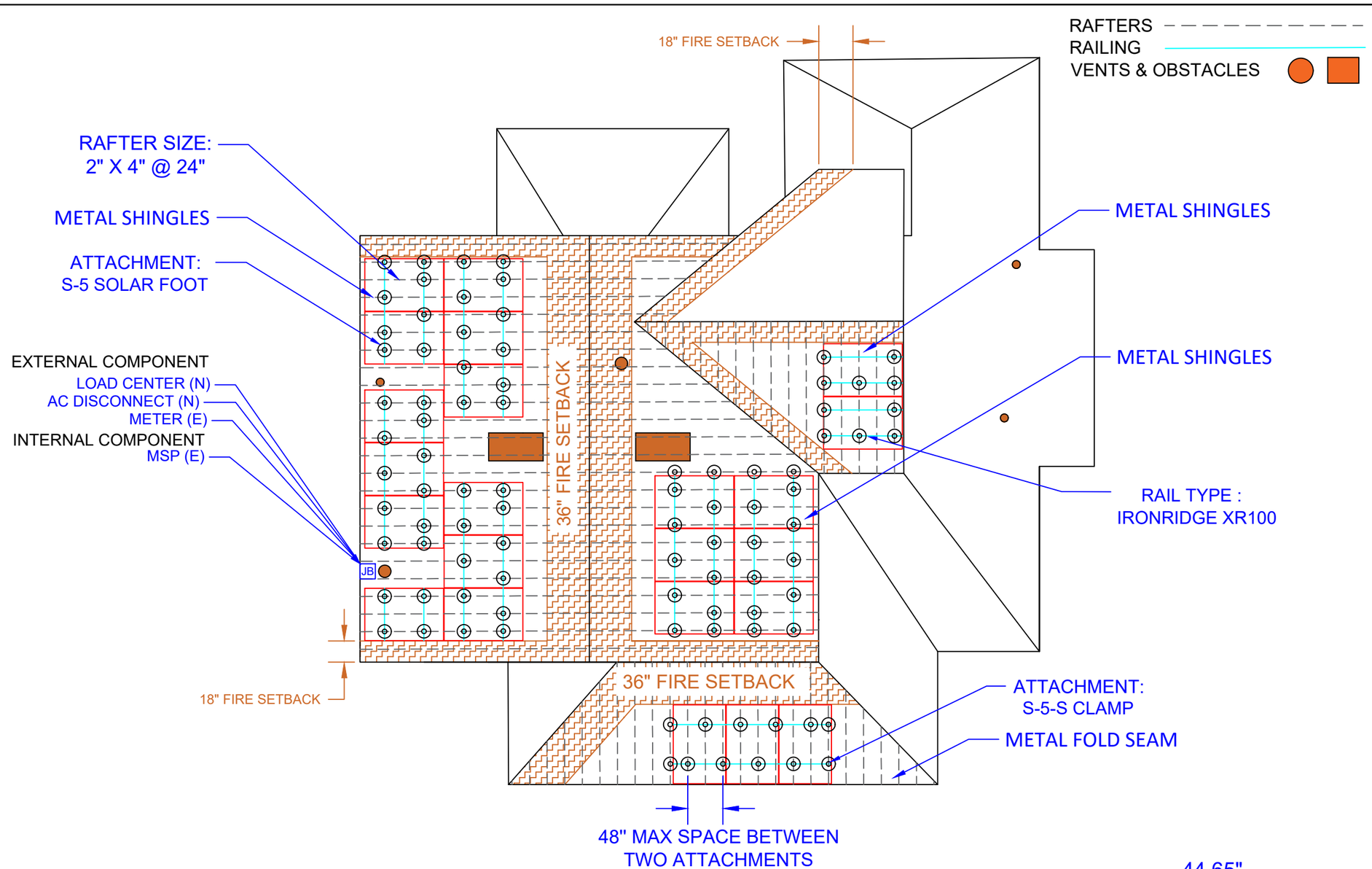
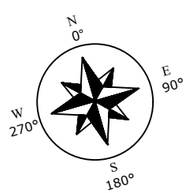
CHECKED BY: M.A

A-101
SHEET-2



01 SOLAR ATTACHMENT PLAN

0.16" = 1'-0"



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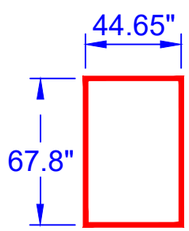

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SOLAR ATTACHMENT PLAN

DATE: 01-11-2024
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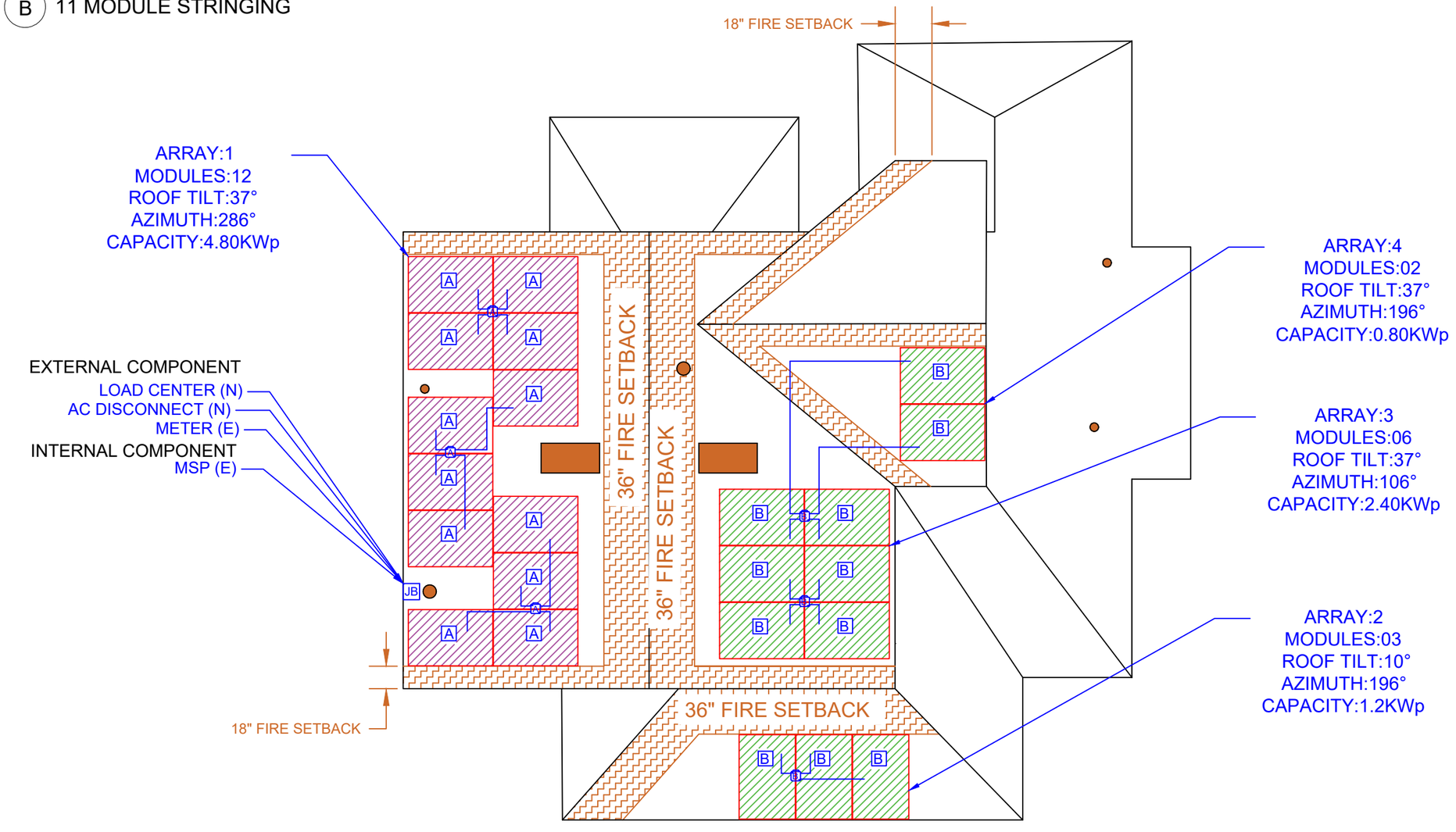
A-103
SHEET-4

A 12 MODULE STRINGING

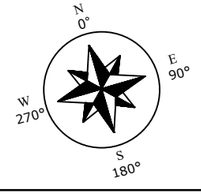
B 11 MODULE STRINGING

VENTS & OBSTACLES



01 ELECTRICAL PLAN

0.16" = 1'-0"



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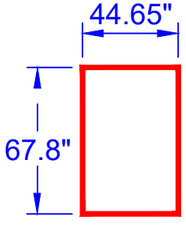

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ELECTRICAL PLAN

DATE: 01-11-2024
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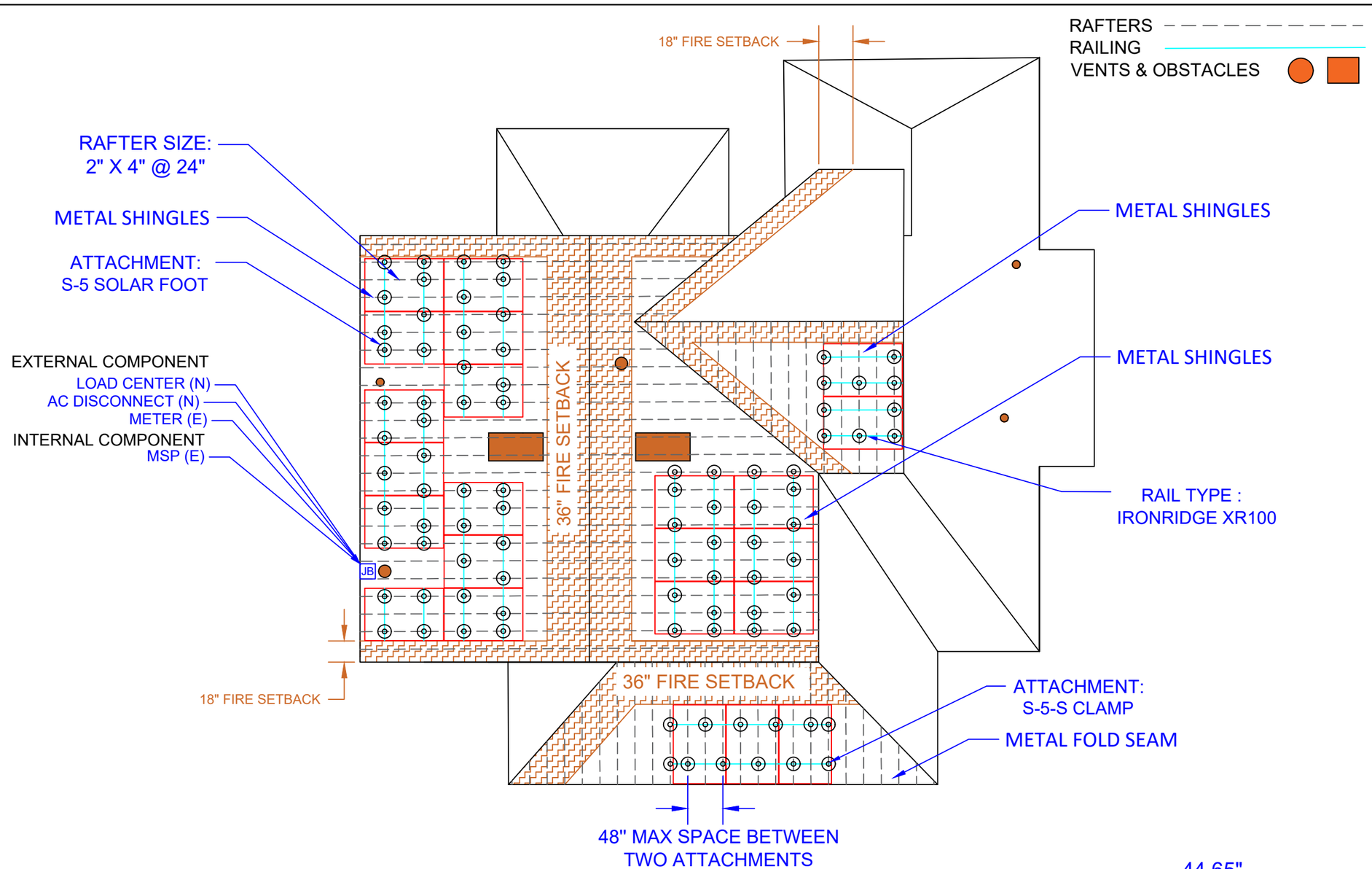
A-102
SHEET-3



01 SOLAR ATTACHMENT PLAN

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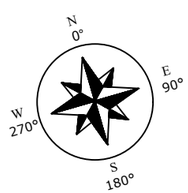

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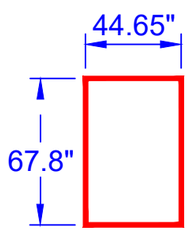

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SOLAR ATTACHMENT PLAN

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A-103
SHEET-4

CONDUCTOR & CONDUIT SCHEDULE W/ELECTRICAL CALCULATIONS

ID	CONDUCTOR	CONDUIT (EMT/FMT/PVC/RMC)	CURRENT CARRYING CONDUCTORS IN CONDUIT + EGC	OCPD	EGC	CONT. CURRENT	MAX CURRENT (125%)	Term.Temp Rating	AMP.@ TERMINAL
01	10AWG AC TRUNK CABLE	3/4" DIA	4 + 1	N/A	06AWG THWN-2,COPPER	17.97A	22.46A	75°C	35A
02	10AWG THWN-2,COPPER	3/4" DIA	4 + 1	30A	10AWG THWN-2,COPPER	17.97A	22.46A	75°C	35A
03	06AWG THWN-2,COPPER	3/4" DIA	3 + 1	50A	10AWG THWN-2,COPPER	35.94A	44.92A	75°C	65A

NOTE:

1. PV SYSTEM EQUIPPED WITH RAPID. SHUTDOWN DISCONNECT AS PER NEC 690.12
2. PRESSURE CONNECTORS AND DEVICES FOR SPLICES AND TAPS INSTALLED ON SERVICE CONDUCTORS SHALL BE MARKED "SUITABLE FOR USE ON THE LINE SIDE OF THE SERVICE EQUIPMENT" OR EQUIVALENT. NEC 230.46

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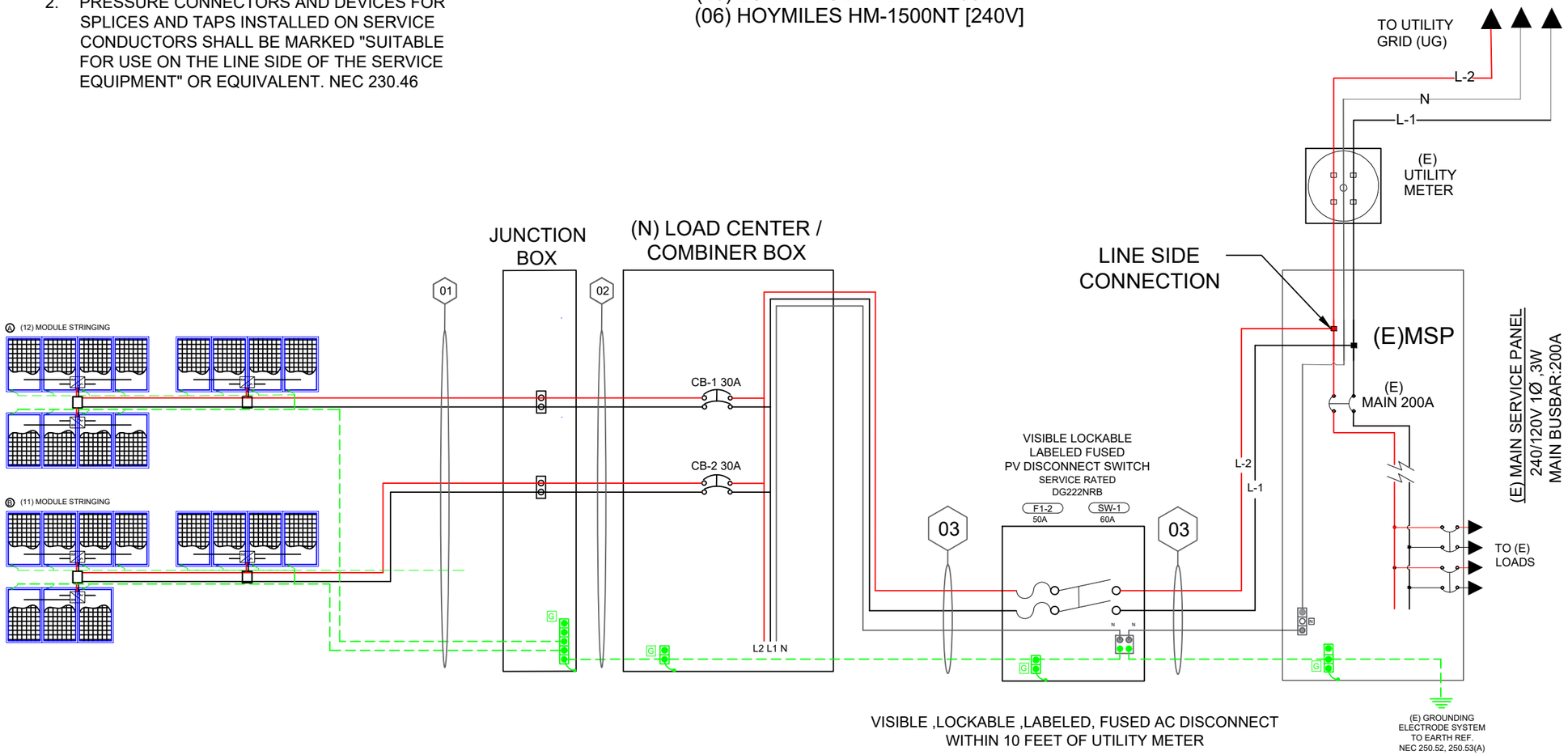

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PV-050220-029071

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3-LINE DIAGRAM

DATE: 01-11-2024
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E-601
SHEET-5

Design Table

a. PV MODULES b. INVERTER
c. DISCONNECT d. OCPDS

PV MODULES

QTY.	MAKE AND MODEL	PMAX	ISC	IMP	VOC	VMP	TEMP.COEFF. OF VOC	FUSE RATING
23	LUXEN SOLAR LNVB-400M	400W	13.63A	12.74A	37.49V	31.40V	-0.28%/°C	25A

MICROINVERTER

QTY.	MAKE AND MODEL	AC VOLTAGE	OCPD RATING	MAX OUTPUT POWER	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX INPUT VOLTAGE	CEC WEIGHTED EFFICIENCY
6	HOYMILES HM-1500NT	240V	30A	1438VA	5.99A	4 x 11.5A	60V	96.5%

DISCONNECTS

REF.	QTY.	MAKE AND MODEL	RATED CURRENT	MAX RATED VOLTAGE
SW1	1	EATON/SQUARE-D OR EQUIV	60A	240VAC
ASHRAE LOW		-12°C WASHINGTON DC REAGAN AP 38.89° , -77.10°		
ASHRAE HIGH 2%		34°C WASHINGTON DC REAGAN AP 38.89° , -77.10°		

OCPDS

REF.	QTY.	RATED CURRENT	MAX VOLTAGE
CB1-2	2	30A	240VAC
F1-2	2	50A	240VAC

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PV-050220-029071

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DESIGN TABLE

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E-602
SHEET-6

COMBINER BOX

WARNING
TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL
NEC 110.27(C) & OSHA 1910.55(f)(7)

WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
NEC 706.15(C)(4) & NEC 690.13(B)

PRODUCTION METER

WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
NEC 705.10(C) & NEC 690.59

Inverter / PV Load

WARNING
THE DISCONNECTION OF THE GROUNDING CONDUCTOR(S) MAY RESULT IN OVERVOLTAGE ON THE EQUIPMENT
NEC 690.31(E)

PHOTOVOLTAIC AC DISCONNECT

RATED AC OUTPUT CURRENT:	35.94A
NOMINAL OPERATING AC VOLTAGE:	240 Vac

NEC 690.54

PHOTOVOLTAIC
DC DISCONNECT
NEC 690.13(B)

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT
NEC 690.56(C)(1)

DC Disconnect

WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

RATED AC OPERATING CURRENT:	N/A
MAX RATED AC OPERATING CURRENT:	N/A
RATED AC OPERATING VOLTAGE:	N/A
MAX RATED AC OPERATING VOLTAGE:	N/A
RATED SHORT CIRCUIT CURRENT:	13.36A
MAXIMUM SYSTEM VOLTAGE:	41.37V

NEC 690.20

PHOTOVOLTAIC
DC DISCONNECT
NEC 690.13(B)

PHOTOVOLTAIC
OFF PV SYSTEM

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT
NEC 690.56(C)(1)

RAPID SHUT DOWN FOR SOLAR PV SYSTEM
596-01003 NEC 690.56(C)(1)

AC Disconnect

WARNING
THIS EQUIPMENT FED BY MULTIPLE SOURCES: TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN POWER SUPPLY SHALL NOT EXCEED AMPACITY OF BUSBAR
NEC 705.12(B)(3)(3)

WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
NEC 706.15(C)(4) & NEC 690.13(B)

PHOTOVOLTAIC AC DISCONNECT

RATED AC OUTPUT CURRENT:	35.94A
NOMINAL OPERATING AC VOLTAGE:	240 Vac

NEC 690.54

RAPID SHUT DOWN FOR SOLAR PV SYSTEM
596-01003 NEC 690.56(C)(1)

BREAKER PANEL, MAIN SERVICE DISCONNECT, UTILITY METER

WARNING
ELECTRICAL SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
NEC 706.15(C)(4) & NEC 690.13(B)

WARNING
POWER SOURCE OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE
NEC 705.12 (B)(3)(2)(c)

WARNING
SINGLE 120-VOLT SUPPLY
DO NOT CONNECT MULTIWIRE BRANCH CIRCUIT
NEC 710.15(C) & 692.9 (C)

CAUTION
MULTIPLE SOURCES OF POWER
PV GENERATION AC DISCONNECT FOR UTILITY OPERATION LOCATED ON THE N CORNER OF THE BUILDING
NEC 690.56(B)

WARNING
TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL
NEC 110.27(C) & OSHA 1910.55(f)(7)

DO NOT DISCONNECT UNDER LOAD
NEC 690.15 (B) & NEC 690.33(D)(2)

RAPID SHUT DOWN FOR SOLAR PV SYSTEM
NEC 690.56(C)(2)

MAIN PHOTOVOLTAIC SYSTEM AC DISCONNECT
NEC 690.13(B)

BATTERY
LABEL LOCATION: BATTERY

CAUTION
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED
NEC 705.12(D)(3)(4) & NEC 690.59

CAUTION
MULTIPLE SOURCES OF POWER
NEC 690.56(B) & NEC 705.10

WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
NEC 705.10(C) & NEC 690.59

PHOTOVOLTAIC AC DISCONNECT

RATED AC OUTPUT CURRENT:	35.94A
NOMINAL OPERATING AC VOLTAGE:	240 Vac

NEC 690.54

EMT/ CONDUIT RACEWAYS

PHOTOVOLTAIC POWER SOURCE
NEC 690.31(O)(2)

SOLAR PV DC CIRCUIT
NEC 690.31(D)(2)

NEC 690.13(B) Each PV system disconnecting means shall plainly indicate whether in the open (off) or closed (on) position and be permanently marked "PV SYSTEM DISCONNECT" or equivalent. Additional markings shall be permitted based upon the specific system configuration. For PV system disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent: "Terminals on the line and load sides may be energized in the open position."

NEC 690.15(B) An isolating device shall be rated to open the maximum circuit current under load or be marked "Do Not Disconnect Under Load" or "Not for Current Interrupting."

NEC 690.31(B)(1) PV system circuit conductors shall be identified at all termination, connection, and splice points by color coding, marking tape, tagging, or other approved means. Conductors relying on other than color coding for polarity identification shall be identified by an approved permanent marking means such as labeling, sleeving or

NEC 690.31(D)(2) Unless located and arranged so the purpose is evident, the following wiring methods and enclosures that contain PV system dc circuit conductors shall be marked with the wording PHOTOVOLTAIC POWER SOURCE or SOLAR PV DC CIRCUIT by means of permanently affixed labels or other approved permanent marking: (1) Exposed raceways, cable trays, and other wiring methods (2) Covers or enclosures of pull boxes and junction boxes (3) Conduit bodies in which any of the available conduit openings are unused.
The labels or markings shall be visible after installation. All letters shall be capitalized and shall be a minimum height of 9.5 mm (3⁄8 in.) in white on a red background. Labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10ft). Labels required by this section shall be suitable for the environment where they are installed.

NEC 690.31(E) Solidly grounded bipolar PV systems shall be clearly marked with a permanent, legible warning notice indicating that the disconnection of the grounded conductor(s) may result in overvoltage on the equipment.

NEC 690.33(D)(2) Interruption of Circuit. Connectors shall be a type that requires the use of a tool to open and marked "Do Not Disconnect Under Load" or "Not for Current Interrupting.

NEC 690.52 Alternating-current modules shall be marked with identification of terminals or leads and with identification of the following ratings.

NEC 690.20 A permanent readily visible label indicating the highest maximum dc voltage in a PV system, calculated in accordance with 690.7, shall be provided by the installer at one of the following locations: (1) Dc PV system disconnecting means (2) PV system electronic power conversion equipment (3) Distribution equipment associated with the PV system.

NEC 690.54 All interactive system(s) points of interconnection with other sources shall be marked as an accessible location at the disconnecting means as a power source and with the rated ac output current and the nominal operating ac voltage.

NEC 690.55 The PV system output circuit conductors shall be marked to indicate polarity where connected to energy storage systems.

NEC 692.56 A fuel cell system that stores electrical energy shall require the following warning sign, or equivalent, at the location of the service disconnecting means of the premises:
WARNING FUEL CELL POWER SYSTEM CONTAINS ELECTRICAL ENERGY STORAGE DEVICES.

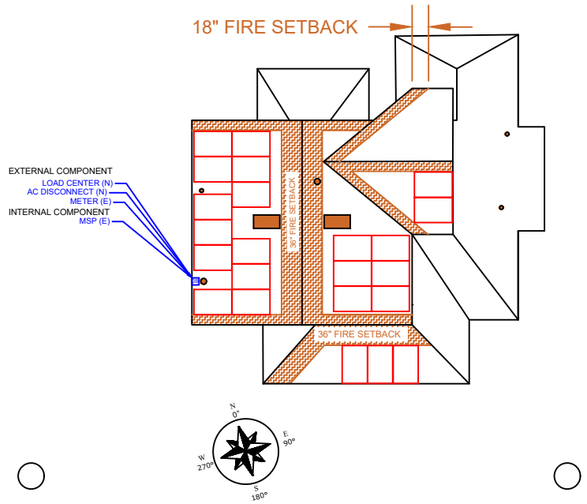
NEC 690.56(B) Plaques or directories shall be installed in accordance with 705.10 and 712.10.

NEC 690.56(C) The type of PV system is shown in figure 690.56 (C).

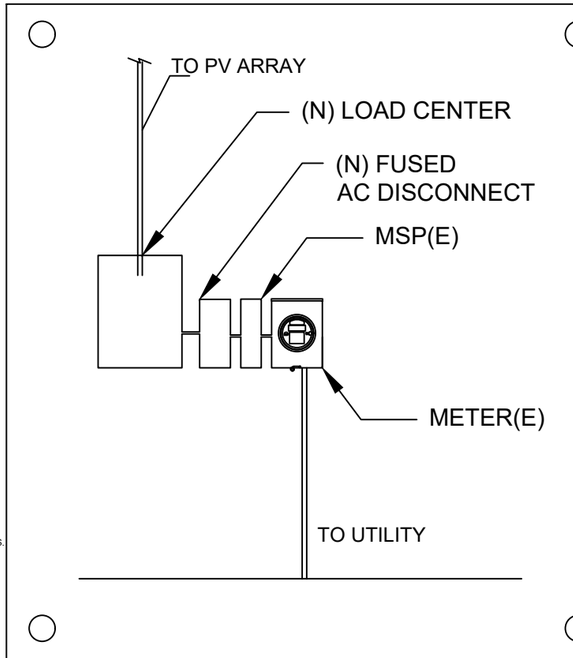
NEC 690.56(C)(2) A rapid shutdown initiation device shall have a label located on or no more than 1 m (3 ft) from the initiation device that includes the following wording: RAPID SHUTDOWN FOR SOLAR PV SYSTEM The label shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3⁄8 in.), in white on red background.

!CAUTION!

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



EQUIPMENT ELEVATION PLAN



SolarSME
Subject Matter Expert

CONTRACTOR

SOLAR SME,INC

PHONE: 832 - 626 - 2337

ADDRESS:
2630 AERO DR GRAND PRAIRIE, TX 75052

LIC.NO:
HIC.NO:
ELE.NO:

(N) PV SYSTEM: 9.20 KW_P

MERRICK HOBEN AND DIANA BERMUDEZ

3511, 22ND STREET, NORTH ARLINGTON, VA 22207

ENGINEER OF DESIGN

NABCEP CERTIFIED
PV Installation Professional
MUHAMMAD ARSHAD
PV-050220-029071

DocuSigned by:
Muhammad Arshad
739E883FB5DC491...

PAGE SIZE : 17" X 11" (ANSI B)

PLACARDS

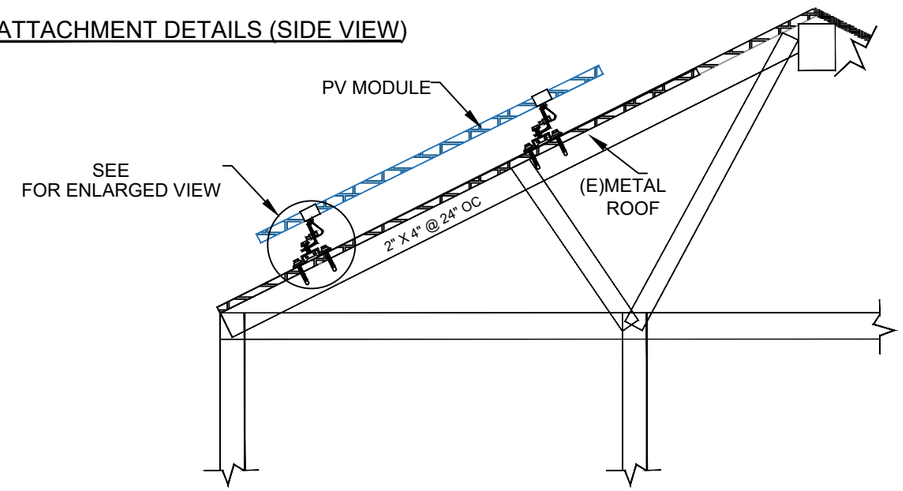
DATE: 01-11-2024
DESIGN BY: H.A
CHECKED BY: M.A

E-603
SHEET-7

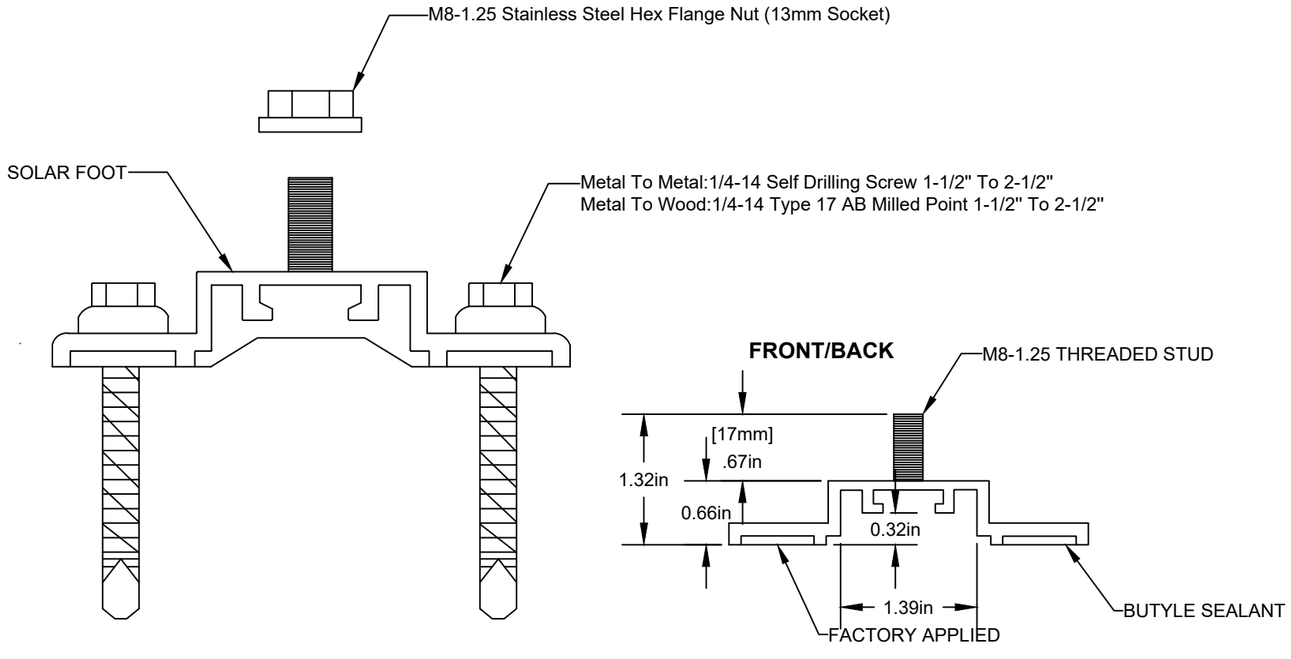
ROOF DETAILS

ROOFING LAYER	1 LAYER
ROOFING TYPE	METAL SHINGLE
RACKING TYPE	IRONRIDGE XR100
ATTACHMENT TYPE	S-5 SOLARFOOT
RAFTER SIZE	2" X 4" @ 24" O.C

1 PV 2.0 ATTACHMENT DETAILS (SIDE VIEW)



2 PV 2.0 ATTACHMENT DETAILS (ENLARGE VIEW)



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Subject Matter Expert

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LIC.NO:
HIC.NO:
ELE.NO:

(N) PV SYSTEM: 9.20 KW_P

MERRICK HOBEN AND DIANA BERMUDEZ

3511, 22ND STREET, NORTH ARLINGTON, VA 22207

ENGINEER OF DESIGN

PAGE SIZE : 17" X 11" (ANSI B)

ASSEMBLY DETAILS

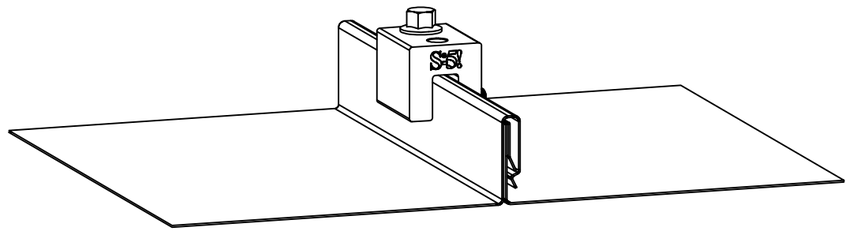
DATE: 01-11-2024
DESIGN BY: H.A
CHECKED BY: M.A

S-501
SHEET-8

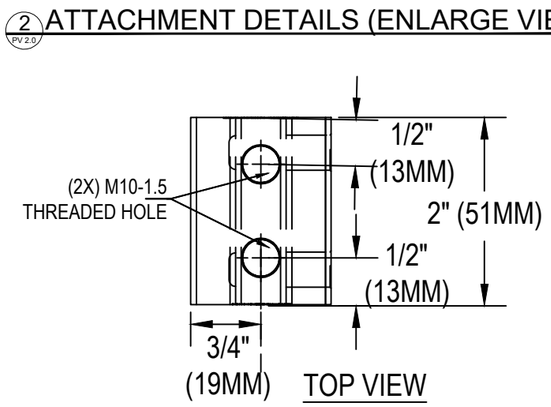
ROOF DETAILS

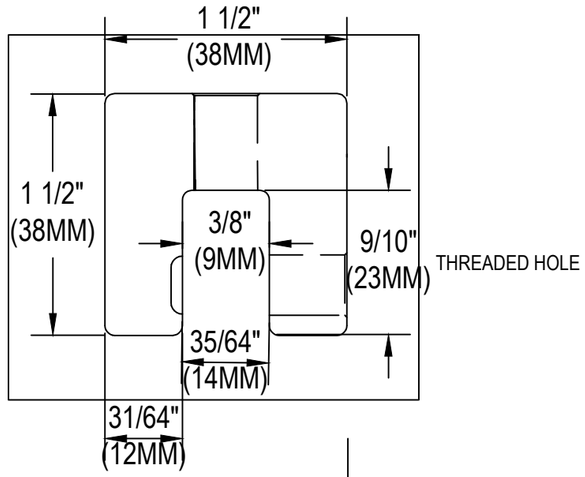
ROOFING LAYER	1 LAYER
ROOFING TYPE	METAL FOLD
RACKING TYPE	IRONRIDGE XR100
ATTACHMENT TYPE	S-5 S CLAMP
RAFTER SIZE	2" X 4" @ 24" O.C

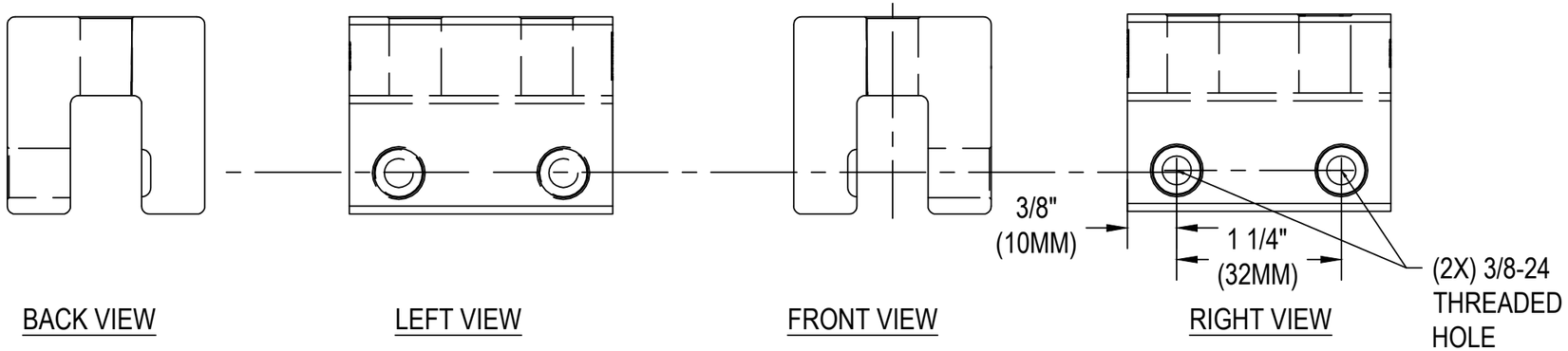
1 PV 2.0 ATTACHMENT DETAILS (SIDE VIEW)



2 PV 2.0 ATTACHMENT DETAILS (ENLARGE VIEW)







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MERRICK HOBEN AND DIANA BERMUDEZ

3511, 22ND STREET, NORTH ARLINGTON, VA 22207

ENGINEER OF DESIGN

PAGE SIZE : 17" X 11" (ANSI B)

ASSEMBLY DETAILS-2

DATE: 01-11-2024
DESIGN BY: H.A
CHECKED BY: M.A

S-502
SHEET-9

Figure 5: It is better to trim the tree, to get max. production.

Main Service Panel:

Figure 7: This is a Main Service Panel (MSP). MSP is mounted inside the house.

Main breaker rating is 200 Amps each.

Utility Meter:

Figure 8 & 9: Meter is mounted on left side of the house. We will be able to place disconnect and load center near this one.


AC
Disconnect
here

Rafters:

Figure 10: Spacing between 2 Rafters is 24” inch on center.

Figure 11: Width of rafter is 1 ½” inch

Figure 12: Height of rafter is 1 1/2” inch

Overall, the rafters are in good condition.

LUXEN SOLAR

Quality Maker

LUXPOWER® SERIES 5

390-410W Mono

M10/182mm Cell . 108 Half-Cell Layout

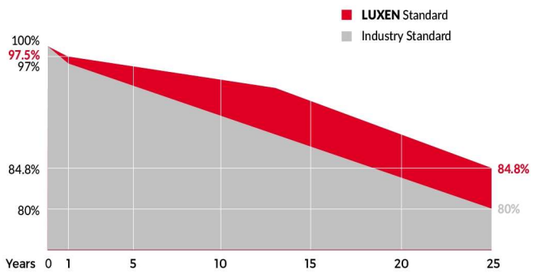
LUXPOWER® Series 5 solar modules stand out with the breakthrough innovation of M10 size (182mm) solar cells for the highest power generation and the lowest LCOE, which makes Series 5 the optimal choice for large solar power plants.
The gallium-doped wafer technology empowers significantly the performance against LID and the latest integrated segmented ribbon technology increases the power output and enhances the module reliability for long-term use.

30 years POWER WARRANTY

25 years PRODUCT WARRANTY

- Gallium-doped Technology
- Half Cut Cell Technology
- MBB Technology
- Anti-PID Low LID Performance
- Less Hot Spot Shading Effects
- Lower BOS & LCOE

Linear performance Warranty



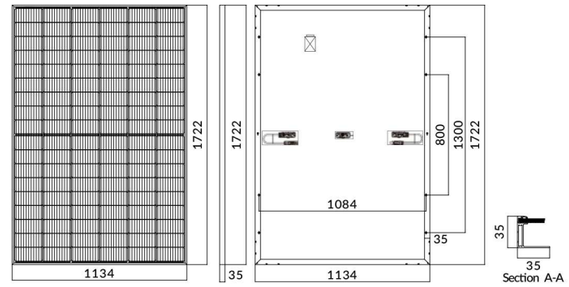
Comprehensive Certificates

- ISO9001:2015 QMS
- ISO14001:2015 EMS
- ISO45001:2018 OHSMS
- IEC61215/IEC61730 Standard quality

LUXEN SOLAR ENERGY CO., LTD.
Suzhou: A301,Zhongyi Building,Suzhou,Jiangsu,215168,China
Nantong: No.1,Haiyue Road,Nantong,Jiangsu,226000,China
T: +86 199 7499 5944 sales@luxensolar.com

MECHANICAL CHARACTERISTICS

Solar Cells		Mono
No. of Cells		108 (6x18)
Dimensions		1722 x 1134 x 35mm
Weight		21.0kgs
Front Glass		3.2mm coated tempered glass
Frame		Anodized aluminium alloy
Junction Box		Ip68 rated (3 by pass diodes)
Output Cables	4.0mm²	
	300mm (+) / 400mm (-)	
	Length can be customized	
Connectors		Mc4 compatible
Mechanical load test		5400Pa



ELECTRICAL PARAMETERS

POWER CLASS	LNVB-390M		LNVB-395M		LNVB-400M		LNVB-405M		LNVB-410M	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum power (Pmax)	390W	294W	395W	298W	400W	302W	405W	306W	410W	310W
Open Circuit Voltage (Voc)	36.99V	34.97V	37.24V	35.25V	37.49V	35.54V	37.74V	35.82V	37.98V	36.10V
Short Circuit Current (Isc)	13.49A	10.81A	13.56A	10.85A	13.63A	10.89A	13.70A	10.93A	13.77A	10.97A
Voltage at Maximum power (Vmpp)	30.95V	28.85V	31.18V	29.13V	31.40V	29.41V	31.62V	29.68V	31.83V	29.95V
Current Maximum Power (Impp)	12.60A	10.19A	12.67A	10.23A	12.74A	10.27A	12.81A	10.31A	12.88A	10.35A
MODULE EFFICIENCY (%)	19.97%		20.23%		20.48%		20.74%		21.00%	

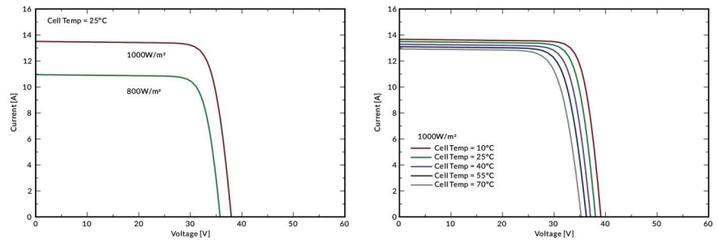
STC: Irradiance 1000W/m², cell temperature 25°C, AM1.5G **NOCT:** Irradiance 800W/m², ambient temperature 20°C, wind speed 1m/s, AM1.5G

PACKING CONFIGURATION

Container	20'GP	40'HQ
Pieces per pallet	31	31
Pallets per container	6	26
Pieces per container	186	806

I-V CURVE

LNVB-405M/I-V



OPERATING CHARACTERISTICS

Operating Module Temperature	-40°C to +85°C
Maximun System Voltage	1500 DC (IEC)
Maximun Series Fuse Rating	25A
Power Tolerance	0/+5W

TEMPERATURE CHARACTERISTICS

Nominal Operating Temperature (Noct)	45±2°C
Temperature Coefficient of Pmax	-0.36%°C
Temperature Coefficient of Voc	-0.28%°C
Temperature Coefficient of Isc	+0.05%°C

Note: Due to continuous technical innovation, R&D and improvement ,technical data above mentioned may be of modification accordingly. LUXEN SOLAR have the sole right to make such modification at anytime without further notice.

LUXEN SOLAR

Microinverter Datasheet

HM-1200NT
HM-1500NT

Description

Hoymiles 4-in-1 microinverter is one of the most cost-effective module-level solar solutions, as it can support up to 4 panels at once and maximize the PV production of your installation. With a maximum DC voltage of 60 volts, Hoymiles microinverter is a PV Rapid Shutdown Equipment and conforms with NEC-2017 and NEC-2020 Article 690.12 and CEC-2021 Sec 64-218.

Both models listed are equipped with reactive power control and can meet the requirements of IEEE 1547, UL 1741 and CA Rule21.

Features

01 Easy installation, just plug and play

02 With Reactive Power Control, compliant with CA Rule 21

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

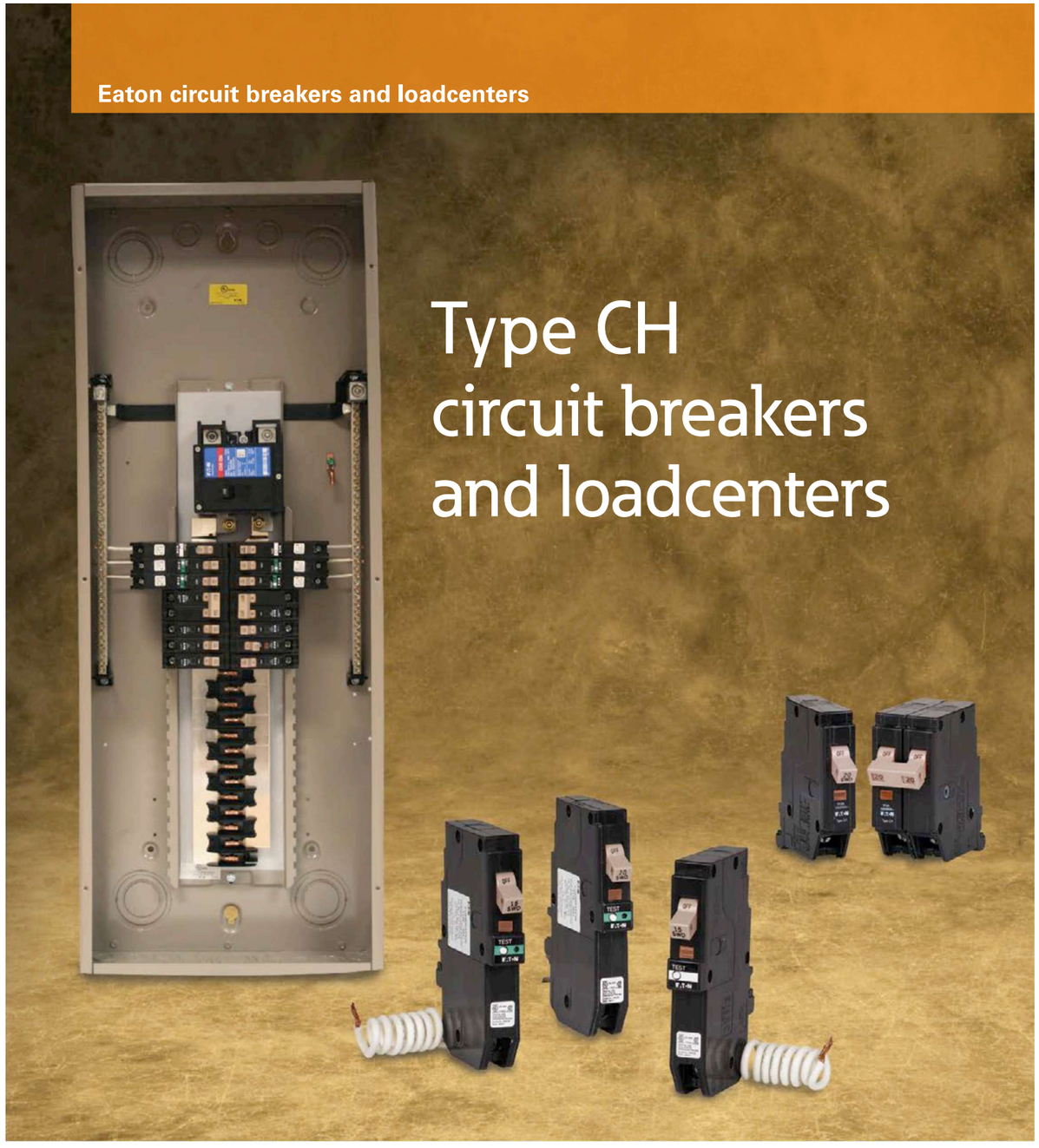
04 External antenna for stronger communication with DTU

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

Technical Specifications

Model	HM-1200NT		HM-1500NT	
Input Data (DC)				
Commonly used module power (W)	240 to 405+		300 to 505+	
Maximum input voltage (V)	60			
MPPT voltage range (V)	16-60			
Start-up voltage (V)	22			
Maximum input current (A)	4 × 11.5		4 × 11.5	
Maximum input short circuit current (A)	4 × 15			
Number of MPPTs	2			
Number of inputs per MPPT	2			
Output Data (AC)				
Peak output power (VA)	1260	1200	1500	1350
Maximum continuous output power (VA)	1200	1109	1438	1246
Maximum continuous output current (A)	5	5.33	5.99	5.99
Nominal output voltage/range (V)[1]	240/211-264	208/183-228	240/211-264	208/183-228
Nominal frequency/range (Hz)[1]	60/55-65			
Power factor (adjustable)	> 0.99 default 0.8 leading ... 0.8 lagging			
Total harmonic distortion	< 3%			
Maximum units per 10AWG branch[2]	4	4	4	4
Efficiency				
CEC peak efficiency	96.7%			
CEC weighted efficiency	96.5%			
Nominal MPPT efficiency	99.8%			
Nighttime power consumption(mW)	<50			
Mechanical Data				
Ambient temperature range (°C)	-40 to +65			
Dimensions (W × H × D mm)	280 × 176 × 33			
Weight (kg)	3.35			
Enclosure rating	Outdoor-NEMA 6 (IP67)			
Cooling	Natural convection – No fans			
Features				
Communication	2.4GHz Proprietary RF (Nordic)			
Type of isolation	Galvanically Isolated HF Transformer			
Monitoring	S-Miles Cloud[3]			
Warranty	Up to 25 years			
Compliance	UL 1741, IEEE 1547, UL 1741 SA (240 Vac), CA Rule 21 (240 Vac), CSA C22.2 No. 107.1-16, FCC Part 15B, FCC Part 15C			
PV Rapid Shutdown	Conforms with NEC-2017 and NEC-2020 Article 690.12 and CEC-2021 Sec 64-218 Rapid Shutdown of PV Systems			

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



EATON
Powering Business Worldwide

Type CH
Premium residential products

Eaton has enhanced its premium Type CH residential circuit breakers, making the best even better. The Type CHF AFCI breakers also include advanced electronics that reduce nuisance tripping and a standard diagnostic LED indicating one of seven trip codes. These features further establish the CH series of products as "best-in-class."

CHF series breaker include:

- Mechanical flag for trip indication
- Exclusive "Trip to OFF" and simple 1-Step breaker reset

Typical applications

- Residential loadcenters and meter breaker panels
- Light commercial distribution panels
- Pool panels
- Residential transfer switch panels
- Various OEM applications

CHF circuit breakers

Arc fault and ground fault breakers (AFCI/GFCI)

AFCI diagnostic trip codes

- Thermal trip/manual disconnect—the breaker has detected an overload, short circuit or was manually turned off
- Low current arc—an arc has been detected due to a break in a single conductor
- High current arc—an arc has been detected between two conductors
- Short delay—an electronic backup to the short-circuit mechanism
- Overvoltage—voltage of 160 V rms or greater
- Ground fault—current has found an alternate path to ground
- Self test failure—the breaker continually tests the internal electronics and software to ensure that the arc fault detection technology is working properly

Pigtail breakers

Plug-on neutral breakers

Standard features and benefits

AFCI [1]

- Advanced electronics to reduce unwanted tripping from non-compliant devices
- Standard LED indicates one of seven trip codes to simplify circuit diagnostics
- Trip codes are stored permanently into the breaker's memory, to help identify "trip" history
- Branch overvoltage protection for sensitive electronics
- Meets areas requiring AFCI protection under the 2008 and all subsequent editions of the NEC®
- Single-pole breakers 15 A and 20 A

GFCI [1]

- Single-pole breakers 15–30 A
- 5 mA protection per UL® 943

Optional plug-on neutral

- Time savings up to 25% per AFCI and GFCI installation
- Improved wireway access
- Easier troubleshooting due to less wiring
- Eliminates unwanted tripping due to loose pigtail connections

Thermal-magnetic breakers

Standard features and benefits [1]

- Tri-Drive screw accepts flat, Robertson or Phillips drivers, making it easier for electricians to install
- Space-saving ¾-inch design accommodates more breakers per panel
- Single- and two-pole breakers up to 50 A
- CH non-flag versions available for 60–70 A in single-pole, 60–125 A in two-pole and up to 100 A in three-pole

[1] Please reference catalog CA08100002E for additional ratings and configurations.

Production Specifications

Eaton DG222NRB

Catalog number: DG222NRB

Eaton General duty cartridge fuse safety switch, 60 A, NEMA 3R, Painted galvanized steel, Class H fuses, Fusible with neutral, Two-pole, Three-wire, Category: general duty safety switch, 240 V

General specifications

Product Name
Eaton general duty cartridge fuse safety switch

Catalog Number
DG222NRB

UPC
782113144221

Product Length/Depth
7.35 in

Product Height
14.37 in

Product Width
8.4 in

Product Weight
10 lb

Warranty
Eaton Selling Policy 25-000, one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

Certifications
UL Listed

Catalog Notes
Maximum hp ratings apply only when dual element fuses are used. 3-Phase hp rating shown is a grounded B phase rating, UL listed.

Physical Attributes

Enclosure
NEMA 3R

Enclosure material
Painted galvanized steel

Fuse configuration
Fusible with neutral

Number Of Poles
Two-pole

Number of wires
3

Type
General duty, cartridge fused

Performance Ratings

Amperage Rating
60A

Fuse class provision
Class H fuses

Voltage rating
240V

Miscellaneous

Product Category
General duty safety switch

Resources

Catalogs
Eaton's Volume 2—Commercial Distribution

Multimedia
Double Up on Safety

Switching Devices Flex Center

Specifications and datasheets
Eaton Specification Sheet - DG222NRB

Eaton Corporation plc
Eaton House
30 Pembroke Road
Dublin 4, Ireland
Eaton.com

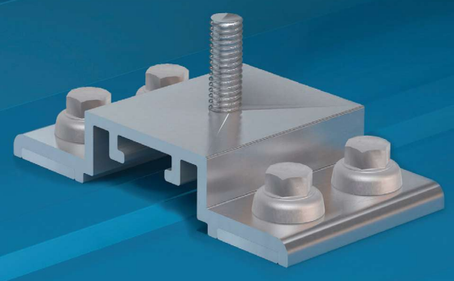
S-5!®

The Right Way!

NEW PRODUCT
SolarFoot™

Introducing the new SolarFoot™ for exposed fastener metal roofing with the strength, testing, quality, and time-proven integrity you expect from S-5!. The SolarFoot provides an ideal mounting platform to attach the L-Foot (not included) of a rail-mounted PV system to the roof. This solution is The Right Way to secure rail-mounted solar systems to exposed fastener metal such as AG-Panel or R-Panel.

The right way to attach almost anything to metal roofs!



SolarFoot Features:

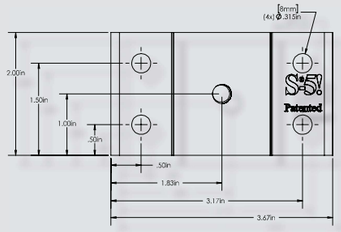
- Manufactured in the U.S.A. from certified raw material
- Fabricated in our own ISO 9001:2015 certified factory
- All aluminum and stainless components
- 25yr limited warranty
- Compatible with all commercial L-Foot products on the market
- Factory applied 40-year isobutylene/isoprene crosslink polymer sealant for reliable weathertightness
- Sealant reservoir to prevent over-compression of sealant
- Load-to-failure tested Normal to Seam by a nationally accredited laboratory on numerous metal roof materials and substrates
- Four points of attachment into structure or deck with tested holding strength for engineered applications
- Integrated M8-1.25x17mm stud and M8-1.25 stainless steel hex flange nut included

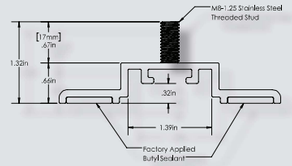
888-825-3432 | www.S-5.com | MADE IN THE USA

S-5!®
The Right Way!

SolarFoot™ Mounting for Exposed Fastener Roofing

The SolarFoot is a simple, cost-effective pedestal for L-Foot (not included) attachment of rail-mounted solar PV. The unique design is compatible with all rail producer L-Foot components. The new SolarFoot assembly ensures a durable weathertight solution for the life of the roof. Special factory applied butyl co-polymeric sealant contained in a reservoir is The Right Way, allowing a water-tested seal. Stainless integrated stud and hex flange lock-nut secure the L-Foot into position. A low center of gravity reduces the moment arm commonly associated with L-Foot attachments. Direct attachment of the SolarFoot to the structural member or deck provides unparalleled holding strength.





**Fasteners sold separately. Fastener type varies with substrate. Contact S-5! on how to purchase fasteners and obtain our test results. L-Foot also sold separately.*

Fastener Selection

Metal to Metal:
1/4-14 Self Drilling Screw
1-1/2" to 2-1/2"

Metal to Wood:
1/4-14 Type 17 AB Milled Point
1-1/2" to 2-1/2"

To source fasteners for your projects, contact S-5!

When other brands claim to be "just as good as S-5!", tell them to PROVE IT.

SolarFoot Advantages:

- Exposed fastener mounting platform for solar arrays attached via L-Foot and Rails
- Weatherproof attachment to exposed fastener roofing
- Butyl sealant reservoir provides long-term waterproof seal
- M8-1.25x17mm stud with M8 hex flange nut for attachment of all popular L-Foot/rail combinations
- Tool: 13 mm Hex Socket or ½" Hex Socket
- Tool Required: Electric screw gun with hex drive socket for self-tapping screws.
- Low Center of Gravity reduces moment arm commonly associated with L-Foot/Rail solar mounting scenarios
- Attaches directly to structure or deck for optimal holding strength
- S-5! Recommended substrate-specific (e.g. steel purlin, wood 2x4, OSB, etc.) fasteners provide excellent waterproofing and pull-out strength
- Fastener through-hole locations comply with NDS (National Design Specification)for Wood Construction

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

The independent lab test data found at www.S-5.com can be used for load-critical designs and applications.

Products are protected by multiple U.S. and foreign patents. For published data regarding holding strength, fastener torque, patents, and trademarks, visit the S-5! website at www.S-5.com.

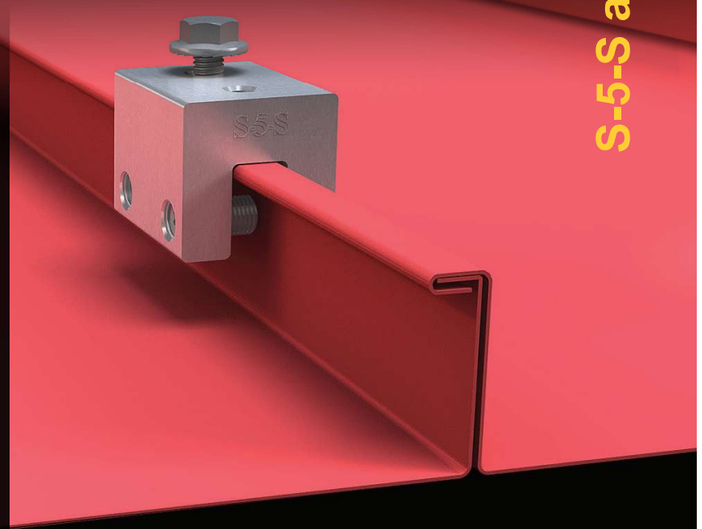
Distributed by:

S-5! ®

The Right Way!®

S-5-S and S-5-S Mini

The right way to attach almost anything to metal roofs!



S-5-S Clamp

The S-5-S clamp was created specifically for popular snap-together profiles—including residential profiles by Taylor Metals and Easy Lock Standing Seam. For horizontal seams under .540 inches (like the Firestone UC4) the S-5-S or S-5-S Mini can be used to avoid the necessity of crimping the seam.

Its simple design and size make it perfect for use with S-5!® snow retention products and other heavy-duty applications. Installation is as simple as setting the patented round-point setscrews into the clamp, placing the clamp on the seam, and tightening them to the specified tension. Then, affix ancillary items using the bolt provided with the product. Go to www.S-5.com/tools for information and tools available for properly attaching and tensioning S-5! clamps.

S-5-S Mini Clamp

The S-5-S Mini is a bit shorter than the S-5-S and has one setscrew rather than two. The mini is the choice for attaching all kinds of rooftop accessories: signs, walkways, satellite dishes, antennas, rooftop lighting, lightning protection systems, solar arrays, exhaust stack bracing, conduit, condensate lines, mechanical equipment—just about anything!*

*S-5! mini clamps are not compatible with, and should not be used with S-5! SnoRail™/SnoFence™ or ColorGard® snow retention systems.

The S-5-S clamp was created specifically for popular snap-together profiles.

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

S-5!®
The Right Way!®

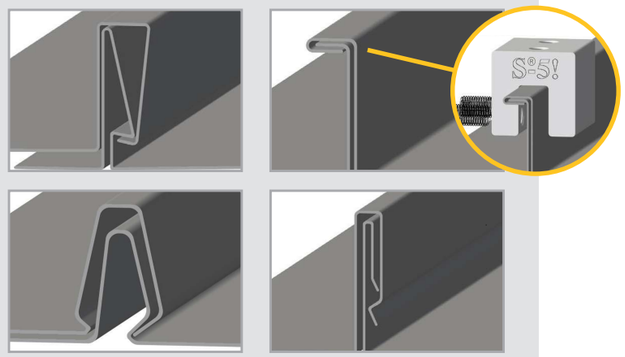
The strength of the S-5-S clamp is in its simple design. The patented setscrews will slightly dimple the metal seam material but not pierce it—leaving roof warranties intact.

The **S-5-S** and **S-5-S Mini** clamps are each furnished with the hardware shown to the right. Each box also includes a bit tip for tightening setscrews using an electric screw gun. A structural aluminum attachment clamp, the S-5-S is compatible with most common metal roofing materials excluding copper. All included hardware is stainless steel. Please visit **www.S-5.com** for more information including CAD details, metallurgical compatibilities and specifications.

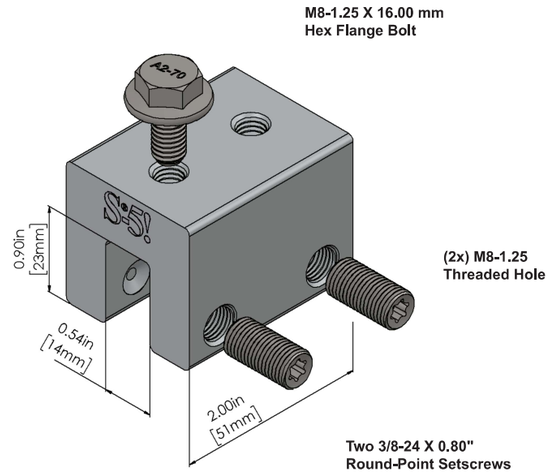
The S-5-S clamp has been tested for load-to-failure results on most major brands and profiles of standing seam roofing. The independent lab test data found at www.S-5.com can be used for load-critical designs and applications. S-5!® holding strength is unmatched in the industry. Profiles that are shaped as illustrated below will work with the S-5-S and S-5-S Mini. In order for the S-5-S or S-5-S Mini to fit these types of seams, the finished seam must:

- Be at least 1.00" high.
- Have a height distance less than or equal to 0.25" between the male portion of the panel and female portion of the panel.

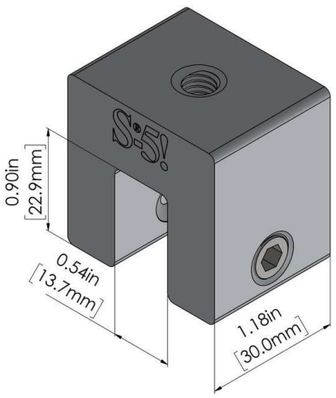
Example Profiles



S-5-S Clamp



S-5-S Mini Clamp



Please note: All measurements are rounded to the second decimal place.

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

Products are protected by multiple U.S. and foreign patents. Visit the website at www.S-5.com for complete information on patents and trademarks. For maximum holding strength, setscrews should be tensioned and re-tensioned as the seam material compresses. Clamp setscrew tension should be verified using a calibrated torque wrench between 160 and 180 inch pounds when used on 22ga steel, and between 130 and 150 inch pounds for all other metals and thinner gauges of steel. Consult the S-5! website at www.S-5.com for published data regarding holding strength.

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Tech Brief

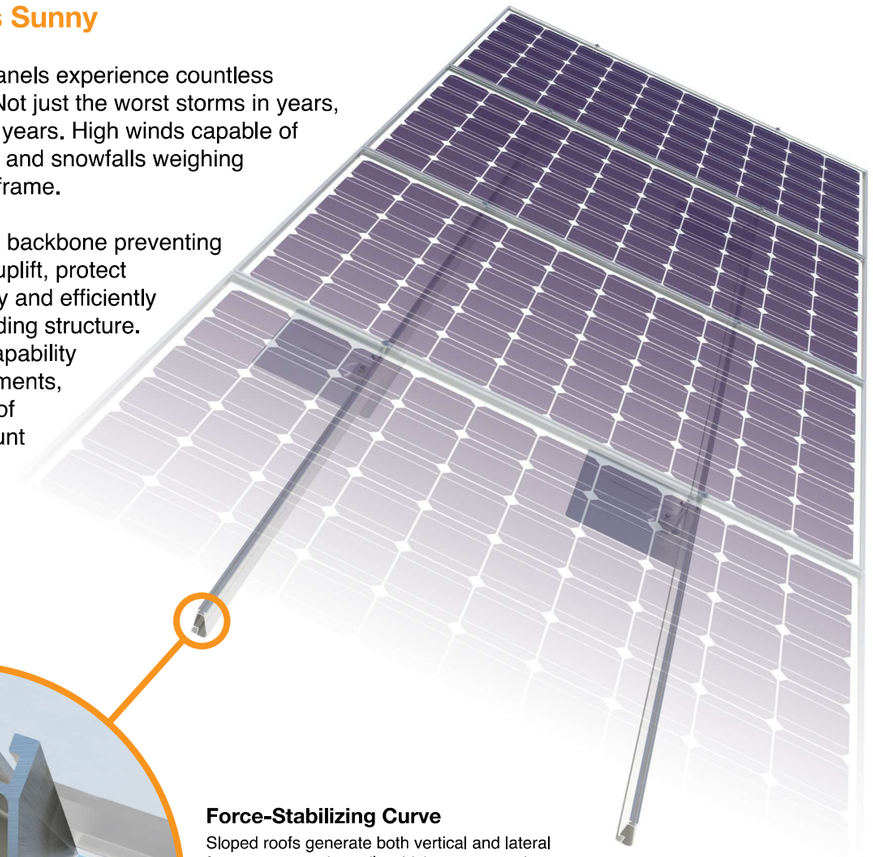
IRONRIDGE

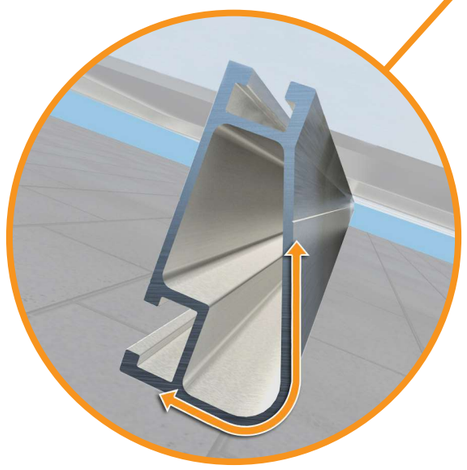
XR Rail Family

Solar Is Not Always Sunny

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

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





Force-Stabilizing Curve

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

Compatible with Flat & Pitched Roofs

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

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

Corrosion-Resistant Materials

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

Tech Brief

XR Rail Family

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

XR10

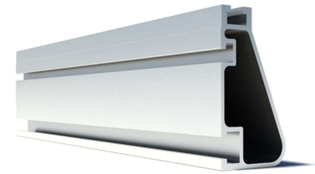
XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves spans up to 6 feet, while remaining light and economical.

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

XR100

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

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



XR1000

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

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

Rail Selection

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

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

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

Example of Conduit on Roof


Example of Conduit on Elevation

Example of Conduit on Roof