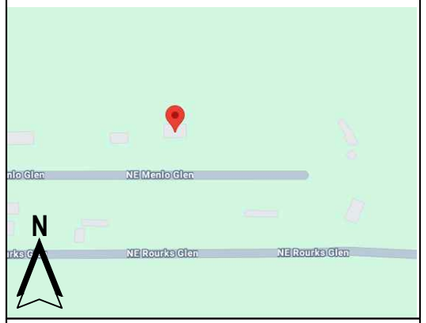
## VICINITY MAP




## AERIAL VIEW


# RICHARD LAZO RESIDENCE
# SCOPE OF WORK:

SYSTEM SIZE: 13.200 kW DC / 11.500 kW AC
MODULE: (30) HD HYUNDAI SOLAR I HIN-T440NF(BK)
INVERTER: (1) TESLA POWERWALL 3
INTERCONNECTION: LOAD SIDE TAP
OCPD SIZE: 60A
MAIN SERVICE PANEL BUS RATING: (E) 200
MAIN SERVICE DISCONNECT RATING: (E) 200
SUB PANEL BUS RATING (IF APPLICABLE): (E) 200
SUB PANEL DISCONNECT RATING (IF APPLICABLE): (E) 200

# DESIGN CRITERIA:

ROOF TYPE(S): METAL ROOF
WIND SPEED: 119 MPH
GROUND SNOW LOAD: 0 PSF
ASCE: 7-22
EXPOSURE CATEGORY: B
MOUNTING METHOD(S): SNAPRACK ULTRA FOOT & S5 SOLAR FOOT
RACKING: SNAPRACK UR-45 172" MILL (USA)

RESERVED FOR AHJ SPECIFIC STAMPS / NOTES
(IF APPLICABLE)

## GOVERNING CODES:

2020 NATIONAL ELECTRIC CODE (NEC)
2023 8TH EDITION FLORIDA BUILDING CODE: BUILDING
2023 8TH EDITION FLORIDA BUILDING CODE: RESIDENTIAL
2023 8TH EDITION FLORIDA BUILDING CODE: MECHANICAL
2023 8TH EDITION FLORIDA BUILDING CODE: PLUMBING
2023 8TH EDITION FLORIDA BUILDING CODE: FUEL GAS
2023 8TH EDITION FLORIDA BUILDING CODE: ENERGY CONSERVATION
2023 8TH EDITION FLORIDA BUILDING CODE: EXISTING BUILDING
2023 8TH EDITION FLORIDA BUILDING CODE: ACCESSIBILITY
2023 8TH EDITION FLORIDA FIRE PREVENTION CODE (NFPA)
AS ADOPTED BY COLUMBIA COUNTY

## GENERAL NOTES

1. UTILITY SHALL BE NOTIFIED BEFORE ACTIVATION OF PHOTOVOLTAIC SYSTEM.
2. 110.2 APPROVAL: ALL ELECTRICAL EQUIPMENT SHALL BE LABELED, LISTED, OR CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY ACCREDITED BY THE UNITED STATES OCCUPATIONAL SAFETY HEALTH ADMINISTRATION
3. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS PRIOR TO INITIATING CONSTRUCTION.
4. CONTRACTOR SHALL REVIEW ALL MANUFACTURER INSTALLATION DOCUMENTS PRIOR TO INITIATING CONSTRUCTION.
5. ALL EQUIPMENT AND ASSOCIATED CONNECTIONS, ETC, AND ALL ASSOCIATED WIRING AND INTERCONNECTIONS SHALL BE INSTALLED ONLY BY QUALIFIED PERSONNEL.
6. THE CONTRACTOR OR OWNER MUST PROVIDE ROOF ACCESS (LADDER TO ROOF) FOR ALL THE REQUIRED INSPECTIONS. LADDERS MUST BE OSHA APPROVED, MINIMUM TYPE I WITH A 250LB. RATING, IN GOOD CONDITION AND DESIGNED FOR ITS INTENDED USE.
7. CONTRACTOR SHALL VERIFY THAT THE ROOF STRUCTURE WILL WITHSTAND THE ADDITIONAL LOADS.
8. LAG SCREWS SHALL PENETRATE A MINIMUM 2" INTO SOLID SAWN STRUCTURAL MEMBERS AND SHALL NOT EXCEED MANUFACTURER RECOMMENDATIONS FOR FASTENERS INTO ENGINEERED STRUCTURAL MEMBERS.
9. AN ACCESS POINT SHALL BE PROVIDED THAT DOES NOT PLACE THE GROUND LADDER OVER OPENINGS SUCH AS WINDOWS OR DOORS ARE LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION AND IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES, OR SIGNS.
10. WHERE DC CONDUCTORS ARE RUN INSIDE BUILDING, THEY SHALL BE CONTAINED IN A METAL RACEWAY; THEY SHALL NOT BE INSTALLED WITHIN 10" OF THE ROOF DECKING OR SHEATHING EXCEPT WHERE COVERED BY THE PV MODULES AND EQUIPMENT.
11. PLUMBING AND MECHANICAL VENTS THROUGH THE ROOF SHALL NOT BE COVERED BY SOLAR MODULES - NO BUILDING, PLUMBING OR MECHANICAL VENTS TO BE COVERED, CONSTRUCTED OR ROUTED AROUND SOLAR MODULES.
12. ALL FIELD -INSTALLED JUNCTION, PULL AND OUTLET BOXES LOCATED BEHIND MODULES SHALL BE ACCESSIBLE DIRECTLY OR BY DISPLACEMENT OF A MODULE SECURED BY REMOVABLE FASTENERS.

## ELECTRICAL NOTES

1. WIRING MATERIALS SHALL COMPLY WITH MAXIMUM CONTINUOUS CURRENT OUTPUT AT 25°C AND MAXIMUM VOLTAGE AT 600V; WIRE SHALL BE WET RATED AT 90°C.
2. EXPOSED PHOTOVOLTAIC SYSTEM CONDUCTORS ON THE ROOF WILL BE USE 2 OR PV-TYPE WIRE.
3. PHOTOVOLTAIC SYSTEM CONDUCTORS SHALL BE IDENTIFIED AND GROUPED. THE MEANS OF IDENTIFICATION SHALL BE PERMITTED BY SEPARATE COLOR-CODING, MARKING TAPE, TAGGING OR OTHER APPROVED MEANS.
4. ALL EXTERIOR CONDUIT, FITTINGS, AND BOXES SHALL BE RAIN-TIGHT AND APPROVED FOR USE IN WET LOCATIONS.
5. ALL METALLIC RACEWAYS AND EQUIPMENT SHALL BE BONDED AND ELECTRICALLY CONTINUOUS.
6. WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, CONTRACTOR SHALL SIZE THEM ACCORDING TO APPLICABLE CODES.
7. REMOVAL OF A UTILITY-INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BUILDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR AND THE PV SOURCE AND/OR OUTPUT CIRCUIT GROUNDED CONDUCTOR.
8. FOR GROUNDED SYSTEMS, THE PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUITS SHALL BE PROVIDED WITH A GROUND-FAULT PROTECTION DEVICE OR SYSTEM THAT DETECTS A GROUND FAULT, INDICATES THAT FAULT HAS OCCURED AND AUTOMATICALLY DISCONNECTS ALL CONDUCTORS OR CAUSES THE INVERTER TO AUTOMATICALLY CEASE SUPPLYING POWER TO OUTPUT CIRCUITS.
9. FOR UNGROUNDED SYSTEMS, THE INVERTER IS EQUIPPED WITH GROUND FAULT PROTECTION AND A GFI FUSE PORT FOR GROUND FAULT INDICATION.
10. PV MODULE FRAMES SHALL BE BONDED TO RACKING RAIL OR BARE COPPER GEC/GEC PER THE MODULE MANUFACTURER'S LISTED INSTRUCTION SHEET.
11. PV MODULE RACKING RAIL SHALL BE BONDED TO BARE COPPER GEC VIA WEEB LUG, ILSCO GBL-4DBT LAY-IN LUG, OR EQUIVALENT LISTED LUG.
12. THE PHOTOVOLTAIC INVERTER WILL BE LISTED AS UL 1741 COMPLIANT.
13. RACKING AND BONDING SYSTEM TO BE UL2703 RATED.
14. ANY REQUIRED GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AS BUS BARS WITHIN LISTED EQUIPMENT.
15. WHEN BACKFED BREAKER IS THE METHOD OF UTILITY INTERCONNECTION, THE BREAKERS SHALL NOT READ "LINE AND LOAD".
16. WHEN APPLYING THE 120% RULE, THE SOLAR BREAKER TO BE POSITIONED AT THE OPPOSITE END OF THE BUS BAR FROM THE MAIN BREAKER.
17. THE WORKING CLEARANCE AROUND THE EXISTING ELECTRICAL EQUIPMENT AS WELL AS THE NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED.

**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884

REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410

RESERVED FOR ENGINEERING STAMP
(IF APPLICABLE)


Digitally signed by Reyes Ruiz
Date: 2026.03.24 16:49:52 -04'00'

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

COVER SHEET

PV-1

## ROOF DESCRIPTION

| ROOF # (ROOF TYPE) | PITCH | AZIMUTH | RAFTER SIZE & SPACING |
|---|---|---|---|
| RS-1 (COMP SHINGLE) | 20° | 179° | 2X4" @ 24" |
| RS-2 (METAL - CORRUGATED) | 20° | 359° | 2X4" @ 24" |

## ARRAY AND ROOF AREA CALC'S

| TOTAL ROOF SQ FT: | | 1997.23 | |
|---|---|---|---|
| ROOF | MODULE COUNT | ARRAY SQ FT | ROOF SQ FT |
| RS-1 | 21 | 441.00 | 782 |
| RS-2 | 9 | 189.00 | 960 |
| TOTAL: | 30 | 630.00 | 1742 |
| TOTAL % ARRAY/ROOF | | 630.00 / 1997.23: | 31.54% |

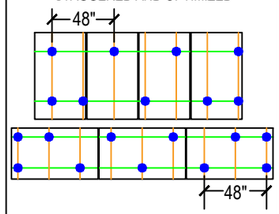
## EQUIPMENT DETAILS

| | |
|---|---|
| SOLAR MODULE: | (30) HD HYUNDAI SOLAR I HIN-T440NF(BK) |
| INVERTER: | (1) TESLA POWERWALL 3 |

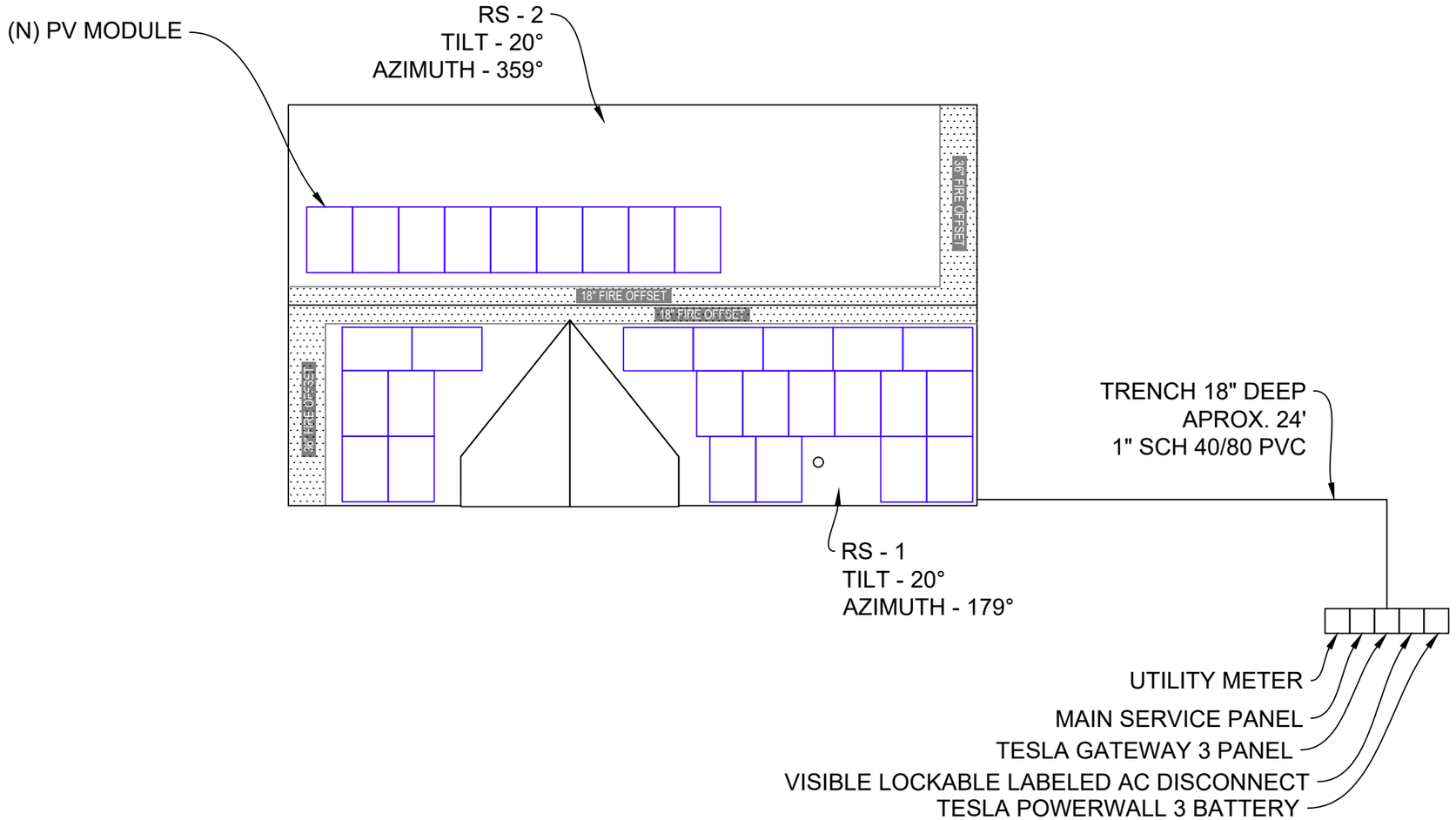
## MODULE INFORMATION

| | |
|---|---|
| MODULE QUANTITY & TYPE = | (30) HD HYUNDAI SOLAR I HIN-T440NF(BK) |
| MODULE WEIGHT = | 50.10 LBS/MODULE |
| MODULE DIMENSIONS (L" X W") = | 67.8" x 44.6" |
| MODULE AREA = | 21.00 FT$^2$ |
| UNIT WEIGHT OF ARRAY = | 2.39 PSF |
| | |

PREFABRICATED TRUSSES
SPACING: 24" OC
CANTILEVER LENGTH <= 6"
SUPPORT LOCATIONS HAVE BEEN STAGGERED AND OPTIMIZED




MAX ATTACHMENT SPACING
SHALL NOT EXCEED 48" O.C.




## GENERAL NOTES:

- VERIFY ALL OBSTRUCTIONS IN THE FIELD.
- VERIFY ALL DIMENSIONS IN THE FIELD.
- CONDUIT TO BE RUN IN ATTIC IF POSSIBLE, OTHERWISE CONDUIT BLOCKS MIN. 1"/MAX 5" ABOVE ROOF SURFACE
- PV MODULES CANNOT BE INSTALLED OVER OR BLOCK ATTIC VENTS, FURNACE OR WATER HEATER VENTS ETC.
- NUMBER OF STORIES: 1
- DISCONNECT SHALL BE INSTALLED WITHIN 10' FROM UTILITY METER
- PV MODULE DIMENSIONS: 67.8" (L) x 44.6" (W)
- SCALE 3/32" = 1'-0"

N


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884

REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410


RESERVED FOR ENGINEERING STAMP
(IF APPLICABLE)

REYES MANUEL RUIZ-DONATE LICENSE No 88991 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED Y REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE DEAL.

PRINTED COPPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

SITE PLAN

PV-2

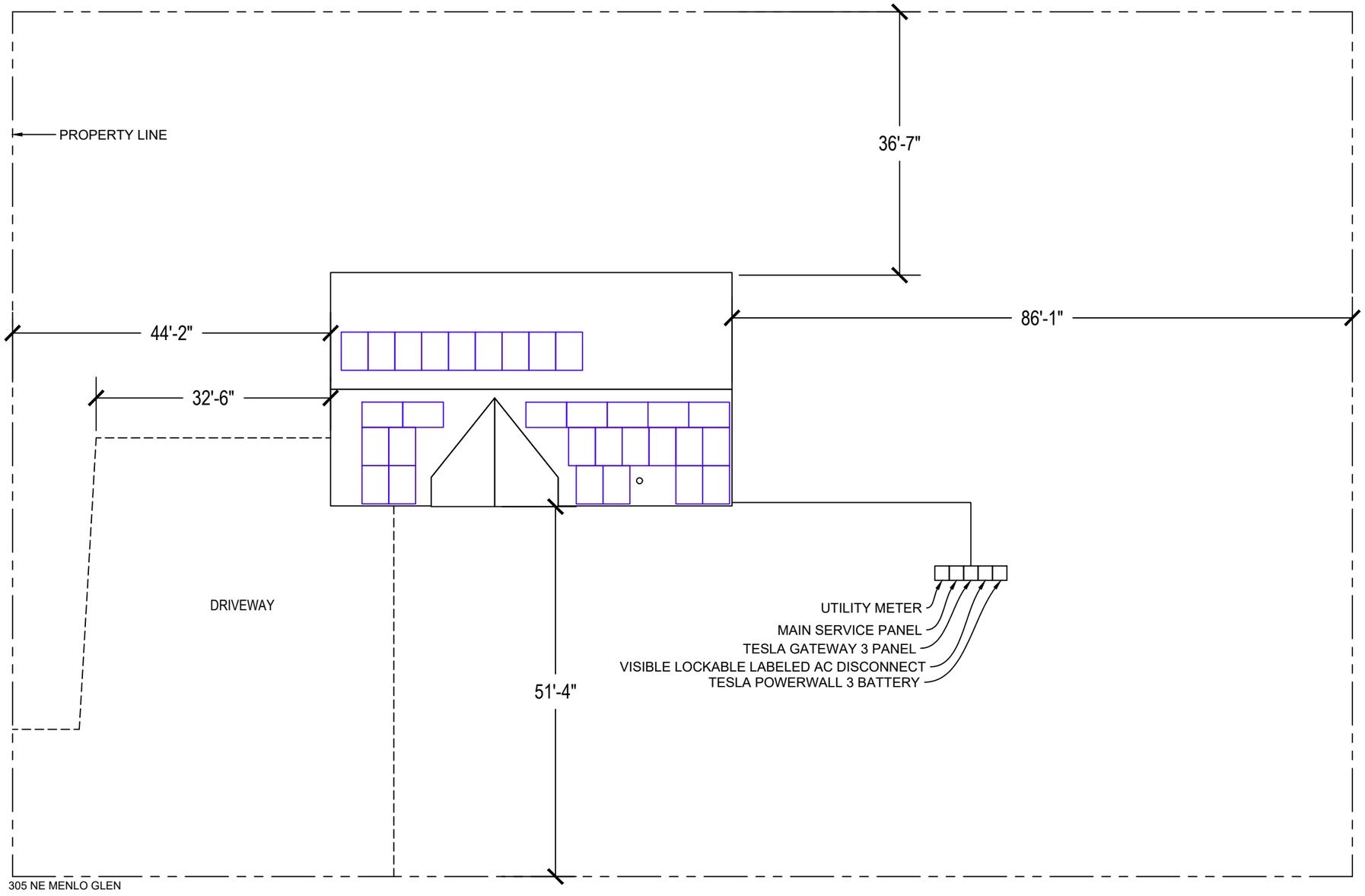
LEGEND:

SCALE 1/16" = 1'-0"

PROPERTY LINE: —— – – ——

DRIVEWAY: – – – – – – – – – –

FENCE: —o——o——o——




N


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO,
32809 FL , UNITED STATES
407-912-3884


REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD
ATLANTIS ARECIBO , PR 00612
787-405-6410

RESERVED FOR ENGINEERING STAMP
(IF APPLICABLE)

REYES MANUEL RUIZ-DONATE LICENSE No 88991 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED Y REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE DEAL.

PRINTED COPPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

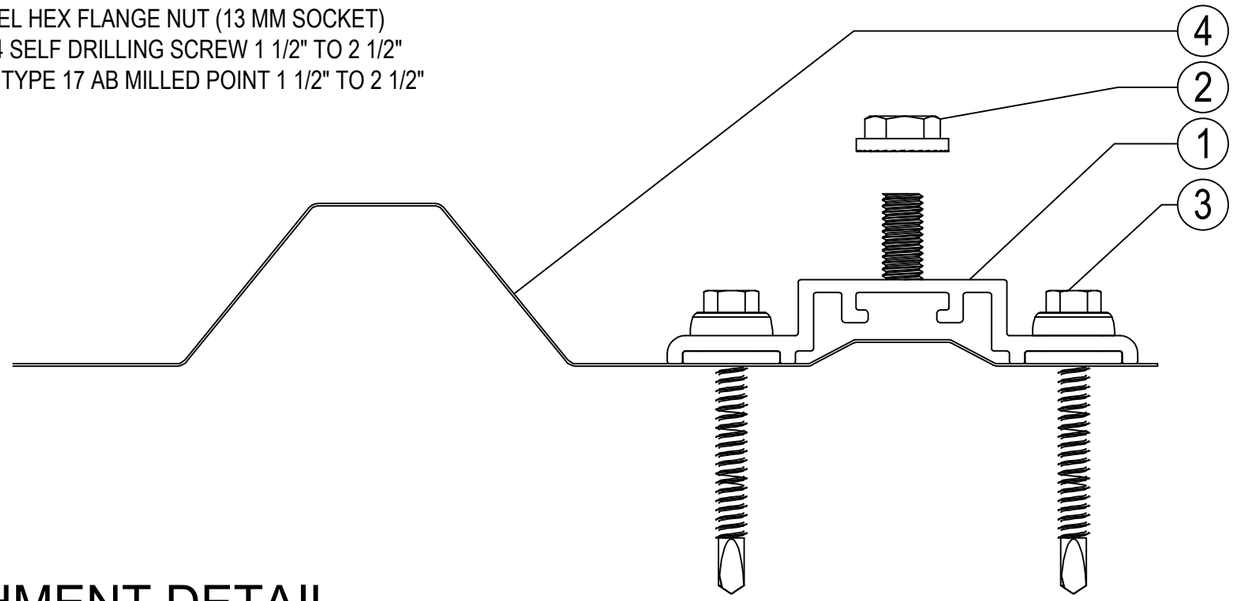
| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

PROPERTY PLAN

PV-3

LEGEND:

1. SOLARFOOT
2. M8-1.25 STAINLESS STEEL HEX FLANGE NUT (13 MM SOCKET)
3. 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"
4. EXAMPLE ROOF




# 1 ATTACHMENT DETAIL

SCALE: NTS

**NOTE:** ACTUAL ROOF CONDITIONS AND RAFTER (OR SEAM) LOCATIONS MAY VARY. INSTALL PER MANUFACTURER(S) INSTALLATION GUIDELINES AND ENGINEERED SPANS FOR ATTACHMENTS

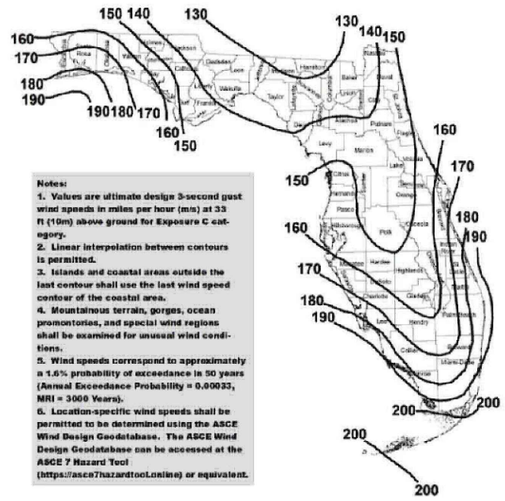
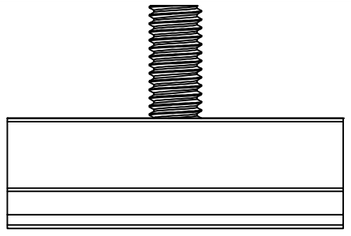
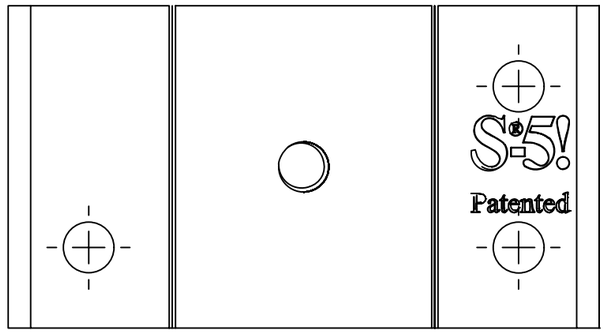


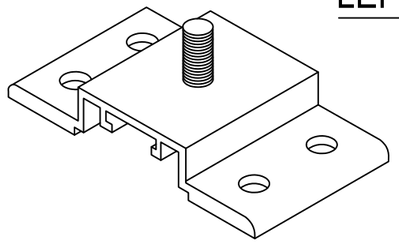

FIGURE 1609.3(3)
ULTIMATE DESIGN WIND SPEEDS, $V_{ULT}$, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



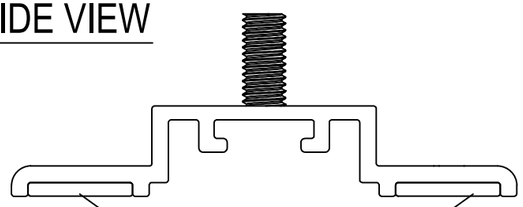
LEFT SIDE VIEW




TOP VIEW

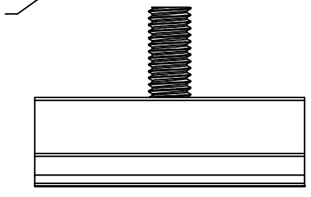


ISOMETRIC

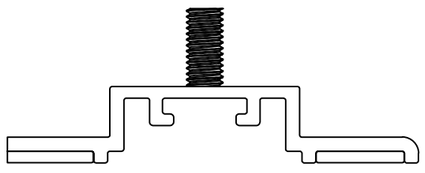


FACTORY APPLIED
BUTYL SEALANT

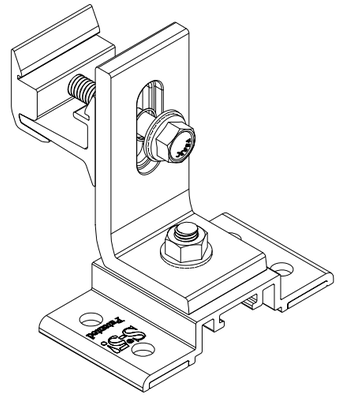
FRONT VIEW

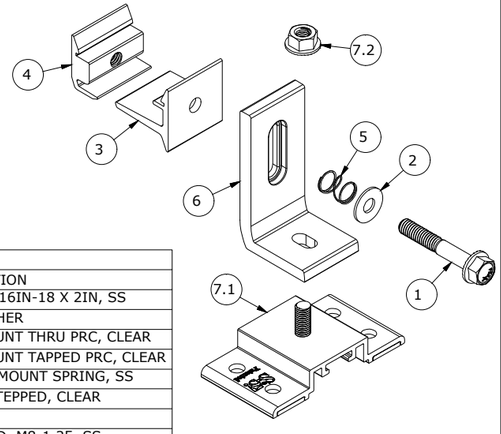


RIGHT SIDE VIEW



BACK VIEW






| PARTS LIST | | |
|---|---|---|
| ITEM | QTY | DESCRIPTION |
| 1 | 1 | BOLT, FLANGE, SERRATED, 5/16IN-18 X 2IN, SS |
| 2 | 1 | 5/16IN X 3/4IN SS FLAT WASHER |
| 3 | 1 | SNAPNRACK, ULTRA RAIL MOUNT THRU PRC, CLEAR |
| 4 | 1 | SNAPNRACK, ULTRA RAIL MOUNT TAPPED PRC, CLEAR |
| 5 | 1 | SNAPNRACK, RL UNIVERSAL, MOUNT SPRING, SS |
| 6 | 1 | SNAPNRACK, AP90 L FOOT, STEPPED, CLEAR |
| 7.1 | 1 | S-5!, SOLARFOOT |
| 7.2 | 1 | S-5!, NUT, FLANGE, SERRATED, M8-1.25, SS |

# 2 ATTACHMENT DETAIL(ENLARGED VIEW)

SCALE: NTS


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884

REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410


RESERVED FOR ENGINEERING STAMP (IF APPLICABLE)

REYES MANUEL RUIZ-DONATE LICENSE No 88991 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED Y REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE DEAL.

PRINTED COPPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

ATTACHMENT DETAILS

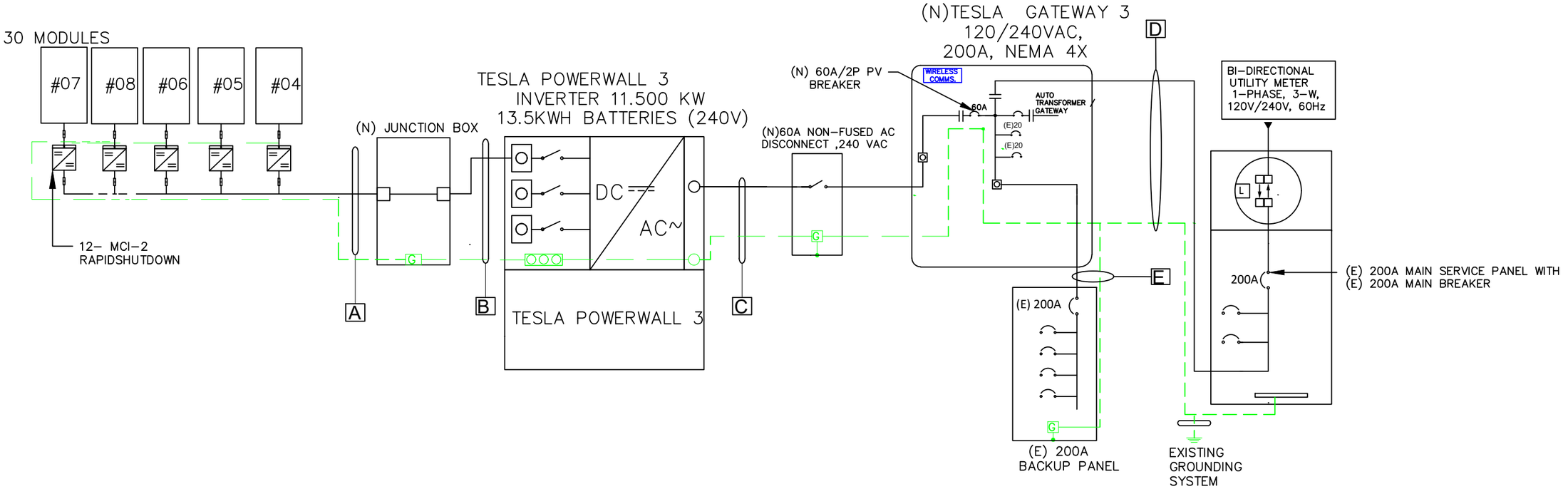
PV-4

| PV MODULE SPECIFICATIONS | |
|---|---|
| MODEL | HD HYUNDAI SOLAR I HIN-T440NF(BK) |
| PMAX | 440W |
| VOC | 38.8V |
| VMP | 32.2V |
| IMP | 13.63A |
| ISC | 14.39A |

| DESIGN CRITERIA AND CALCULATIONS BASED UPON: |
|---|
| NEC TABLE CEC/NEC 310.15(B)(1) 90°C (194°F) |
| ASHRAE 2% AVERAGE HIGH = 32°C |
| NEC TABLE 310.15(B)(2) 75°C DERATE FACTOR = 1.2 |

| WIRE TAG | CONDUIT | WIRE GAUGE | WIRE QTY | WIRE TYPE | TEMP. RATING | WIRE AMPACITY (A) | TEMP. DERATE | CONDUIT FILL DERATE | DERATED AMPACITY (A) | INVERTER QTY. | DESIGN CURRENT (A) | GROUND SIZE | GROUND WIRE TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | OPEN AIR | 12 AWG | 01 | TRUNK CABLE | 90°C | 30 | 0.96 | N/A | 28.80 | - | 15 | 06 AWG | BARE CU GND |
| B | 1" EMT/PVC/LFMC | 10 AWG | 12 | THWN-2 | 90°C | 40 | 0.96 | 1.0 | 38.40 | - | 15 | 10 AWG | THWN-2 |
| C | 1" EMT/PVC/LFMC | 06 AWG | 03 | THWN | 75°C | 60 | 0.94 | 1.0 | 60.00 | 1 | 60.00 | 10 AWG | THWN |
| D | 2" EMT/PVC/LFMC | 4/0 AWG | 03 | XHHW-2 AL | 90°C | 200 | 0.94 | 1.0 | 200.00 | - | 200.00 | 02 AWG | XHHW-2 AL |
| E | 2" PVC | 4/0 AWG | 03 | XHHW-2 AL | 90°C | 200 | 0.94 | 1.0 | 200.00 | - | 200.00 | 02 AWG | XHHW-2 AL |

## 1 ELECTRICAL LINE DIAGRAM & WIRING CALC.




**I REYES M RUIZ DONATE PE# 88991 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE FLORIDA BUILDING CODE.**


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884


REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410

RESERVED FOR ENGINEERING STAMP (IF APPLICABLE)

REYES MANUEL RUIZ DONATE LICENSE No 88991 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE SEAL.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

Digitally signed by Reyes Ruiz
Date: 2026.03.24 16:50:15 -04'00'

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

SINGLE LINE DIAGRAM

PV-5

# DISCONNECT

DISCONNECT 1 OF 2
MULTIPLE POWER SOURCES
ON PROPERTY;
UTILITY AND PV SYSTEM

DISCONNECT 2 OF 2
MULTIPLE POWER SOURCES
ON PROPERTY;
UTILITY AND PV SYSTEM

LOCATED AT RAPID SHUTDOWN DISCONNECT SWITCH
NEC 690.56(C)(3)

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LOCATED AT MAIN SERVICE DISCONNECT
NEC 690.13(B)

**MAIN PHOTOVOLTAIC SYSTEM DISCONNECT**

LOCATED AT POINT OF INTERCONNECTION AND EACH AC DISCONNECTING MEANS
NEC 690.54

**PHOTOVOLTAIC AC DISCONNECT**

| | | |
|---|---|---|
| RATED AC OUTPUT CURRENT: | 48 | AMPS |
| NOMINAL OPERATING AC VOLTAGE: | 240 | VOLTS |

LOCATED AT EACH PV DISCONNECTING MEANS
NEC 690.13(B)

**PHOTOVOLTAIC**

**AC DISCONNECT**

ON-SITE GENERATION
UTILITY DISCONNECT
SWITCH

pvlabels.com 03-204

# COMBINER BOX

LOCATED AT JUNCTION BOX, COMBINER BOX
NEC 690.13(B)

**⚠WARNING**

ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION

DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

LOCATED AT SOLAR COMBINER PANEL (IF APPLICABLE)
NEC 690.13(B)

**⚠WARNING**

PHOTOVOLTAIC SYSTEM
COMBINER PANEL
DO NOT ADD LOADS

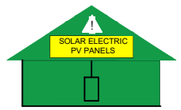
EMERGENCY CONTACT WARNING LABEL:
(LOCATED ADJACENT TO MAIN DISCONNECT)
NFPA1: 11.12.2.1.5 INSTALLER INFORMATION:
EMERGENCY TELEPHONE NUMBER:
SUNWAVE ENERGY: (407) 912-3884

EMERGENCY TELEPHONE NUMBER:
SUNWAVE ENERGY:(407) 912-3884

# MAIN PANEL

RAPID SHUTDOWN
NEC 690.56(C)(1) AND NFPA 11.12.2.1.1.3 MUST BE LOCATED ON THE MAIN SERVICE PANEL

EMERGENCY RESPONDER
THIS SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN




TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN ENTIRE PV SYSTEM

# RACEWAYS

LOCATED AT EMT / CONDUIT RACEWAYS, SPACED AT MAXIMUM 10 FT OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.
NEC 690.31(G)(3)(4)
LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE.
IFC 605.11.1.1

WARNING: PHOTOVOLTAIC POWER SOURCE

# METER

# BATTERY ONLY

**⚠WARNING⚠**
THREE POWER SOURCES
SOURCES: UTILITY GRID, BATTERY AND PV SOLAR ELECTRIC SYSTEM

NOTE:METER AND MAIN SERVICE PANEL

LABELING NOTES:

1. LABELS CALLED OUT ACCORDING TO ALL COMMON CONFIGURATIONS. ELECTRICIAN TO DETERMINE EXACT REQUIREMENTS IN THE FIELD PER CURRENT NEC AND LOCAL CODES AND MAKE APPROPRIATE ADJUSTMENTS.

2. LABELING REQUIREMENTS BASED ON THE NATIONAL ELECTRIC CODE, OSHA STANDARD 19010.145, ANSI Z535.

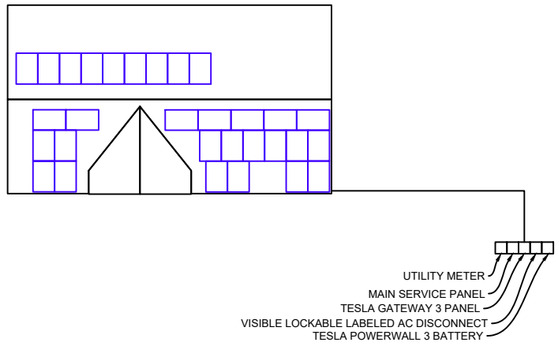
3. MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.

4. LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED [NEC 110.21] THEY SHALL BE PERMANENTLY ATTACHED, WEATHER/SUNLIGHT RESISTANT, AND SHALL NOT BE HAND WRITTEN NEC PER 110.21(B)

5. APPLICABLE LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8", WHITE ON RED BACKGROUND; REFLECTIVE, AND PERMANENTLY AFFIXED [IFC 605.11.1.1]

# CAUTION

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




N

305 NE MENLO GLEN, LAKE CITY, FL 32055


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884

REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410


RESERVED FOR ENGINEERING STAMP (IF APPLICABLE)


THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED Y REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE DEAL.

PRINTED COPPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

| DRAWN BY: | DATE: |
|---|---|
| AV | 3/24/2026 |

LABELS / PLACARD

PV-6

# JOB HAZARD ANALYSIS

**CUSTOMER NAME/JOB ID:**_____ **CUSTOMER ADDRESS**

_____**INSTALL DATE** ____-____-_____ **Time**____:____**am/pm**

| HAZARD CATEGORY | HAZARD TYPE | HAZARD CONTROL MEASURES |
|---|---|---|
| LADDER SAFETY | • LOCATION<br>• CONDITION<br>• WORKING CLEARANCE | |
| FALL PROTECTION | • WORKING 6' OR HIGHER | |
| ELECTRICAL SAFETY | • ARCH FLASH<br>• ELECTRIC SHOCK/ELECTROCUTION | |
| WEATHER CONDITIONS | • HEAT/COLD TEMP<br>• RAINY/ICY/WINDY | |
| PUBLIC SAFETY | • WORK/OBJECTS OVERHEAD<br>• SLIPS/TRIPS/FALLS<br>• ACCESS TO LIVE ELECTRICAL | |

| | |
|---|---|
| NEAREST EMERGENCY FACILITY | |
| CONTACT IMMEDIATLY IN EMERGENCY (911 AND/OR) | |

## GENERAL SITE DISCRIPTION/NOTES

## CREW MEMBERS ON SITE FOR INSTALL

| NAME | SIGNATURE |
|---|---|
| FMU/LMD- | |
| | |
| | |
| | |
| | |

**ELECTRICAL COMPLETION PHOTOS QR CODE**

**ROOFTOP INSTALLATION PHOTOS QR CODE**

**MPU COMPLETION PHOTOS QR CODE**


**SUNWAVE ENERGY LLC .**
170SUNPORT LN SUIT 900,ORLANDO, 32809 FL , UNITED STATES
407-912-3884


REYES RUIZ DONATE
LICENSE NUMBER: PE88991
55 CALLE MIDAS URB CIUDAD ATLANTIS ARECIBO , PR 00612
787-405-6410

RESERVED FOR ENGINEERING STAMP (IF APPLICABLE)

REYES MANUEL RUIZ DONATE LICENSE No 88991 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY REYES MANUEL RUIZ DONATE ON THE DATE ADJACENT TO THE SEAL.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC

SYSTEM SIZE:
13200W DC - 11500W AC

MODULE:(30) HD HYUNDAI SOLAR I HIN-T440NF(BK)

INVERTER(S):
(1) TESLA POWERWALL 3
( )

AHJ: COLUMBIA COUNTY

UTILITY: FLORIDA POWER AND LIGHT COMPANY
METER #: ----

SHEET INDEX:



LAZO
RESIDENCE
305 NE MENLO GLEN,
LAKE CITY
FL, 32055
786-431-6051
LAZORICHARD@GMAIL.COM

DRAWN BY: AV
DATE: 3/24/2026

JOB HAZARD SHEET

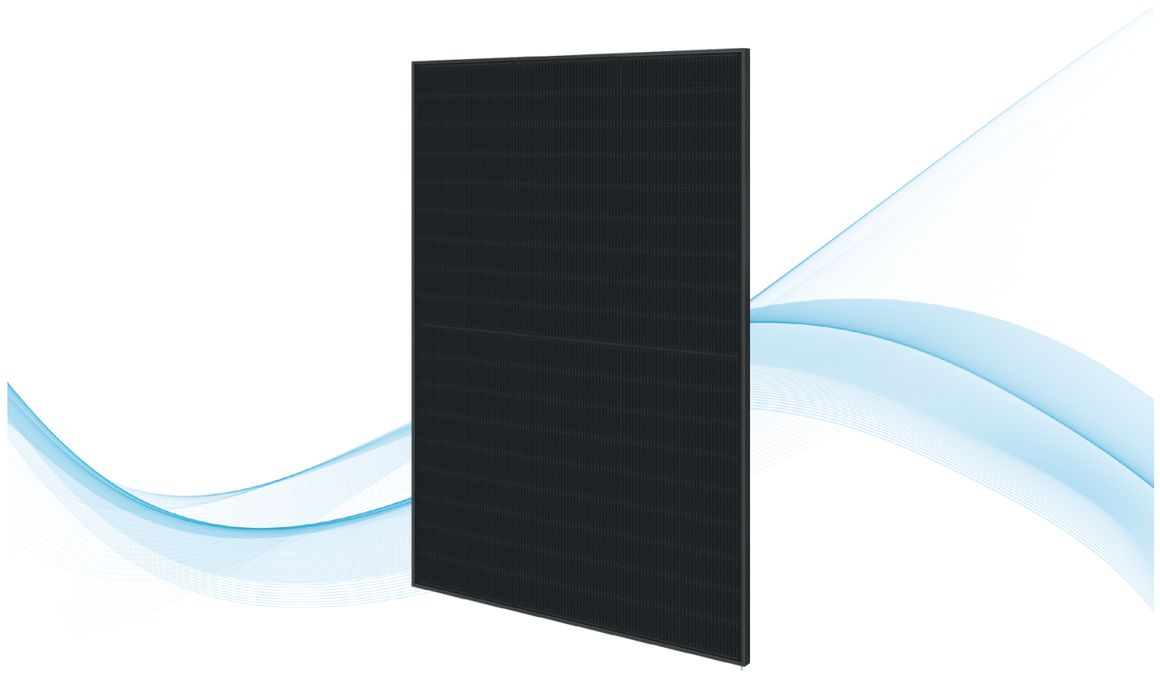
PV-7

# HD HYUNDAI SOLAR MODULE

## NF(BK) Series

### Premium N-Type TOPCon Module

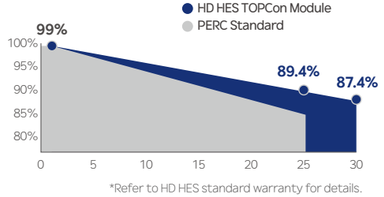
HiN-T430NF(BK) I HiN-T435NF(BK) I HiN-T440NF(BK)




22.53% High Efficiency | High-End TOPCon Technology | Higher Bifaciality | Long-Term Reliability | Compatible with Carport Applications | For Residential (Full Black Design)

### HD Hyundai's Warranty Provisions

- 25 YEARS • 25-Year Product Warranty
  - Materials and workmanship
- 30 YEARS • 30-Year Performance Warranty
  - First year degradation: 1%
  - Linear warranty after initial year: with 0.4%p annual degradation, 87.4% is guaranteed up to 30years




*Refer to HD HES standard warranty for details.

### Certification

ISO | SA | kiwa PVEL

- ISO 9001 : Quality management systems
- ISO 14001 : Environmental management systems
- ISO 45001 : Occupational health and safety management systems
- UL 61730: Photovoltaic (PV) module safety qualification (CSA)
- IEC 61701: Salt mist corrosion testing
- IEC 62716: Ammonia corrosion testing
- IEC 62804: Potential Induced Degradation (PID) testing
- IEC 60068-2-68: Sand and dust testing for environmental durability

### Electrical Characteristics

| HiN-TxxxNF(BK) | | HiN-T430NF(BK) | | HiN-T435NF(BK) | | HiN-T440NF(BK) | |
|---|---|---|---|---|---|---|---|
| Item | Unit | | BNPI | | BNPI | | BNPI |
| Nominal output (Pmax) | W | 430 | 476 | 435 | 482 | 440 | 488 |
| Open circuit voltage (Voc) | V | 38.4 | 38.4 | 38.6 | 38.6 | 38.8 | 38.8 |
| Short circuit current (Isc) | A | 14.25 | 15.79 | 14.32 | 15.87 | 14.39 | 15.94 |
| Voltage at Pmax (Vmpp) | V | 31.9 | 31.9 | 32.1 | 32.1 | 32.3 | 32.3 |
| Current at Pmax (Impp) | A | 13.48 | 14.94 | 13.56 | 15.02 | 13.63 | 15.10 |
| Module efficiency | % | 22.02 | | 22.28 | | 22.53 | |
| Power Class Sorting | W | 0 ~ +5 | | | | | |
| Temperature coefficient of Pmax | %/K | -0.30 | | | | | |
| Temperature coefficient of Voc | %/K | -0.25 | | | | | |
| Temperature coefficient of Isc | %/K | 0.046 | | | | | |
| Bifaciality | % | 80%±10% | | | | | |

*STC : Irradiance 1,000 W/m², cell temperature 25℃, AM=1.5 / Test uncertainty for Pmax ±3%; Voc ±3%; Isc ±3%
**The electrical properties of BNPI are measured under the irradiance corresponding to 1000 W/m² on the module front and 135 W/m² on the module rear.

| Additional Power Gain from rear side | | | | | |
|---|---|---|---|---|---|
| Pmpp gain | Pmpp[W] | Vmpp[V] | Impp[A] | Voc[V] | Isc[A] |
| 5% | 458 | 32.30 | 14.18 | 38.80 | 14.97 |
| 15% | 493 | 32.30 | 15.27 | 38.80 | 16.12 |
| 25% | 528 | 32.40 | 16.36 | 38.90 | 17.27 |

*Electrical characteristics with different rear power gain (reference to 440W)

### Mechanical Characteristics

| | |
|---|---|
| Dimensions | 1,722mm (L) x 1,134mm (W) x 30mm (H)<br>(67.8in x 44.6in x 1.2in) |
| Weight | 24.5 kg (50.01lbs) |
| Solar Cells | N-Type TOPCon, 108 (6x18) monocrystalline 16BB half-cut bifacial cells |
| Output Cables | Cable : (+)1,200mm(47.2in), (-)1,200mm(47.2in) / Customized length available<br>Connector : Stäubli MC4 genuine Connector / Compatible, IP68 |
| Junction Box | 3-part, 3 bypass diodes, IP68 rated |
| Construction | Front : 2.0mm(0.08in) semi-tempered solar glass with high transmittance and anti-reflective coating<br>Rear : 2.0mm(0.08in) semi-tempered solar glass |
| Frame | Anodized aluminum alloy |

### Installation Safety Guide

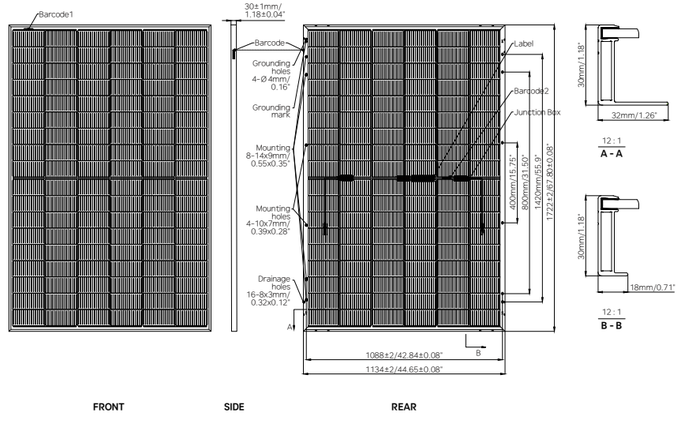
- Only qualified personnel should install or perform maintenance.
- Be aware of dangerous high DC voltage.
- Do not handle or install modules when they are wet.

| | |
|---|---|
| Nominal Module Operation Temperature | 44℃ ± 2℃ |
| Operating Temperature | -40℃~+85℃ |
| Maximum System Voltage | DC 1,500 V |
| Maximum Reverse Current | 30A |
| Maximum Test Load<br>*See Installation Manual | Front 5,400Pa<br>*Rear 5,400Pa |
| Fire Performance | Type 29 |

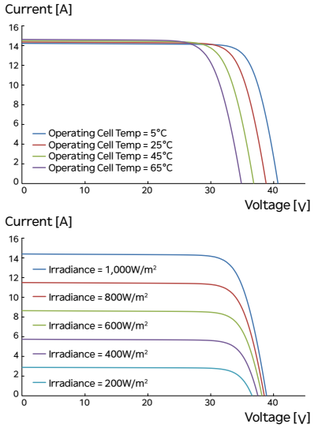
### Shipping Configurations

| | | | |
|---|---|---|---|
| Packing Direction | Vertical | Packing pallet weight (kg) | 912 |
| Container Size (HC) | 40' | Modules Per Pallet (pcs) | 36 |
| Pallets Per Container | 26 | Modules Per Container (pcs) | 936 |

### Module Diagram (unit : mm)




### I-V Curves (HiN-T440NF(BK))




**Sales & Marketing**
hes.sales@hd.com



HD HYUNDAI ENERGY SOLUTIONS

# Powerwall 3

## Power Everything

—
Powerwall 3 is a fully integrated solar and battery system, designed to accelerate the transition to sustainable energy. Customers can receive whole home backup, cost savings, and energy independence by producing and consuming their own energy while participating in grid services. Once installed, customers can manage their system using the Tesla App to customize system behavior to meet their energy goals.

Powerwall 3 achieves this by supporting up to 20 kW DC of solar and providing 11.5 kW AC of continuous power per unit. It has the ability to start heavy loads up to 185 A LRA, meaning a single unit can support the power needs of most homes. Powerwall 3 is designed for mass production, fast and efficient installations, easy system expansion, and simple connection to any electrical service.

2024

# Powerwall 3 Technical Specifications

### System Technical Specifications

| | |
|---|---|
| **Model Number** | 1707000-xx-y |
| **Nominal Grid Voltage (Input & Output)** | 120/240 VAC |
| **Grid Type** | Split phase |
| **Frequency** | 60 Hz |
| **Overcurrent Protection Device** | Configurable up to 60 A |
| **Solar to Battery to Home/Grid Efficiency** | 89% [1,2] |
| **Solar to Home/Grid Efficiency** | 97.5% [3] |
| **Supported Islanding Devices** | Backup Gateway 2, Backup Switch |
| **Connectivity** | Wi-Fi (2.4 and 5 GHz), Dual-port switched Ethernet, Cellular (LTE/4G [4]) |
| **Hardware Interface** | Dry contact relay, Rapid Shutdown (RSD) certified switch and 2-pin connector, RS-485 for meters |
| **AC Metering** | Revenue Grade (+/- 0.5%) |
| **Protections** | Integrated arc fault circuit interrupter (AFCI), Isolation Monitor Interrupter (IMI), PV Rapid Shutdown (RSD) using Tesla Mid-Circuit Interrupters |
| **Customer Interface** | Tesla Mobile App |
| **Warranty** | 10 years |

### Solar Technical Specifications

| | |
|---|---|
| **Maximum Solar STC Input** | 20 kW |
| **Withstand Voltage** | 600 V DC |
| **PV DC Input Voltage Range** | 60 — 550 V DC |
| **PV DC MPPT Voltage Range** | 150 — 480 V DC |
| **MPPTs** | 6 |
| **Maximum Current per MPPT ($I_{mp}$)** | 13 A [5] |
| **Maximum Short Circuit Current per MPPT ($I_{sc}$)** | 15 A [5] |

### Battery Technical Specifications

| | |
|---|---|
| **Nominal Battery Energy** | 13.5 kWh AC [2] |
| **Maximum Continuous Discharge Power** | 11.5 kW AC |
| **Maximum Continuous Charge Power** | 5 kW AC |
| **Output Power Factor Rating** | 0 - 1 (Grid Code configurable) |
| **Maximum Continuous Current** | 48 A |
| **Maximum Output Fault Current** | 10 kA |
| **Load Start Capability (1 s)** | 185 A LRA |
| **Power Scalability** | Up to 4 Powerwall 3 units supported |

[1] Typical solar shifting use case.
[2] Values provided for 25°C (77°F), at beginning of life. 3.3 kW charge/discharge power.
[3] Tested using CEC weighted efficiency methodology.
[4] Cellular connectivity subject to network service coverage and signal strength.
[5] Where the DC input current exceeds the MPPT rating, a jumper can be used to combine two MPPTs into a single input to intake DC current up to 26 A $I_{MP}$ / 30 A $I_{SC}$.

# Powerwall 3 Technical Specifications

## Environmental Specifications

| | |
|---|---|
| **Operating Temperature** | –20°C to 50°C (–4°F to 122°F) [6] |
| **Operating Humidity (RH)** | Up to 100%, condensing |
| **Storage Temperature** | –20°C to 30°C (–4°F to 86°F), up to 95% RH, non-condensing, State of Energy (SOE): 25% initial |
| **Maximum Elevation** | 3000 m (9843 ft) |
| **Environment** | Indoor and outdoor rated |
| **Enclosure Rating** | NEMA 3R |
| **Ingress Rating** | IP67 (Battery & Power Electronics)<br>IP45 (Wiring Compartment) |
| **Pollution Rating** | PD3 |
| **Operating Noise @ 1 m** | < 50 db(A) typical<br><62 db(A) maximum |

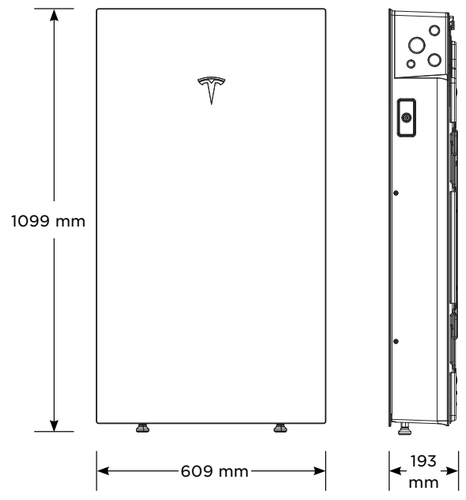
[6] Performance may be de-rated at operating temperatures above 40°C (104°F).

## Compliance Information

| | |
|---|---|
| **Certifications** | UL 1642, UL 1699B, UL 1741, UL 1741 SA, UL 1741 SB, UL 1741 PCS, UL 3741, UL 1973, UL 1998, UL 9540, IEEE 1547-2018, IEEE 1547.1, UN 38.3 |
| **Grid Connection** | United States |
| **Emissions** | FCC Part 15 Class B |
| **Environmental** | RoHS Directive 2011/65/EU |
| **Seismic** | AC156, IEEE 693-2005 (high) |
| **Fire Testing** | Meets the unit level performance criteria of UL 9540A |

## Mechanical Specifications

| | |
|---|---|
| **Dimensions** | 1099 x 609 x 193 mm (43.25 x 24 x 7.6 in) |
| **Weight** | 130 kg (287 lb) |
| **Mounting Options** | Floor or wall mount |



# Solar Shutdown Device Technical Specifications

—

The Solar Shutdown Device is a Mid-Circuit Interrupter (MCI) and is part of the PV system rapid shutdown (RSD) function in accordance with Article 690 of the applicable NEC. When paired with Tesla Solar Inverter, solar array shutdown is initiated by any loss of AC power.

| | Model | MCI-1 | MCI-2 |
|---|---|---|---|
| Electrical Specifications | Nominal Input DC Current Rating ($I_{MP}$) | 12 A | 13 A |
| | Maximum Input Short Circuit Current ($I_{SC}$) | 19 A | 17 A |
| | Maximum System Voltage (PVHCS) | 600 V DC | 1000 V DC[6] |
| RSD Module Performance | Maximum Number of Devices per String | 5 | 5 |
| | Control | Power Line Excitation | Power Line Excitation |
| | Passive State | Normally Open | Normally Open |
| | Maximum Power Consumption | 7 W | 7 W |
| | Warranty | 25 years | 25 years |
| Environmental Specifications | Operating Temperature | -40°C to 50°C (-40°F to 122°F) | -45°C to 70°C (-49°F to 158°F) |
| | Storage Temperature | –30°C to 70°C (–22°F to 158°F) | –30°C to 70°C (–22°F to 158°F) |
| | Enclosure Rating | NEMA 4X / IP65 | NEMA 4X / IP65 |
| Mechanical Specifications | Electrical Connections | MC4 Connector | MC4 Connector |
| | Housing | Plastic | Plastic |
| | Dimensions | 125 x 150 x 22 mm (5 x 6 x 1 in) | 173 x 45 x 22 mm (6.8 x 1.8 x 1 in) |
| | Weight | 350 g (0.77 lb) | 120 g (0.26 lb) |
| | Mounting Options | ZEP Home Run Clip<br>M4 Screw (#10)<br>M8 Bolt (5/16")<br>Nail / Wood screw | Wire Clip |
| Compliance Information | Certifications | UL 1741 PVRSE, UL 3741, PVRSA (Photovoltaic Rapid Shutdown Array) | |
| | RSD Initiation Method | PV System AC Breaker or Switch | |

[6]Maximum System Voltage is limited by Tesla Solar Inverter to 600 V DC.

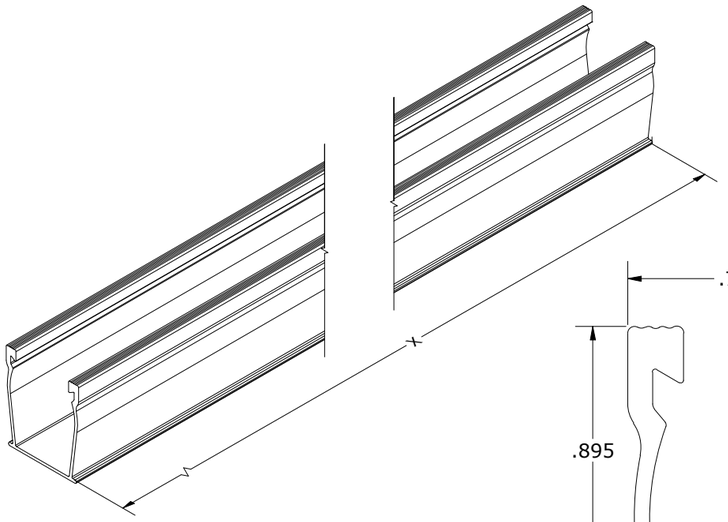
## UL 3741 PV Hazard Control (and PVRSA) Compatibility

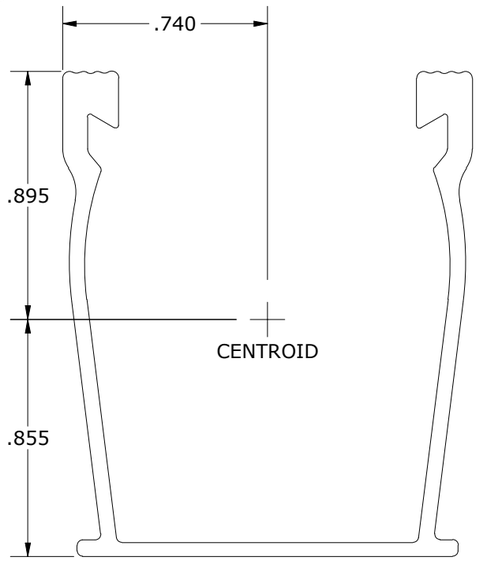
The following categories of solar module meet the UL 3741 PVHCS listing when installed with Tesla Solar Inverter and Solar Shutdown Devices.

| | |
|---|---|
| Tesla Solar Roof | PV Hazard Control System: BIPV compliance document |
| Tesla or Hanwha (Q.Peak Duo BLK or BLK-G6+) Modules certified for use with ZEP racking | PV Hazard Control System: ZS PVHCS compliance document |
| Other module and racking combinations | PV Hazard Control System: Generic PV Array compliance document |

| DESCRIPTION: | DOC NUMBER: | |
|---|---|---|
| SNAPNRACK, TDS, UR-45 RAIL (USA) | SNR-DC-01451 | SnapNrack® |
| PART NUMBER(S): | DRAWN BY: | |
| 232-10095-USA, 232-10096-USA | H.WULFEKOETTER | SNR SOLAR LLC<br>775 FIERO LANE, SUITE 200<br>SAN LUIS OBISPO, CA 93401 USA<br>EMAIL: CONTACT@SNAPNRACK.COM |
| UNITS: IN, LB, DEG [MM, KG, DEG] / SHEET: 1:1 | REV: A / DATE: 11/15/2024 |  |

| UR-45 RAIL PROPERTIES | | |
|---|---|---|
| SKU | FINISH | RAIL LENGTH (X) |
| 232-10095-USA | MILL | 172 in |
| 232-10096-USA | BLACK | 172 in |






| SECTION PROPERTIES | |
|---|---|
| A | 0.319 in² |
| Ixx | 0.134 in⁴ |
| Iyy | 0.121 in⁴ |
| Sx (TOP) | 0.152 in³ |
| Sx (BOT) | 0.156 in³ |
| Sy (LEFT) | 0.164 in³ |
| Sy (RIGHT) | 0.164 in³ |

| | |
|---|---|
| MATERIALS: | 6005-T5 ALUMINUM |
| DESIGN LOAD (LBS): | N/A |
| ULTIMATE LOAD (LBS): | N/A |
| TORQUE SPECIFICATION: | N/A FT-LBS |
| CERTIFICATION: | UL 2703, FILE E359313, DOMESTIC CONTENT COMPLIANT |
| WEIGHT (LBS): | 5.55 |

April 18, 2025

SnapNrack
775 Fiero Lane, Ste. 200
San Luis Obispo, CA 93401
TEL: (877) 732-2860

Attn.: SnapNrack - Engineering Department

Re: SnapNrack pre-engineered PV racking systems:

- UR45 Railed System (Report # 2025-00538)
- TopSpeed Original Rail-less System (Report # 2022-02141.08)
- Topspeed Universal Rail-less System (Report # 2025-02168)

Subject: Engineering certification for the State of Florida.

PAUL K. ZACHER LICENSE No. 73522 STATE OF FLORIDA PROFESSIONAL ENGINEER EXP. 02/28/2027

THIS ITEM HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY PAUL K. ZACHER, PE ON USING A SHA-1 AUTHENTICATION CODE.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SHA-1 AUTHENTICATION CODE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

PZSE, Inc. - Structural Engineers has provided engineering and span tables as presented in the above referenced reports. All information, data, and analysis therein are based on, and comply with, the following building codes and typical specifications:

Building Codes:

1. ASCE/SEI 7-10, 7-16 & 7-22 Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers
2. 2023 Florida Building Code, 7th Edition and 2017 Florida Building Code 6th Edition
3. 2023 Florida Residential Code, 7th Edition and 2017 Florida Residential Code 6th Edition
4. AC428 Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012, by ICC-ES
5. Aluminum Design manual 2020, by The Aluminum Association, Inc.
6. ANSI/AWC NDS-2018 & 2015, National Design Specification for Wood Construction, by the American Wood Council

This letter certifies that the design criteria and design methodology for the SnapNrack product span tables are in compliance with the above codes. Please refer to the system specific Engineering Certification Reports (listed above) for system specific design criteria and limitations.

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

Prepared by:
PZSE, Inc. – Structural Engineers
Roseville, CA

snapnrack.com

# Certification Details

SnapNrack Ultra Rail system has been evaluated by Underwriters Laboratories (UL) and Listed to UL/ANSI Standard 2703 for Grounding/Bonding, Mechanical Loading, and Fire Classification.

## Grounding/Bonding

The Ultra Rail system has been designed in compliance with UL Standard 2703 Section 9.1 Exception, which permits accessible components that **are not part** of the fault current ground path to **not be electrically bonded** to the mounting system (e.g. roof attachments, array skirt, etc.). For more details on the integrated grounding functionality see the Grounding Specifications section.

This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. See the Grounding Specifications for the list of modules tested with the Ultra Rail system for integrated grounding.

Ground Lugs have been evaluated to both UL 467 and UL 2703 Listing requirements.

Ultra Rail has been listed with a number of Module Level Power Electronic (MLPE) devices. A complete list can be found in the Grounding Specifications section.

The mounting system Bonding Listing is only valid when installed with a Non-Separately Derived PV system. The PV system is required to have a direct electrical connection to another source, such as connecting to the grid via a grid interactive inverter.

**SnapNrack recommends that bare copper never come into contact with aluminum.**

## Mechanical Loading

The Ultra Rail system is Listed for mechanical loading for different load ratings depending on the mounting configuration and PV module installed. For more details on the mechanical loading details see the Mechanical Loading Specifications section.

SnapNrack engineered systems should only be used with SnapNrack components and hardware. Any application outside of those specified in this Installation Manual and the Structural Engineering Report may void the warranty and structural certification could become invalid.

If the module clamps have been engaged and need to be loosened and reengaged, SnapNrack recommends moving the module frame 3mm to engage the bonding pin in a new location.

The UL Listing covers mechanical load ratings for the various span lengths, module orientations and positive, negative, and side load ratings. These values can be found in the Mechanical Loading Specifications section.

SnapNrack recommends a periodic re-inspection of the completed installation for loose components, loose fasteners, and any corrosion, such that if found, the affected components are to be immediately replaced.

## Fire

The Ultra Rail system has been evaluated for a Class A System Fire Classification for a Steep-Sloped Roof (≥ 2:12 pitch) using Type 1 and Type 2 modules. In order to maintain the System Classification, modules are clamped to the mounting rails between 0 and 12 inches from the top and bottom edges of the module.

The Ultra Rail system has been evaluated for a Class A System Fire Classification for a Low-Sloped Roof (< 2:12 pitch) using Type 1 and Type 2 modules. In order to maintain the System Classification, modules are clamped to the mounting rails between 0 and 16.3 inches from the top and bottom edges of the module.

The optional Array Skirt accessory has also been evaluated and the Ultra Rail system will maintain the Class A System Fire Classification detailed above if installed with the Skirt.

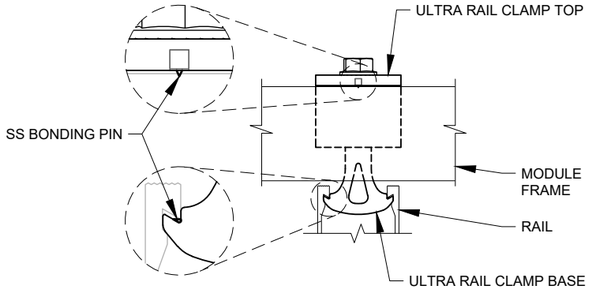
Because the system was tested at 5 inches above the test roof fixture Ultra Rail can be installed without any height restrictions and will maintain the Class A System Fire Classification. See Rail Installation section for potential module-specific height restrictions due to module temperature.

# Grounding Specifications

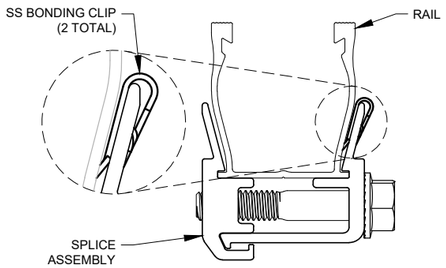
snapnrack.com

## System Bonding Methods

1. SnapNrack Ultra Rail Mid Clamp
2. SnapNrack Ultra Rail End Clamp
3. SnapNrack Mid Clamp
4. SnapNrack Adjustable End Clamp
5. SnapNrack UR-40 & UR-45 Rail Splice
6. SnapNrack UR-60 Rail Splice

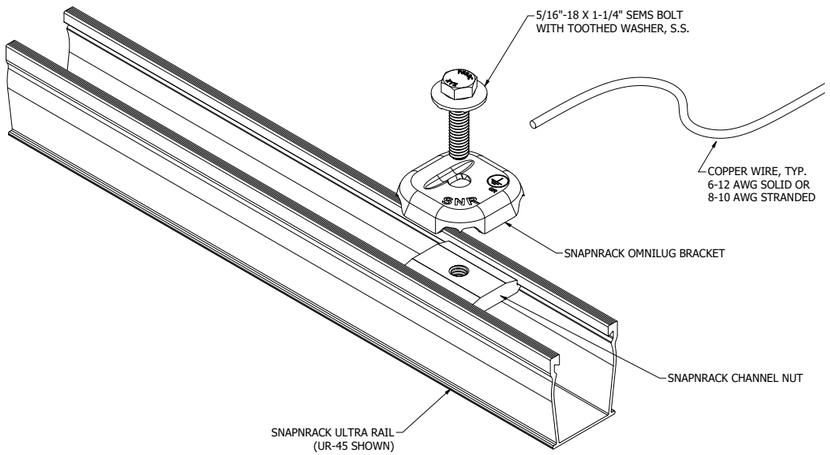



**Note:**
SnapNrack module clamps contain a SnapNrack Channel Nut with integral bonding clips or pins in assembly to properly bond the system (except Universal End Clamps).




**Note:**
SnapNrack Ultra Rail Splices contain integral bonding clips in assembly to properly bond the system.

## SnapNrack OmniLug Assembly

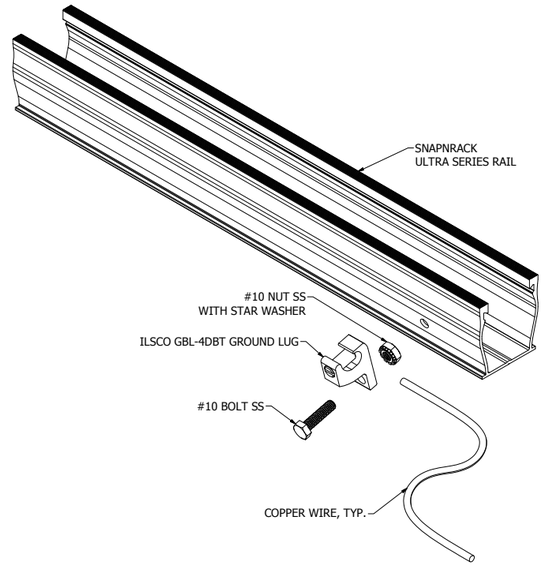




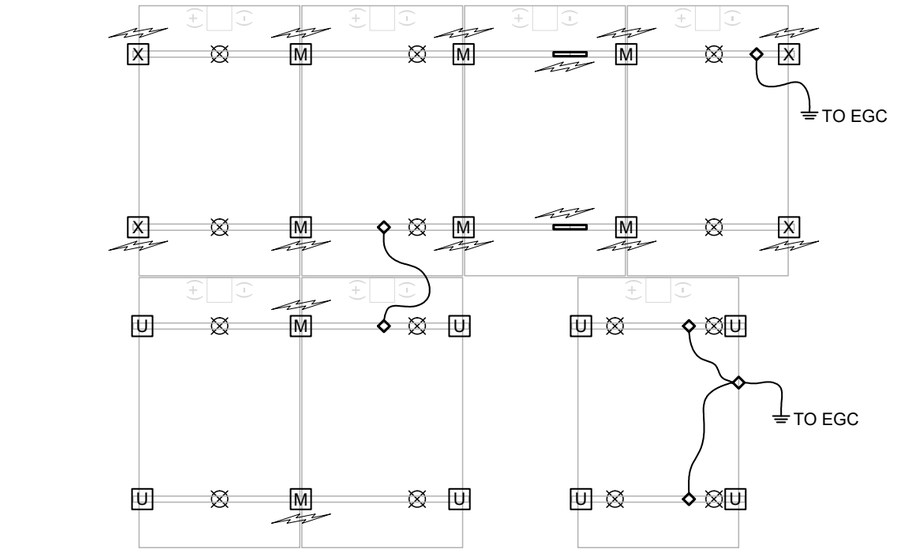

# Grounding Specifications

snapnrack.com

## Ilsco Lay-in Lug Assembly




## Ground Path Details



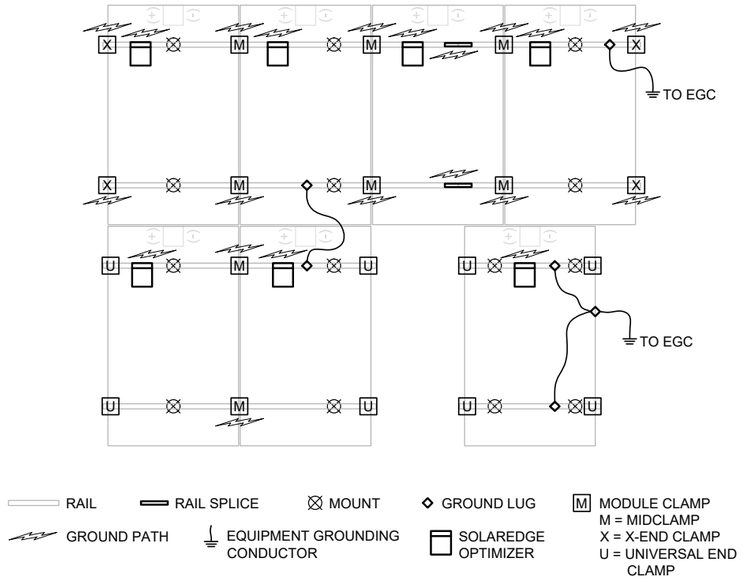

RAIL — RAIL SPLICE — MOUNT — GROUND LUG — M MODULE CLAMP (M = MIDCLAMP, X = X-END CLAMP, U = UNIVERSAL END CLAMP)

GROUND PATH — EQUIPMENT GROUNDING CONDUCTOR

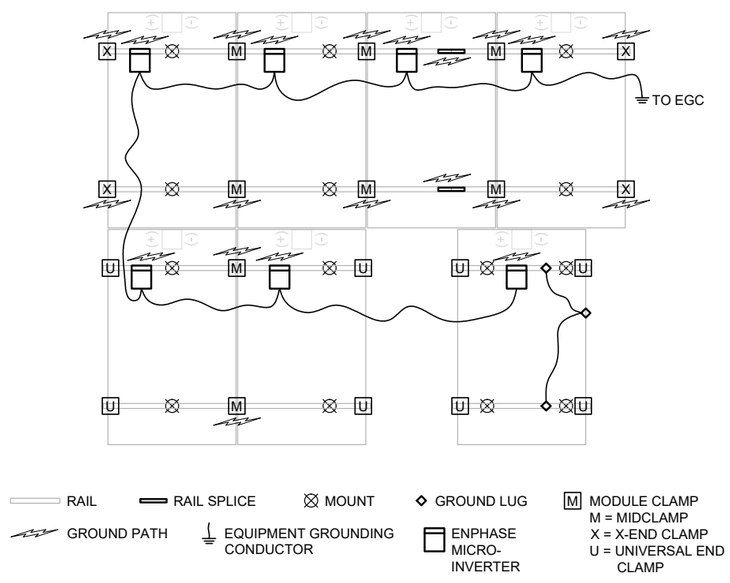
# Grounding Specifications

snapnrack.com

## Ground Path Details - SolarEdge




## Ground Path Details - Enphase

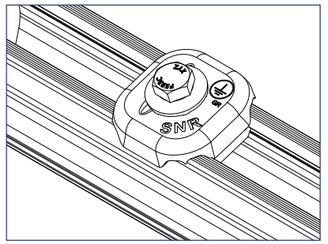





# Grounding Specifications

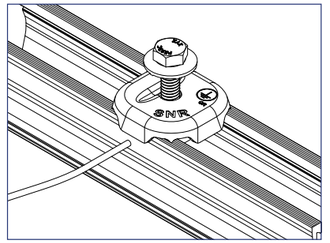
snapnrack.com

## INSTALLATION INSTRUCTIONS - SNAPNRACK OMNILUG



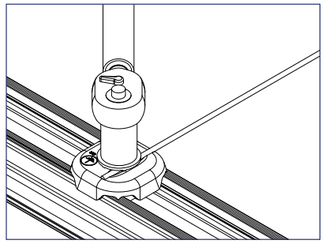

1) Snap the SnapNrack OmniLug into the rail channel on **one rail per module row**.

**Install Note:**
SnapNrack OmniLug may be used in side or top channel, and may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.



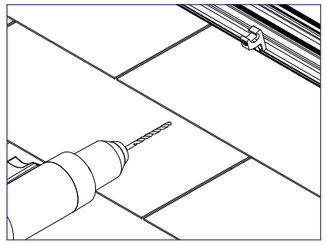

2) Place grounding conductor into slot underneath the washer.

**Install Note:**
SnapNrack OmniLug is Listed for use with 6-12 AWG solid or 8-10 AWG stranded copper conductors.



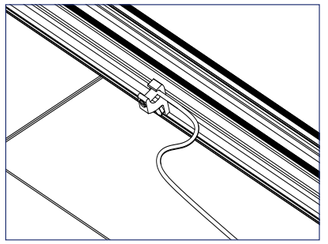
3) Tighten hardware to 130 in-lbs.

## INSTALLATION INSTRUCTIONS - ILSCO LAY-IN LUG

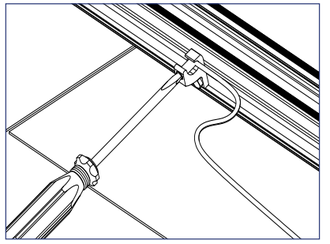


1) Drill and deburr a 1/4" hole in the back side of the rail for the Ilsco lug to attach to, place the bolt through the hole, and attach the lug assembly on **one rail per module row**.

**Install Note:**
Torque rail connection to 35 in-lbs.



2) Place grounding conductor into slot.

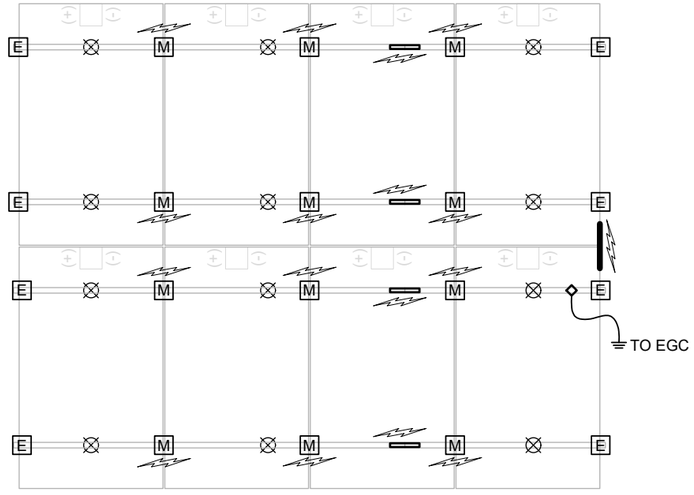


3) Tighten set screw per Ilsco's recommendation (see below).

**Install Note:**
Torque set screw to 20 in-lbs for #10-#14 solid and stranded copper, 25 in-lbs for #8 stranded copper, and 35 in-lbs for #4-#6 stranded copper.

**Note:**
- System has been evaluated to a maximum overcurrent device (OCD) protection level of 20 Amps.
- Universal End Clamp (UEC) does not bond module to rail. Be sure to separately ground any modules that are only secured by UECs, especially during servicing.
- SnapNrack recommends that bare copper never come into contact with aluminum.
- SnapNrack OmniLug: torque bolt to 130 in-lbs. The Ground Lug may be used in side or top channel. It may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.
- Grounding with a standard Ilsco GBL-4DBT Lug is a listed alternate and requires drilling of a hole in the rail.
- Ilsco hardware connection to rail: 5 ft-lbs. Torque for lug set screw: #10-#14 solid and stranded copper- 20 in-lbs, #8 stranded copper- 25 in-lbs, #4-#6 stranded copper- 35 in-lbs.

## Ground Path Details - DynoBond




RAIL
RAIL SPLICE
MOUNT
GROUND LUG
M MODULE CLAMP
M = MIDCLAMP
E = END CLAMP
DYNORAXX DYNOBOND
EQUIPMENT GROUNDING CONDUCTOR
GROUND PATH

**R/C (QIMS2), DynoRaxx (E357716) photovoltaic bonding jumper cat. no. DynoBond is an optional component that may be used with this system. The DynoBond jumper has been evaluated to provide module to module bonding. The DynoBond device attaches to the frame flange of adjacent modules.**



Grounding Specifications

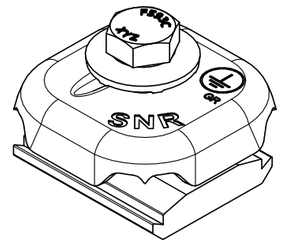
snapnrack.com

## GROUNDING MARKING DETAILS

**All components included in the Ultra Rail UL 2703 Listing for grounding/bonding are packaged and marked with the UL logo, SnapNrack File E359313, and "PV Mounting System"**

**The SnapNrack OmniLug is marked with the ground symbol**
**Ilsco Ground Lugs have green colored set screws or bolts to indicate connection to the grounding electrode conductor**

SnapNrack®
www.snapnrack.com
www.snapnrack.com/patent
242-02071-USA
**242-02071-USA**
SNAPNRACK,
ULTRA RAIL,
MID CLAMP,
BLACK, USA
SID # 0140
c UL us LISTED PV Mounting System
INSTALL MANUAL
08/20/24
QTY: 20




## INSTRUCTION FOR MAINTAINING THE GROUNDING BONDING WHEN REMOVING A MODULE FOR SERVICING

**CAUTION:** Module removal may disrupt the bonding path and could introduce the risk of electric shock. Additional steps may be required to maintain the bonding path. Modules should only be removed by qualified persons in compliance with the instructions in this manual.

Module removal is not presented as a frequently expected occurrence and will not be required as part of routine maintenance.

Scenarios that could result in a disruption of the bonding path are, for example irregularly-shaped arrays, arrays consisting of individual rows, and any other scenario where module removal could disrupt the bonding path.

In most cases, the removal of a module for servicing will not disturb or break grounding continuity because SnapNrack Ultra Rail systems are bonded through the rail. If a module is to be removed that will break continuity, these are the steps that must be taken to maintain a continuously bonded SnapNrack Ultra Rail system.

### Required Tools

- Socket Wrench
- Torque Wrench
- 1/2" Socket
- 7/16" Socket

### Required Materials

1. #10 Or Larger Bare Copper Conductor
2. SnapNrack SKU 242-10034
3. Ilsco Part No. SGB-4
4. DnoRaxx Dynobond™

S-5!®

The Right Way!®

## S-5-S Clamp

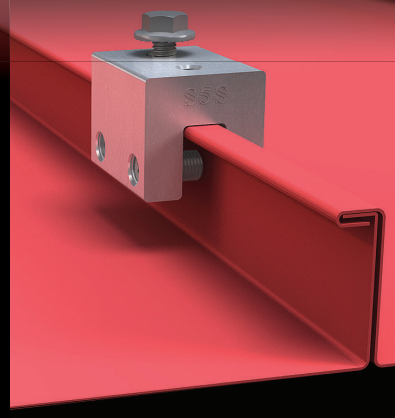
The S-5-S clamp was created specifically for popular snap-together profiles—including residential profiles by Taylor Metals and Easy Lock Standing Seam. For horizontal seams under .540 inches (like the Firestone UC4) the S-5-S or S-5-S Mini can be used to avoid the necessity of crimping the seam.

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.**

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

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

The right way to attach almost anything to metal roofs!

S-5!®

The Right Way!®

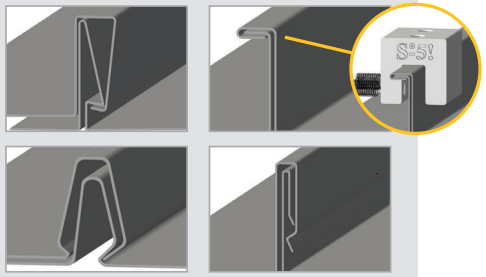
**The strength of the S-5-S clamp is in its simple design. The patented setscrews will slightly dimple the metal seam material but not pierce it—leaving roof warranties intact.**

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.

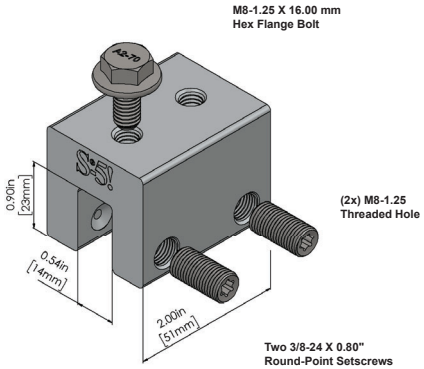
The S-5-S clamp has been tested for load-to-failure results on most major brands and profiles of standing seam roofing. The independent lab test data found at www.S-5.com can be used for load-critical designs and applications. S-5!® holding strength is unmatched in the industry. Profiles that are shaped 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.

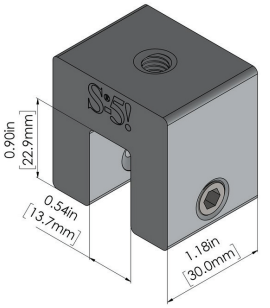
### Example Profiles



## 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.**



Distributed by