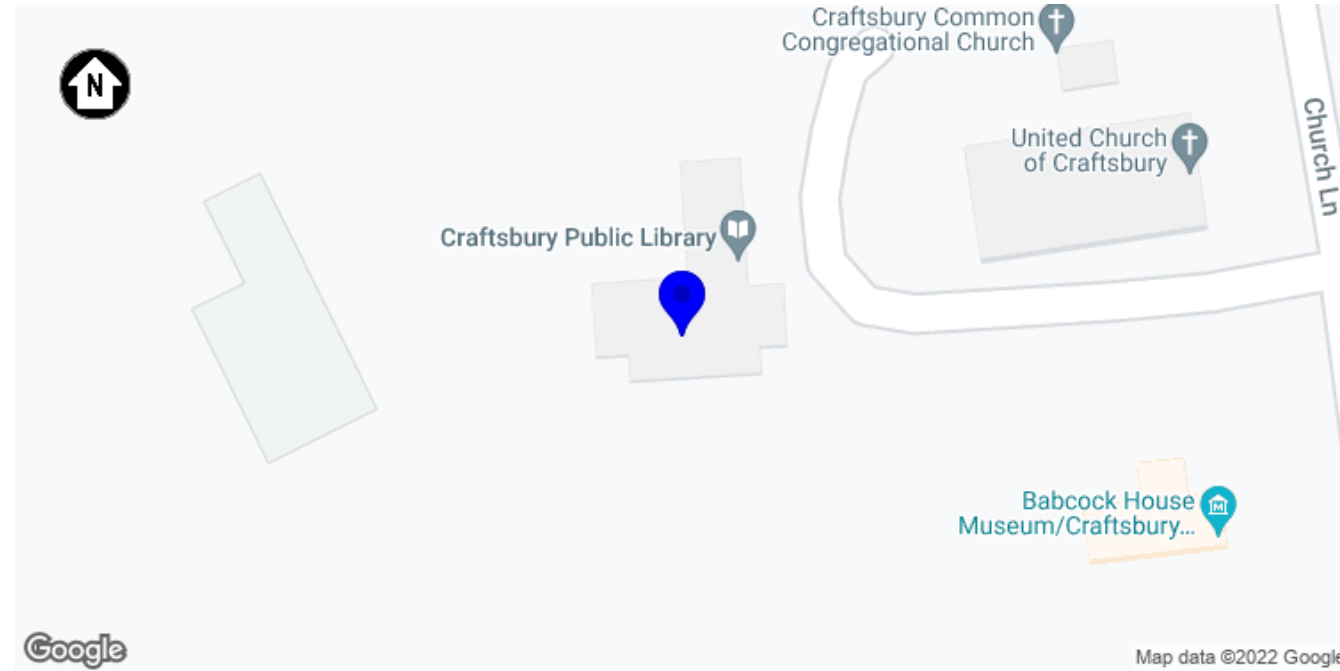


DIRECTORY OF PAGES	
PV-1	PROJECT SUMMARY
PV-2	SITE PLAN
PV-4	SAFETY LABELS
PV-5.1	ATTACHMENT PLAN 5.1
PV-5.2	ATTACHMENT PLAN 5.2
PV-6	ATTACHMENT DETAILS
PV-7	FIRE SAFETY PLAN
APPENDIX	ELECTRICAL CALCULATIONS
	MODULE DATASHEET
	PV HAZARD CONTROL SYSTEM DATASHEET
	DISCONNECT DATASHEETS
	DISCONNECT DATASHEETS
	INVERTER DATASHEET
	MOUNTING SYSTEM DATASHEET
	MOUNTING SYSTEM ENGINEERING LETTER
	UL 2703 CLASS A FIRE CERTIFICATION
	UL 2703 GROUND AND BONDING CERTIFICATION
	ANCHOR DATASHEET



1 PLOT
PV-1 SCALE: NTS



2 LOCALE
PV-1 SCALE: NTS

PROJECT DETAILS	
PROPERTY ADDRESS	12 CHURCH LN, CRAFTSBURY, VT 05827 US
ZONING	RESIDENTIAL
USE AND OCCUPANCY CLASSIFICATION	ONE- OR TWO-FAMILY DWELLING GROUP (GROUP R3)
UTILITY COMPANY	VERMONT ELECTRIC COOPERATIVE, INC
ELECTRICAL CODE	2017 NEC (NFPA 70)
FIRE CODE	2015 NFPA 1
OTHER BUILDING CODES	IBC 2015 IPC 2018

CONTRACTOR INFORMATION	
COMPANY	VINCE O'CONNELL ACCOUNT
ADDRESS	PO BOX 48, CRAFTSBURY COMMON, VT 05827
CONTRACTOR SIGNATURE	

SCOPE OF WORK

THIS PROJECT INVOLVES THE INSTALLATION OF A GRID-INTERACTIVE PV SYSTEM. PV MODULES WILL BE MOUNTED USING A PREENGINEERED MOUNTING SYSTEM. THE MODULES WILL BE ELECTRICALLY CONNECTED WITH DC TO AC POWER INVERTERS AND INTERCONNECTED TO THE LOCAL UTILITY USING MEANS AND METHODS CONSISTENT WITH THE RULES ENFORCED BY THE LOCAL UTILITY AND PERMITTING JURISDICTION.

THIS DOCUMENT HAS BEEN PREPARED FOR THE PURPOSE OF DESCRIBING THE DESIGN OF A PROPOSED PV SYSTEM WITH ENOUGH DETAIL TO DEMONSTRATE COMPLIANCE WITH APPLICABLE CODES AND REGULATIONS. THE DOCUMENT SHALL NOT BE RELIED UPON AS A SUBSTITUTE FOR FOLLOWING MANUFACTURER INSTALLATION INSTRUCTIONS. THE SYSTEM SHALL COMPLY WITH ALL MANUFACTURERS LISTING AND INSTALLATION INSTRUCTIONS, AS WELL AS ALL APPLICABLE CODES. NOTHING IN THIS DOCUMENT SHALL BE INTERPRETED IN A WAY THAT OVERRIDES THEM. CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF ALL CONDITIONS, DIMENSIONS, AND DETAILS IN THIS DOCUMENT.

SYSTEM DETAILS	
DESCRIPTION	NEW GRID-INTERACTIVE PV SYSTEM WITH NO ENERGY STORAGE
DC RATING OF SYSTEM	9.66KW
AC RATING OF SYSTEM	9.00KW
AC OUTPUT CURRENT	37.5A
INVERTER(S)	1 X SOL-ARK 12K-P
MODULE	LONGI SOLAR LR4-60HPB-345M
ARRAY WIRING	(2) STRINGS OF 7 (MPPT A) (2) STRINGS OF 7 (MPPT B)

INTERCONNECTION DETAILS	
POINT OF CONNECTION	NEW LOAD-SIDE AC CONNECTION PER NEC 705.12(B)(2)(3)(B) AT MSP
UTILITY SERVICE	120/240V 1Φ
LOCATION	MAIN SERVICE PANEL W/200A BUSBAR 175A MCB (DERATED)

SITE DETAILS	
ASHRAE EXTREME LOW	-28°C (-18°F)
ASHRAE 2% HIGH	29°C (84°F)
CLIMATE DATA SOURCE	MONTPELIER AIRPORT (KMPV)
RISK CATEGORY	II
WIND EXPOSURE CATEGORY	C

P-182569

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
CRAFTSBURY, VT 05827

PROJECT SUMMARY
DOC ID: 182569-225712-1
DATE: 12/27/22
CREATOR: V.O.
REVIEWER:

REVISIONS

PV-1

P-182569

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
CRAFTSBURY, VT 05827

SITE PLAN

DOC ID: 182569-225712-1

DATE: 12/27/22

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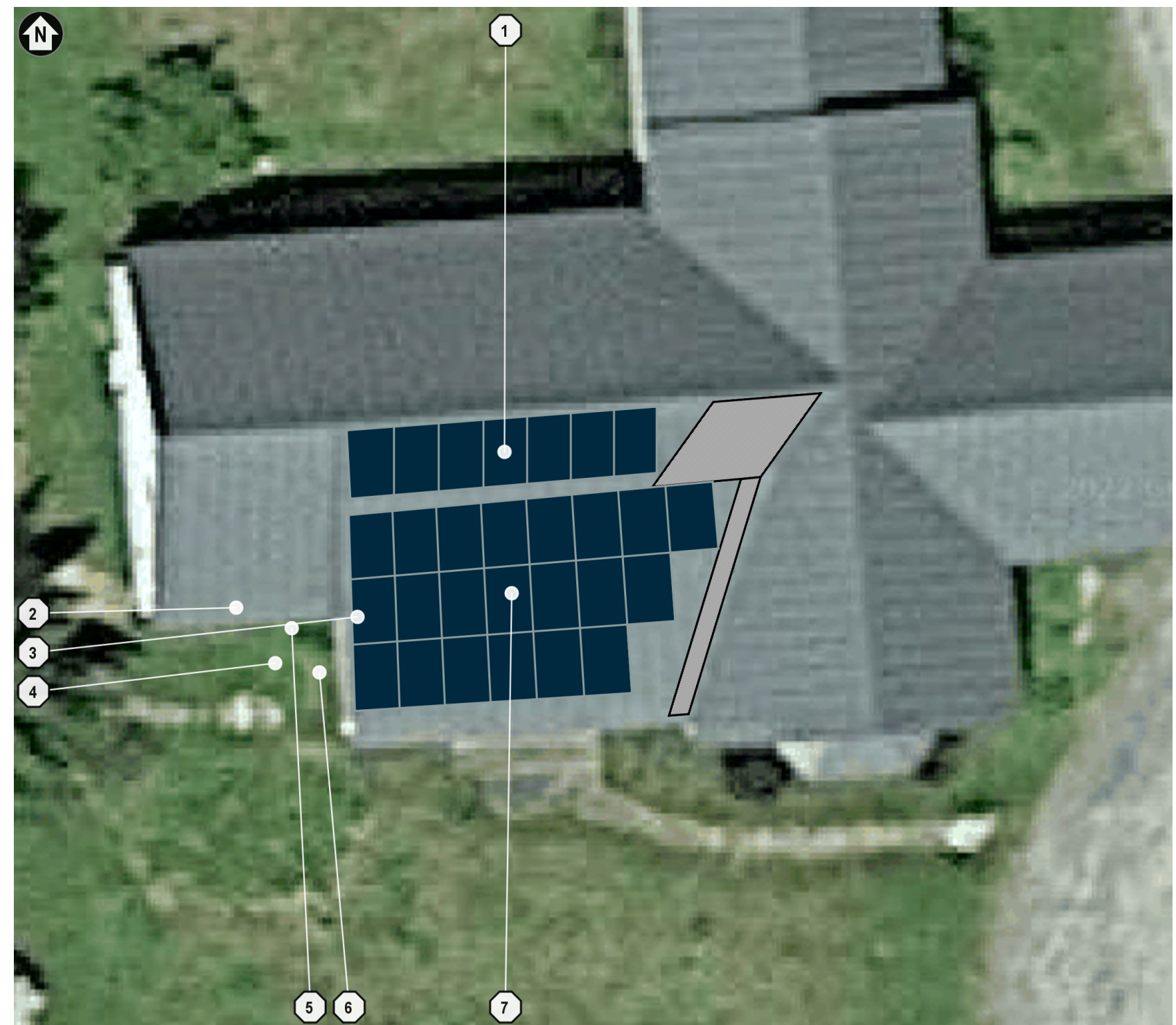
REVIEWER:

REVISIONS

PV-2

GENERAL NOTES	
1	EQUIPMENT LIKELY TO BE WORKED UPON WHILE ENERGIZED SHALL BE INSTALLED IN LOCATIONS THAT SATISFY MINIMUM WORKING CLEARANCES PER NEC 110.26.
2	CONTRACTOR SHALL USE ONLY COMPONENTS LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY FOR THE INTENDED USE.
3	CONTRACTOR IS RESPONSIBLE FOR FURNISHING ALL EQUIPMENT, CABLES, ADDITIONAL CONDUITS, RACEWAYS, AND OTHER ACCESSORIES NECESSARY FOR A COMPLETE AND OPERATIONAL PV SYSTEM.
4	WHERE DC PV SOURCE OR DC PV OUTPUT CIRCUITS ARE RUN INSIDE THE BUILDING, THEY SHALL BE CONTAINED IN METAL RACEWAYS, TYPE MC METAL-CLAD CABLE, OR METAL ENCLOSURES FROM THE POINT OF PENETRATION INTO THE BUILDING TO THE FIRST READILY ACCESSIBLE DISCONNECTING MEANS, PER NEC 690.31(G).
5	ALL EMT CONDUIT FITTINGS SHALL BE LISTED AS WEATHERPROOF FITTINGS AND INSTALLED TO ENSURE A RAINTIGHT FIT, PER NEC 358.42.

- ① (N) PROPOSED ROOF-MOUNTED PHOTOVOLTAIC ARRAY. 10:12 (40°) SLOPED ROOF, 7 PV MODULES (BLACK FRAME, BLACK BACKSHEET), 175° AZIMUTH
- ② (N) INVERTER, INDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT THROUGH THE INTERIOR OF THE BUILDING
- ③ (N) STRING COMBINER, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT OVER ROOF NO CLOSER THAN 0.5" ABOVE ROOF SURFACE
- ④ (N) VISIBLE, LOCKABLE, READILY-ACCESSIBLE AC DISCONNECT LOCATED WITHIN 10 FT OF UTILITY METER, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT THROUGH THE INTERIOR OF THE BUILDING
- ⑤ (N) DISCONNECT, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT THROUGH THE INTERIOR OF THE BUILDING
- ⑥ (N) PRODUCTION METER, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT THROUGH THE INTERIOR OF THE BUILDING
- ⑦ (N) PROPOSED ROOF-MOUNTED PHOTOVOLTAIC ARRAY. 4:12 (18°) SLOPED ROOF, 21 PV MODULES (BLACK FRAME, BLACK BACKSHEET), 176° AZIMUTH



1 SITE PLAN
PV-2 SCALE: 1" = 10'

DC RACEWAYS

1

C1 - STRING COMBINER
(MODEL NOT SPECIFIED)

3

SW1 - DISCONNECT
(EATON DG222URB)

3 5 6

SW2 - DISCONNECT
(EATON DG222NRB)

3 5 6 7

I1 - INVERTER
(SOL-ARK 12K-P)

3 4

MSP - MAIN SERVICE PANEL

2 5 6 8 9

10

1 SEE NOTE NO. 4 (DC RACEWAYS)

WARNING
PHOTOVOLTAIC POWER SOURCE

NEC690.31(G)(3) AND NFPA 111.12.2.1.3

3 EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT (C1, SW1, SW2, I1)

! WARNING !
ELECTRIC SHOCK HAZARD. TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.

NEC690.13(B)

4 DC DISCONNECT (MPPT CHANNEL A OF I1, MPPT CHANNEL B OF I1) (I1)

DIRECT-CURRENT PHOTOVOLTAIC POWER SOURCE
MAXIMUM VOLTAGE: 325V
MAX CIRCUIT-CURRENT: 34.2A

NEC690.53

5 AC SOLAR DISCONNECT (SW1, SW2, CB1 IN MSP)

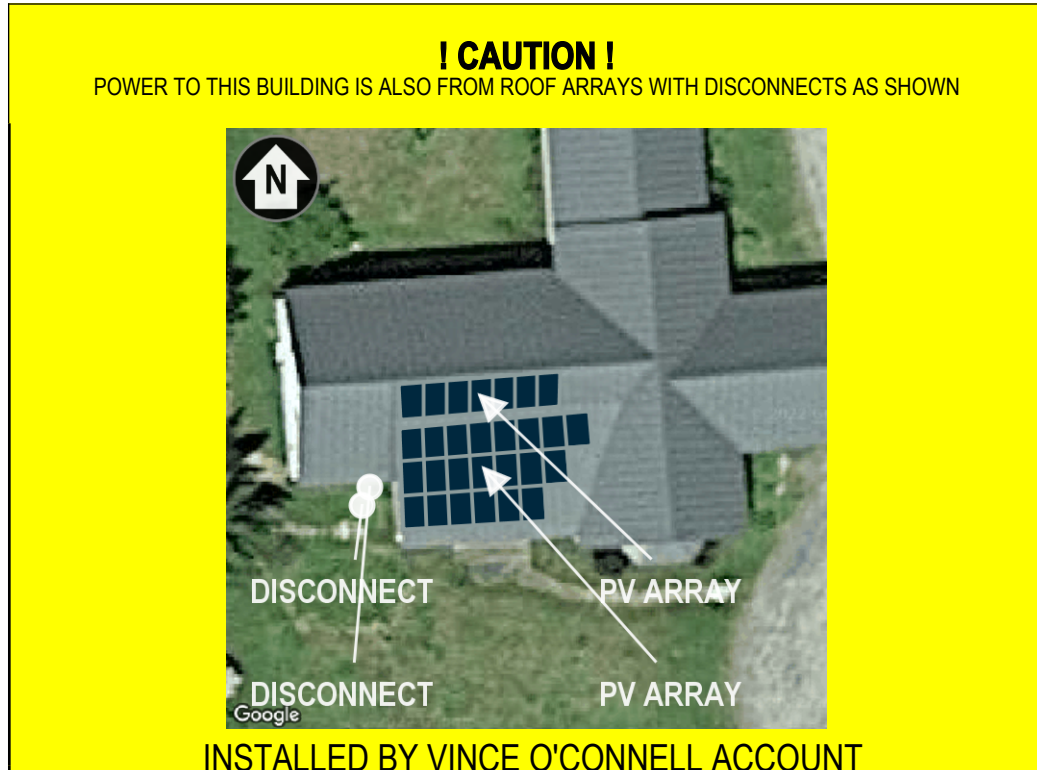
PV SYSTEM DISCONNECT

NEC690.13(B)

8 SOLAR BREAKER (MSP)

MAIN BREAKER HAS BEEN RESIZED TO 175 AMPS. DO NOT UPSIZE BREAKER.

2 POINT-OF-INTERCONNECTION OR AT MAIN SERVICE DISCONNECT (MSP)



NEC690.56(B),705.10

6 AC DISCONNECT (SW1, SW2, CB1 IN MSP)

MAXIMUM AC OPERATING CURRENT: 37.5A
MAXIMUM AC OPERATING VOLTAGE: 240V

NEC690.54

9 ANY AC ELECTRICAL PANEL THAT IS FED BY BOTH THE UTILITY AND THE PHOTOVOLTAIC SYSTEM (MSP)

! WARNING !
DUAL POWER SOURCE. SECOND SOURCE IS PHOTOVOLTAIC SYSTEM.

NEC705.12(B)(3)

7 SEE NOTE NO. 5 (SW2)

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

NEC690.56(C)(3)

10 SOLAR BREAKER (MSP)

! WARNING !
INVERTER OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE.

NEC705.12(B)(2)(3)(B)

LABELING NOTES

- 1 ALL PLAQUES AND SIGNAGE REQUIRED BY 2017 NEC AND 2015 NFPA 1 WILL BE INSTALLED AS REQUIRED.
- 2 LABELS, WARNING(S) AND MARKING SHALL COMPLY WITH ANSI Z535.4, WHICH REQUIRES THAT DANGER, WARNING, AND CAUTION SIGNS USED THE STANDARD HEADER COLORS, HEADER TEXT, AND SAFETY ALERT SYMBOL ON EACH LABEL. THE ANSI STANDARD REQUIRES A HEADING THAT IS AT LEAST 50% TALLER THAN THE BODY TEXT, IN ACCORDANCE WITH NEC 110.21(B).
- 3 A PERMANENT PLAQUE OR DIRECTORY SHALL BE INSTALLED PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS IF NOT IN THE SAME LOCATION IN ACCORDANCE WITH NEC 690.56(B).
- 4 LABEL(S) WITH MARKING, "WARNING PHOTOVOLTAIC POWER SOURCE," SHALL BE LOCATED AT EVERY 10 FEET OF EACH DC RACEWAY AND WITHIN ONE FOOT OF EVERY TURN OR BEND AND WITHIN ONE FOOT ABOVE AND BELOW ALL PENETRATIONS OF ROOF/CEILING ASSEMBLIES, WALLS AND BARRIERS. THE LABEL SHALL HAVE 3/8" TALL LETTERS AND BE REFLECTIVE WITH WHITE TEXT ON A RED BACKGROUND
- 5 LABEL(S) WITH MARKING, "RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM," SHALL BE LOCATED WITHIN 3FT OF RAPID SHUTDOWN SWITCH. THE LABEL SHALL HAVE 3/8" TALL LETTERS AND BE REFLECTIVE WITH WHITE TEXT ON A RED BACKGROUND

P-182569

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
CRAFTSBURY, VT 05827

SAFETY LABELS

DOC ID: 182569-225712-1

DATE: 12/27/22

CREATOR: V.O.

REVIEWER:

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PV-4

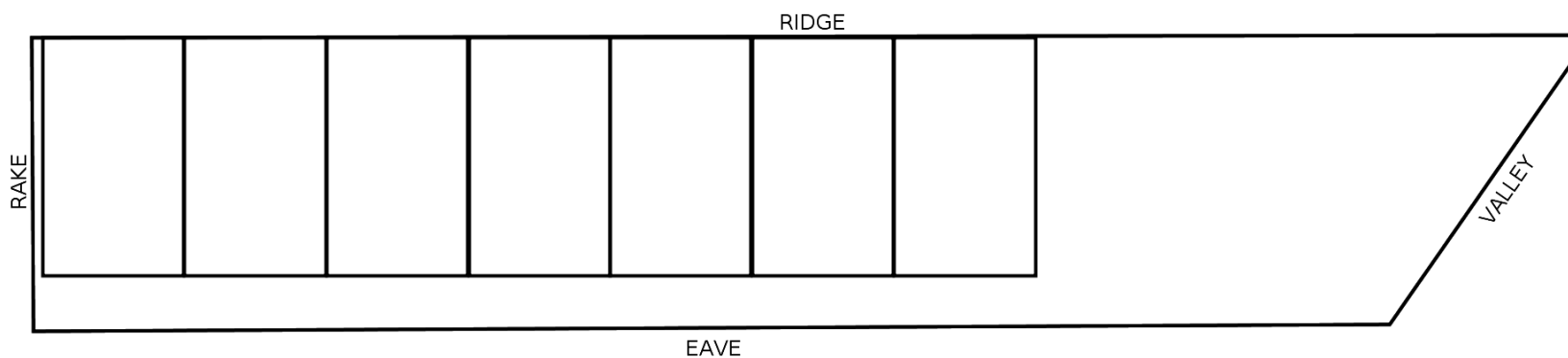
P-182569

ROOF PROPERTIES	
ROOF MATERIAL	STANDING SEAM METAL (18IN)
SLOPE	10/12 (39.8°)
MEAN ROOF HEIGHT	22.6FT
DECK SHEATHING	15/32" OSB
CONSTRUCTION	TRUSSES (4X10 TOP-CHORD), 32IN OC

MODULE MECHANICAL PROPERTIES	
MODEL	LONGI SOLAR LR4-60HPB-345M
DIMENSIONS (AREA)	69.9IN X 41.4IN X 1.4IN (20.1 SQ FT)
WEIGHT	44.1LB

MOUNTING SYSTEM PROPERTIES	
MAX. ALLOW. RAIL SPAN	74.0IN (ZONES 1, 2, AND 3)
MAX. MOUNT SPACING	36.0IN (ZONES 1, 2, AND 3)
MAX. ALLOW. CANTILEVER	29.6IN (ZONES 1, 2, AND 3)
GROUNDING AND BONDING	INTEGRAL GROUNDING CERTIFIED TO UL 2703 REQUIREMENTS

NOTES	
1	TRUSS LOCATIONS ARE APPROXIMATE. ACTUAL LOCATIONS MAY DIFFER AND CONTRACTOR MAY NEED TO ADJUST MOUNT LOCATIONS. IN NO CASE SHALL THE MOUNT SPACING EXCEED "MAX. MOUNT SPACING"



1 ATTACHMENT PLAN (ORTHOGONAL PROJECTION)
PV-5.1 SCALE: 3/16" = 1'

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
CRAFTSBURY, VT 05827

ATTACHMENT PLAN

DOC ID: 182569-225712-1

DATE: 12/27/22

CREATOR: V.O.

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REVISIONS

NO.	DESCRIPTION

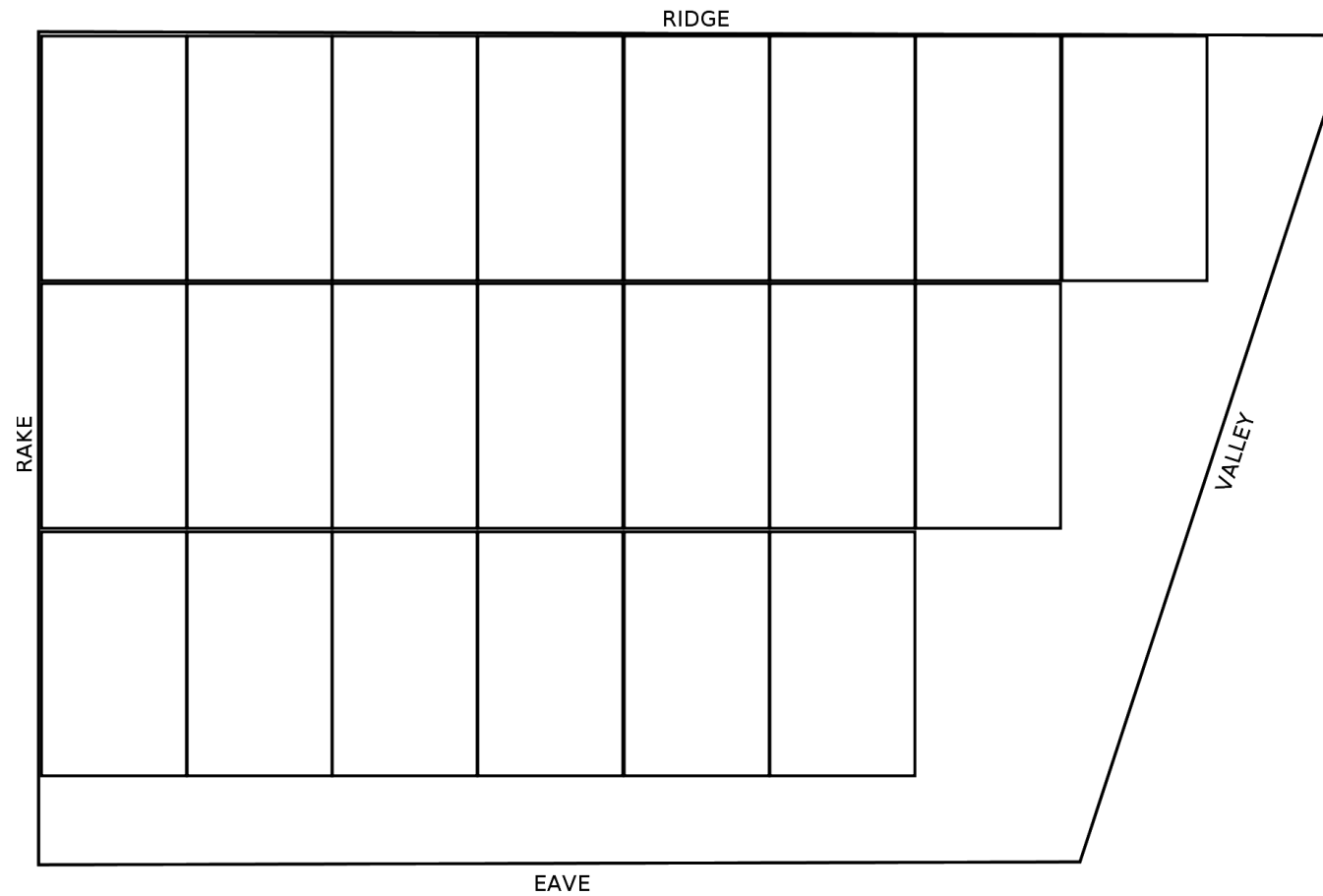
PV-5.1

ROOF PROPERTIES	
ROOF MATERIAL	STANDING SEAM METAL (18IN)
SLOPE	4/12 (18.4°)
MEAN ROOF HEIGHT	22.9FT
DECK SHEATHING	19/32" (5/8" NOM.) PLYWOOD
CONSTRUCTION	TRUSSES (4X10 TOP-CHORD), 32IN OC

MODULE MECHANICAL PROPERTIES	
MODEL	LONGI SOLAR LR4-60HPB-345M
DIMENSIONS (AREA)	69.9IN X 41.4IN X 1.4IN (20.1 SQ FT)
WEIGHT	44.1LB

MOUNTING SYSTEM PROPERTIES	
MAX. ALLOW. RAIL SPAN	74.0IN (ZONES 1, 2, AND 3)
MAX. MOUNT SPACING	36.0IN (ZONES 1, 2, AND 3)
MAX. ALLOW. CANTILEVER	29.6IN (ZONES 1, 2, AND 3)
GROUNDING AND BONDING	INTEGRAL GROUNDING CERTIFIED TO UL 2703 REQUIREMENTS

NOTES	
1	TRUSS LOCATIONS ARE APPROXIMATE. ACTUAL LOCATIONS MAY DIFFER AND CONTRACTOR MAY NEED TO ADJUST MOUNT LOCATIONS. IN NO CASE SHALL THE MOUNT SPACING EXCEED "MAX. MOUNT SPACING"



1 ATTACHMENT PLAN (ORTHOGONAL PROJECTION)
 PV-5.2 SCALE: 3/16" = 1'

P-182569

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
 CRAFTSBURY, VT 05827

ATTACHMENT PLAN

DOC ID: 182569-225712-1

DATE: 12/27/22

CREATOR: V.O.

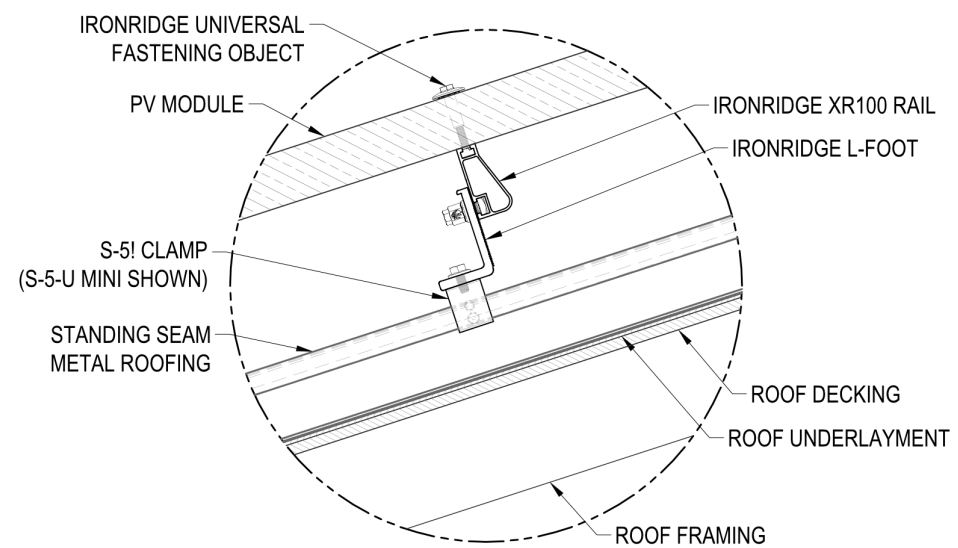
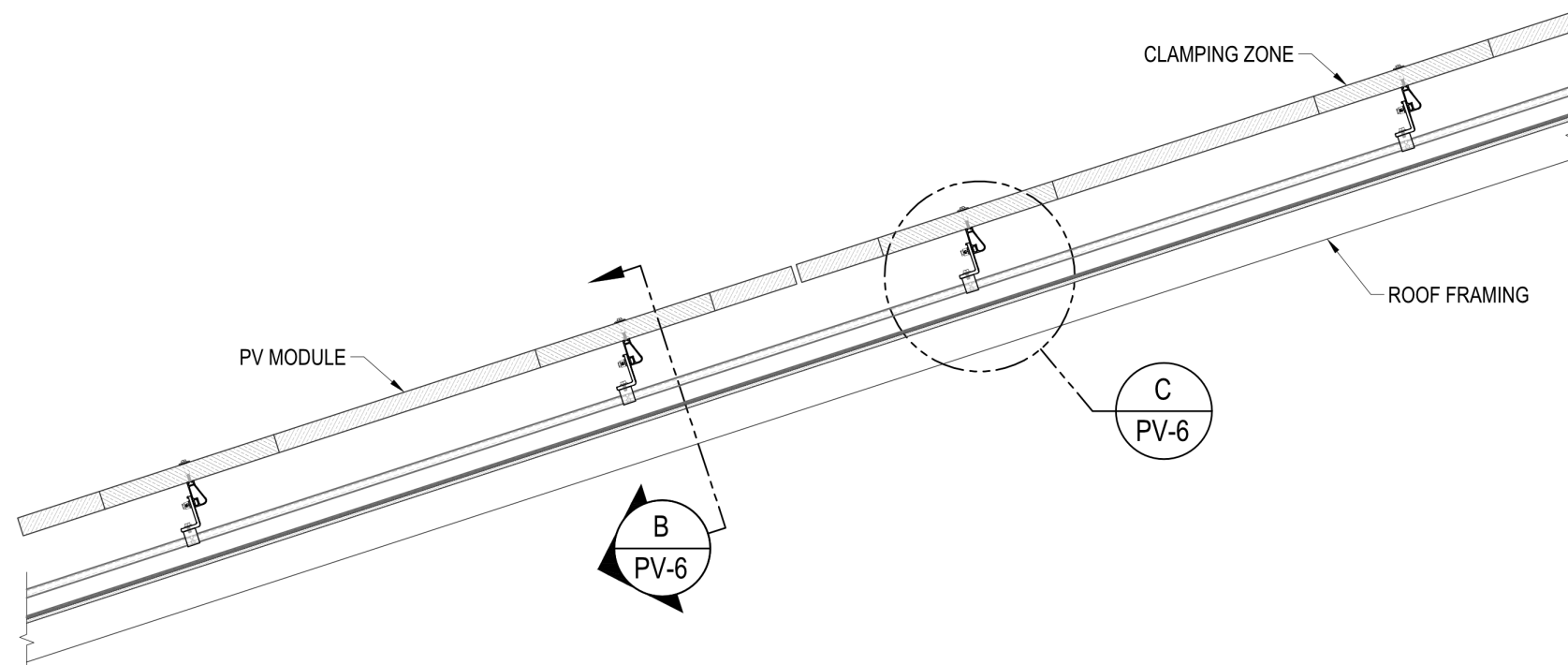
REVIEWER:

REVISIONS

PV-5.2

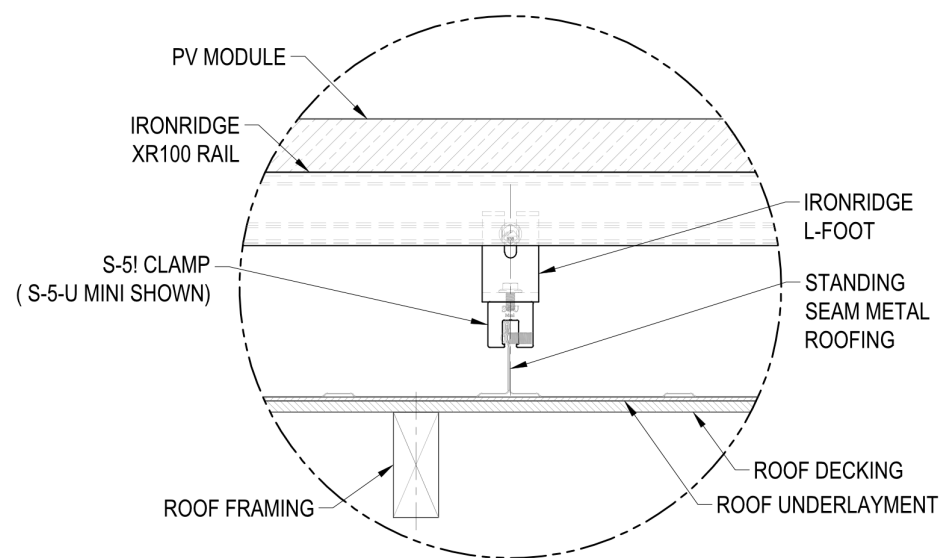
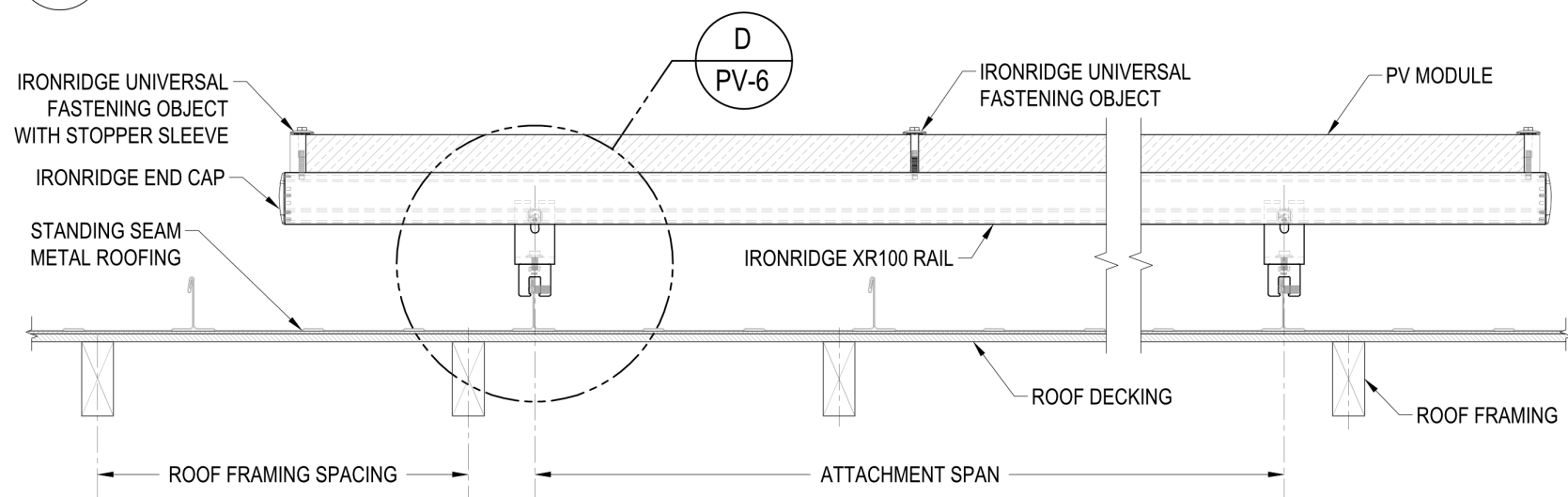
MOUNTING SYSTEM NOTES

- 1 FLASHING SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS.
- 2 IF THERE IS ANY CONFLICT BETWEEN WHAT IS DEPICTED HERE AND INSTRUCTIONS PROVIDED BY A MANUFACTURER, THE MANUFACTURER'S INSTRUCTIONS SHALL SUPERCEDE.



A RACKING ELEVATION (TRANSVERSE VIEW)
PV-6 SCALE: NTS

C ATTACHMENT DETAIL (TRANSVERSE VIEW)
PV-6 SCALE: NTS



B RACKING ELEVATION (LONGITUDINAL VIEW)
PV-6 SCALE: NTS

D ATTACHMENT DETAIL (LONGITUDINAL VIEW)
PV-6 SCALE: NTS

GRID-TIED SOLAR POWER SYSTEM

12 CHURCH LN
CRAFTSBURY, VT 05827

ATTACHMENT DETAILS

DOC ID: 182569-225712-1

DATE: 12/27/22

CREATOR: V.O.

REVIEWER:

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NO.	DESCRIPTION

PV-6

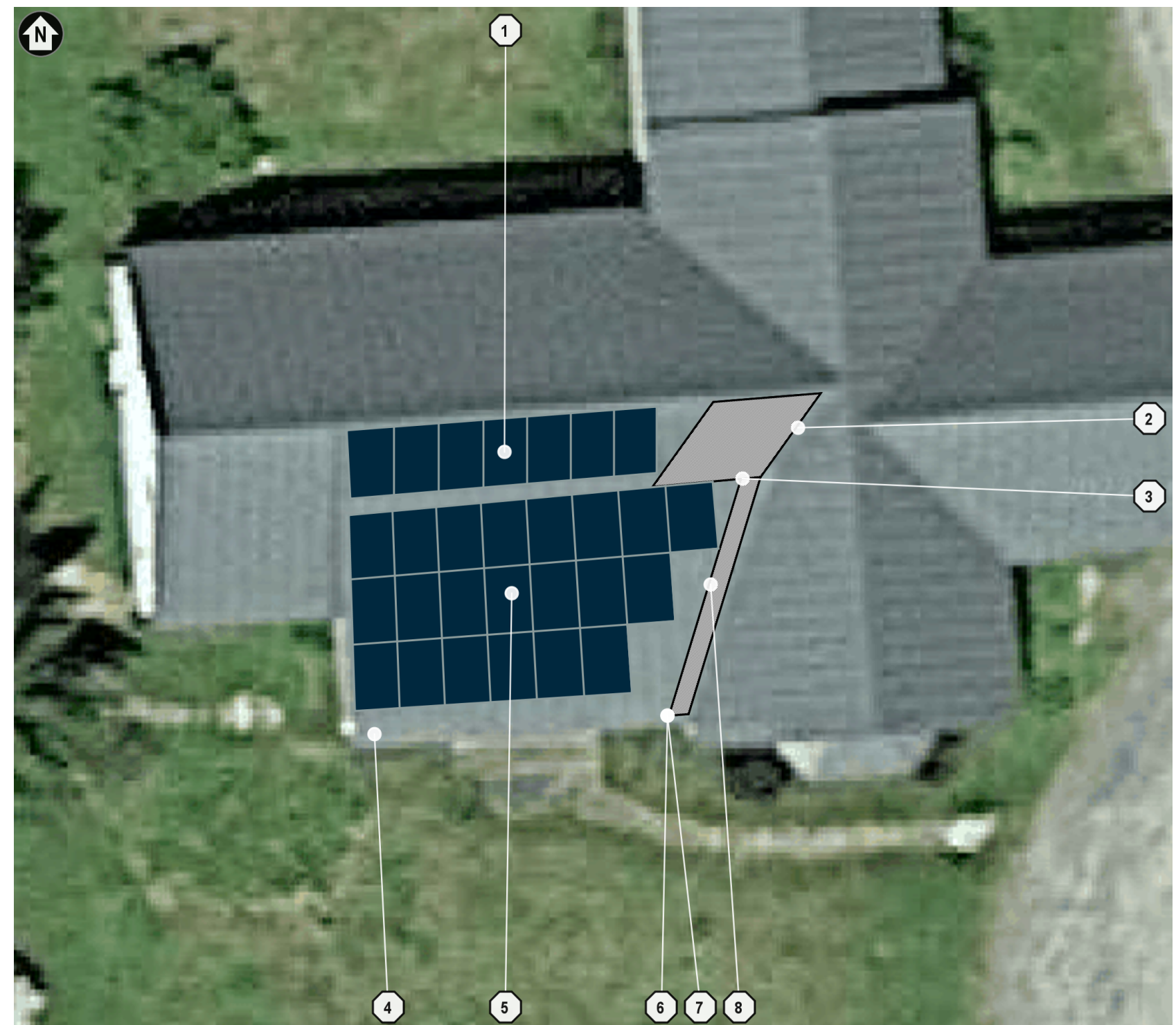
FIRE SAFETY PLAN

DOC ID: 182569-225712-1
DATE: 12/27/22
CREATOR: V.O.
REVIEWER:

REVISIONS	

GENERAL NOTES	
1	EXTERIOR-MOUNTED DC CONDUITS, WIRING SYSTEMS, AND RACEWAYS FOR PHOTOVOLTAIC CIRCUITS SHALL BE LOCATED AS CLOSE AS POSSIBLE TO THE RIDGE, HIP, OR VALLEY, AND FROM THE HIP OR VALLEY AS DIRECTLY AS POSSIBLE TO AN OUTSIDE WALL TO REDUCE TRIP HAZARDS AND MAXIMIZE VENTILATION OPPORTUNITIES (NFPA 1 11.12.2.2.4.1)
2	CONDUIT RUNS BETWEEN SUBARRAYS AND TO DC COMBINER BOXES SHALL BE DESIGNED TO TAKE THE SHORTEST PATH FROM THE ARRAY TO THE DC COMBINER BOX. (NFPA 1 11.12.2.2.4.2)
3	DC COMBINER BOXES SHALL BE LOCATED SO THAT THE CONDUIT RUNS ARE MINIMIZED IN THE PATHWAYS BETWEEN THE ARRAYS. (NFPA 1 11.12.2.2.4.3)
4	ROOF ACCESS POINTS SHALL BE DEFINED AS AREAS WHERE FIRE DEPARTMENT LADDERS ARE NOT PLACED OVER OPENINGS (WINDOWS OR DOORS), ARE LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION, AND ARE IN LOCATIONS WHERE THEY WILL NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS (TREE LIMBS, WIRES, OR SIGNS). (NFPA 1 11.12.2.2.1.3)
5	PHOTOVOLTAIC MODULES SHALL BE LOCATED NO CLOSER THAN 1-1/2 FEET TO A HIP OR VALLEY IF MODULES ARE TO BE PLACED ON BOTH SIDES OF THE HIP OR VALLEY. WHERE MODULES ARE LOCATED ON ONLY ONE SIDE OF A HIP OR VALLEY OF EQUAL LENGTH, THE PHOTOVOLTAIC MODULES SHALL BE ALLOWED TO BE PLACED DIRECTLY ADJACENT TO THE HIP OR VALLEY. (NFPA 1 11.12.2.2.1.3)
6	PHOTOVOLTAIC MODULES SHALL BE LOCATED NO LESS THAN 3 FT BELOW THE RIDGE. (NFPA 1 11.12.2.2.2)

- 1 PV MODULES INSTALLED ON ROOF WITH IRONRIDGE ROOF MOUNTING SYSTEM. THE MOUNTING SYSTEM IS UL 2703 CLASS A FIRE RATED ON A 10/12 SLOPED ROOF WHEN INSTALLED WITH TYPE 1 OR 2 MODULES. THE LONGI SOLAR LR4-60HPB-345M IS TYPE 1.
- 2 7.3 FT. WIDE FIRE ACCESS PATHWAY, PER NFPA 1 11.12.2.2.1.3 AND NFPA 1 11.12.2.2.1.2
- 3 ROOF ACCESS POINT
- 4 ROOF ACCESS POINT
- 5 PV MODULES INSTALLED ON ROOF WITH IRONRIDGE ROOF MOUNTING SYSTEM. THE MOUNTING SYSTEM IS UL 2703 CLASS A FIRE RATED ON A 4/12 SLOPED ROOF WHEN INSTALLED WITH TYPE 1 OR 2 MODULES. THE LONGI SOLAR LR4-60HPB-345M IS TYPE 1.
- 6 ROOF ACCESS POINT
- 7 ROOF ACCESS POINT
- 8 1.3 FT. WIDE FIRE ACCESS PATHWAY, PER NFPA 1 11.12.2.2.1.3 AND NFPA 1 11.12.2.2.1.2
- 9 CABLES, WHEN RUN BETWEEN ARRAYS, SHALL BE ENCLOSED IN CONDUIT.



1 FIRE SAFETY PLAN
PV-7 SCALE: 1" = 10'

Conductor, Conduit, and OCPD Sizing Validation

1. Maximum System Voltage Test

1.1. Sol-Ark inverter w/28 LONGi Solar LR4-60HPB-345M (345W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/28 LONGi Solar LR4-60HPB-345M (345W)s
Module	LR4-60HPB-345M (345W)
Highest number of modules in series in a PV Source Circuit	7
Design Low Temp.	-28°C
Module Voc	40.3V
Temp. Coefficient Voc	-0.115V/C

NEC Code Calculations

A. Maximum Voltage of PV Source Circuit <i>see 690.7(A)</i>	324.76V
--	---------

NEC 690.7(A) requires that if the PV module manufacturer provides a temperature coefficient of open-circuit voltage, it must be used to calculate the PV array's maximum system voltage. It includes an information note recommending the use of the ASHRAE 'Extreme Annual Mean Minimum Design Dry Bulb Temperature' as the design low temperature. Using these values, the module Voc (40.3V) will increase to 46.39V at the design low temperature (-28°C).

$$(-28^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 40.3\text{V} = 46.39\text{V}$$

The string Voc at the design low temperature is 324.76V.

$$46.39\text{V} \times 7 = 324.76\text{V}$$

NEC Code Validation Tests

1.	PV Source Circuit maximum Voc must not exceed 600V $324.76\text{V} < 600\text{V} = \text{true}$	PASS
----	--	------

1.2. Sol-Ark inverter w/28 LONGi Solar LR4-60HPB-345M (345W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/28 LONGi Solar LR4-60HPB-345M (345W)s
Module	LR4-60HPB-345M (345W)
Highest number of modules in series in a PV Source Circuit	7
Design Low Temp.	-28°C
Module Voc	40.3V
Temp. Coefficient Voc	-0.115V/C

NEC Code Calculations

A. Maximum Voltage of PV Source Circuit <i>see 690.7(A)</i>	324.76V
--	---------

NEC 690.7(A) requires that if the PV module manufacturer provides a temperature coefficient of open-circuit voltage, it must be used to calculate the PV array's maximum system voltage. It includes an information note recommending the use of the ASHRAE 'Extreme Annual Mean Minimum Design Dry Bulb Temperature' as the design low temperature. Using these values, the module Voc (40.3V) will increase to 46.39V at the design low temperature (-28°C).

$$(-28^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 40.3\text{V} = 46.39\text{V}$$

The string Voc at the design low temperature is 324.76V.

$$46.39\text{V} \times 7 = 324.76\text{V}$$

NEC Code Validation Tests

1.	PV Source Circuit maximum Voc must not exceed 600V $324.76\text{V} < 600\text{V} = \text{true}$	PASS
----	--	------

2. Wire, Conduit, and OCPD Code Compliance Validation

2.1. #1: String of PV Modules: PV Source to Transition Box

Circuit Section Properties

Conductor	10 AWG PV Wire, Copper
Equipment Ground Conductor (EGC)	6 AWG Bare, Copper
OCPD(s)	N/A
Raceway/Cable	Free Air
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	51°C
Power Source Description	PV Source Circuit of 7 LR4-60HPB-345M (345W) PV modules
Power Source Current	10.93A
Voltage	231.7V
Module Series Fuse Rating	20A
Total Number of Series Strings	4

NEC Code Calculations

A. Continuous Current <i>see 690.8(A)(1)</i>	13.66A
---	--------

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (10.93A) multiplied by 1.25
 $10.93A \times 1.25 = 13.66A$

B. Continuous Current of All Other Strings <i>see 690.8(A)(2)</i>	13.66A
--	--------

Current of all other strings = $10.93A \times 1.25 = 13.66A$

C. Ampacity of Conductor <i>see Table 310.15(B)(17)</i>	55A
--	-----

Ampacity (30°C) for a copper conductor with 90°C insulation in free air is 55A.

D. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	41.8A
--	-------

The temperature factor for 90°C insulation at 51°C is 0.76.
 The fill factor for conductors in free air is 1.
 The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.76) and by the fill factor (1).
 $55A \times 0.76 \times 1 = 41.8A$

E. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	35A
--	-----

The lowest temperature rating for this conductor at any termination is 75°C.
 Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 75°C rating would be the amount referenced in the 75°C column in Table 310.15(B)(16), which is 35A.

F. Minimum Required EGC Size <i>see 690.45 and Table 250.122</i>	12 AWG
---	--------

No OCPD is used in circuit and an assumed rating of 20A has been calculated in accordance with 690.45
 The smallest EGC size allowed is 12 AWG for OCPD rating 20A according to Table 250.122.
 According to 690.45, it is not necessary to increase the size of the PV array's EGC when conductors are oversized for voltage drop considerations.

NEC Code Validation Tests

1.	System must meet requirements for not having series fuse (690.9(A))	PASS
2.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $41.8A \geq 13.66A = \text{true}$	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 13.66A \times 1.25 = \text{true}$	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $35A \geq 13.66A \times 1.25 = \text{true}$	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) $6 \text{ AWG} \geq 12 \text{ AWG} = \text{true}$	PASS
6.	EGC must meet code requirements for physical protection (690.46) $6 \text{ AWG} \geq 6 \text{ AWG} = \text{true}$	PASS

2.2. #2: String PV Modules: Transition Box to Inverter

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	12 AWG THWN-2, Copper
OCPD(s)	N/A
Raceway/Cable	0.5" dia. EMT
Lowest Terminal Temperature Rating	90°C
Maximum Wire Temperature	29°C
Power Source Description	PV Source Circuit of 7 LR4-60HPB-345M (345W) PV modules
Power Source Current	10.93A
Voltage	231.7V
Module Series Fuse Rating	20A
Total Number of Series Strings	4

NEC Code Calculations

A. Continuous Current <i>see 690.8(A)(1)</i>	13.66A
---	--------

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (10.93A) multiplied by 1.25
 $10.93A \times 1.25 = 13.66A$

B. Continuous Current of All Other Strings <i>see 690.8(A)(2)</i>	13.66A
--	--------

Current of all other strings = $10.93A \times 1.25 = 13.66A$

C. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	55A
--	-----

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 55A.

D. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	55A
--	-----

The temperature factor for 90°C insulation at 29°C is 1.
 The fill factor for a conduit/cable that has 2 wires is 1.
 The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (1) and by the fill factor (1).
 $55A \times 1 \times 1 = 55A$

E. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	55A
--	-----

The lowest temperature rating for this conductor at any termination is 90°C.
 Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 90°C rating would be the amount referenced in the 90°C column in Table 310.15(B)(16), which is 55A.

F. Minimum Required EGC Size <i>see 690.45 and Table 250.122</i>	12 AWG
---	--------

No OCPD is used in circuit and an assumed rating of 20A has been calculated in accordance with 690.45
 The smallest EGC size allowed is 12 AWG for OCPD rating 20A according to Table 250.122.
 According to 690.45, it is not necessary to increase the size of the PV array's EGC when conductors are oversized for voltage drop considerations.

G. Minimum Recommended Conduit Size <i>see 300.17</i>	0.5" dia.
--	-----------

The total area of all conductors is 0.0865in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.5.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	8 AWG	THWN-2	0.0366in ²	0.0732in ²
1	Equipment Ground	12 AWG	THWN-2	0.0133in ²	0.0133in ²
3					0.0865in ²

$0.0865\text{in}^2 / 0.4 = 0.2162\text{in}^2$ (Corresponding to a diameter of 0.5")

NEC Code Validation Tests

1.	System must meet requirements for not having series fuse (690.9(A))	PASS
2.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $55A \geq 13.66A = \text{true}$	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 13.66A \times 1.25 = \text{true}$	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $55A \geq 13.66A \times 1.25 = \text{true}$	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) $12 \text{ AWG} \geq 12 \text{ AWG} = \text{true}$	PASS
6.	Conduit must meet code recommendation for minimum size (300.17) $0.5\text{in.} \geq 0.5\text{in.} = \text{true}$	PASS

2.3. #3: String Combiner Output: String Combiner to Inverter

Circuit Section Properties

Conductor	4 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	N/A
Raceway/Cable	0.75" dia. EMT
Lowest Terminal Temperature Rating	90°C
Maximum Wire Temperature	29°C
Power Source Description	Array of 2 strings, with 7, and 7 LONGi Solar LR4-60HPB-345M modules
Power Source Current	21.86A
Voltage	231.7V

NEC Code Calculations

A. Continuous Current <i>see 690.8(A)(1)</i>	27.33A
---	--------

The continuous current for this PV output circuit is equal to the short circuit current of each string (10.93A) multiplied by the number of strings (2) multiplied by 1.25
 $10.93A \times 2 \times 1.25 = 27.33A$

B. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	95A
--	-----

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 95A.

C. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	95A
--	-----

The temperature factor for 90°C insulation at 29°C is 1.
 The fill factor for a conduit/cable that has 2 wires is 1.
 The ampacity derated for Conditions of Use is the product of the conductor ampacity (95A) multiplied by the temperature factor (1) and by the fill factor (1).
 $95A \times 1 \times 1 = 95A$

D. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	95A
--	-----

The lowest temperature rating for this conductor at any termination is 90°C.
 Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 90°C rating would be the amount referenced in the 90°C column in Table 310.15(B)(16), which is 95A.

E. Minimum Required EGC Size <i>see Table 250.122 and 690.45</i>	10 AWG
---	--------

The smallest EGC size allowed is 10 AWG for OCPD rating 34A according to Table 250.122.
 According to 690.45, it is not necessary to increase the size of the PV array's EGC when conductors are oversized for voltage drop considerations.

F. Minimum Recommended Conduit Size <i>see 300.17</i>	0.75" dia.
--	------------

The total area of all conductors is 0.1859in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.75.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	4 AWG	THWN-2	0.0824in ²	0.1648in ²
1	Equipment Ground	10 AWG	THWN-2	0.0211in ²	0.0211in ²
3					0.1859in ²

$0.1859in^2 / 0.4 = 0.4648in^2$ (Corresponding to a diameter of 0.75")

NEC Code Validation Tests

1.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $95A \geq 27.33A = \text{true}$	PASS
2.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $95A > 27.33A \times 1.25 = \text{true}$	PASS
3.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $95A \geq 27.33A \times 1.25 = \text{true}$	PASS
4.	EGC must meet code requirements for minimum size (Table 250.122) $10 \text{ AWG} \geq 10 \text{ AWG} = \text{true}$	PASS
5.	Conduit must meet code recommendation for minimum size (300.17) $0.75in. \geq 0.75in. = \text{true}$	PASS

2.4. #4: Inverter Output: Inverter to AC Disconnect

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	0.75" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	49°C
Power Source Description	Sol-Ark 12K-P 9000W Inverter
Power Source Current	37.5A
Voltage	240V
Inverter Max OCPD rating	63A

NEC Code Calculations

A. Continuous Current <i>see Article 100</i>	37.5A
---	-------

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	55A
--	-----

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 55A.

C. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	45.1A
--	-------

The temperature factor for 90°C insulation at 49°C is 0.82.
 The fill factor for a conduit/cable that has 3 wires is 1.
 The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.82) and by the fill factor (1).
 $55A \times 0.82 \times 1 = 45.1A$

D. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	50A
--	-----

The lowest temperature rating for this conductor at any termination is 75°C.
 Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 75°C rating would be the amount referenced in the 75°C column in Table 310.15(B)(16), which is 50A.

E. Minimum Allowed OCPD Rating <i>see 240.4</i>	47A
--	-----

NEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
 $37.5A \times 1.25 = 46.87A$

F. Minimum Required EGC Size <i>see Table 250.122</i>	10 AWG
--	--------

The smallest EGC size allowed is 10 AWG for OCPD rating 50A according to Table 250.122.

G. Minimum Recommended Conduit Size <i>see 300.17</i>	0.75" dia.
--	------------

The total area of all conductors is 0.1309in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.75.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	8 AWG	THWN-2	0.0366in ²	0.0732in ²
1	Neutral	8 AWG	THWN-2	0.0366in ²	0.0366in ²
1	Equipment Ground	10 AWG	THWN-2	0.0211in ²	0.0211in ²
4					0.1309in ²

$0.1309in^2 / 0.4 = 0.3273in^2$ (Corresponding to a diameter of 0.75")

NEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) $50A \geq 37.5A \times 1.25 = \text{true}$	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4(B) and 240.4) $45.1A \geq 45A$ (Next Smaller OCPD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $45.1A \geq 37.5A = \text{true}$	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 37.5A \times 1.25 = \text{true}$	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $50A \geq 37.5A \times 1.25 = \text{true}$	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) $10 \text{ AWG} \geq 10 \text{ AWG} = \text{true}$	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) $0.75in. \geq 0.75in. = \text{true}$	PASS

2.5. #5: AC Disconnect Output: AC Disconnect to Utility Disconnect

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	0.5" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	49°C
Power Source Description	Sol-Ark 12K-P 9000W Inverter
Power Source Current	37.5A
Voltage	240V

NEC Code Calculations

A. Continuous Current	37.5A
<i>see Article 100</i>	

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor	55A
<i>see Table 310.15(B)(16)</i>	

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 55A.

C. Derated Ampacity of Conductor	45.1A
<i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	

The temperature factor for 90°C insulation at 49°C is 0.82.
The fill factor for a conduit/cable that has 2 wires is 1.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.82) and by the fill factor (1).
 $55A \times 0.82 \times 1 = 45.1A$

D. Max Current for Terminal Temp. Rating	50A
<i>see 110.14(C)</i>	

The lowest temperature rating for this conductor at any termination is 75°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 75°C rating would be the amount referenced in the 75°C column in Table 310.15(B)(16), which is 50A.

E. Minimum Allowed OCPD Rating	47A
<i>see 240.4</i>	

NEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
 $37.5A \times 1.25 = 46.87A$

F. Minimum Required EGC Size	10 AWG
<i>see Table 250.122</i>	

The smallest EGC size allowed is 10 AWG for OCPD rating 50A according to Table 250.122.

G. Minimum Recommended Conduit Size	0.5" dia.
<i>see 300.17</i>	

The total area of all conductors is 0.0943in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.5.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	8 AWG	THWN-2	0.0366in ²	0.0732in ²
1	Equipment Ground	10 AWG	THWN-2	0.0211in ²	0.0211in ²
3					0.0943in ²

$0.0943in^2 / 0.4 = 0.2358in^2$ (Corresponding to a diameter of 0.5")

NEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) $50A \geq 37.5A \times 1.25 = true$	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4(B) and 240.4) $45.1A \geq 45A$ (Next Smaller OCPD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $45.1A \geq 37.5A = true$	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 37.5A \times 1.25 = true$	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $50A \geq 37.5A \times 1.25 = true$	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) $10 AWG \geq 10 AWG = true$	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) $0.5in. \geq 0.5in. = true$	PASS

2.6. #6: Utility Disconnect Output: Utility Disconnect to PV Generation Meter

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	0.75" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	49°C
Power Source Description	Sol-Ark 12K-P 9000W Inverter
Power Source Current	37.5A
Voltage	240V

NEC Code Calculations

A. Continuous Current	37.5A
<i>see Article 100</i>	

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor	55A
<i>see Table 310.15(B)(16)</i>	

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 55A.

C. Derated Ampacity of Conductor	45.1A
<i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	

The temperature factor for 90°C insulation at 49°C is 0.82.
The fill factor for a conduit/cable that has 3 wires is 1.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.82) and by the fill factor (1).
 $55A \times 0.82 \times 1 = 45.1A$

D. Max Current for Terminal Temp. Rating	50A
<i>see 110.14(C)</i>	

The lowest temperature rating for this conductor at any termination is 75°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 75°C rating would be the amount referenced in the 75°C column in Table 310.15(B)(16), which is 50A.

E. Minimum Allowed OCPD Rating	47A
<i>see 240.4</i>	

NEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
 $37.5A \times 1.25 = 46.87A$

F. Minimum Required EGC Size	10 AWG
<i>see Table 250.122</i>	

The smallest EGC size allowed is 10 AWG for OCPD rating 50A according to Table 250.122.

G. Minimum Recommended Conduit Size	0.75" dia.
<i>see 300.17</i>	

The total area of all conductors is 0.1309in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.75.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	8 AWG	THWN-2	0.0366in ²	0.0732in ²
1	Neutral	8 AWG	THWN-2	0.0366in ²	0.0366in ²
1	Equipment Ground	10 AWG	THWN-2	0.0211in ²	0.0211in ²
4					0.1309in ²

$0.1309in^2 / 0.4 = 0.3273in^2$ (Corresponding to a diameter of 0.75")

NEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) $50A \geq 37.5A \times 1.25 = true$	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4(B) and 240.4) $45.1A \geq 45A$ (Next Smaller OCPD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $45.1A \geq 37.5A = true$	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 37.5A \times 1.25 = true$	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $50A \geq 37.5A \times 1.25 = true$	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) $10 AWG \geq 10 AWG = true$	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) $0.75in. \geq 0.75in. = true$	PASS

2.7. #7: Production Meter Output: PV Generation Meter to Main Service Panel

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	0.75" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	49°C
Power Source Description	Sol-Ark 12K-P 9000W Inverter
Power Source Current	37.5A
Voltage	240V

NEC Code Calculations

A. Continuous Current <i>see Article 100</i>	37.5A
---	-------

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	55A
--	-----

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 55A.

C. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	45.1A
--	-------

The temperature factor for 90°C insulation at 49°C is 0.82.
The fill factor for a conduit/cable that has 3 wires is 1.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.82) and by the fill factor (1).
 $55A \times 0.82 \times 1 = 45.1A$

D. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	50A
--	-----

The lowest temperature rating for this conductor at any termination is 75°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 75°C rating would be the amount referenced in the 75°C column in Table 310.15(B)(16), which is 50A.

E. Minimum Allowed OCPD Rating <i>see 240.4</i>	47A
--	-----

NEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
 $37.5A \times 1.25 = 46.87A$

F. Minimum Required EGC Size <i>see Table 250.122</i>	10 AWG
--	--------

The smallest EGC size allowed is 10 AWG for OCPD rating 50A according to Table 250.122.

G. Minimum Recommended Conduit Size <i>see 300.17</i>	0.75" dia.
--	------------

The total area of all conductors is 0.1309in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.75.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	8 AWG	THWN-2	0.0366in ²	0.0732in ²
1	Neutral	8 AWG	THWN-2	0.0366in ²	0.0366in ²
1	Equipment Ground	10 AWG	THWN-2	0.0211in ²	0.0211in ²
4					0.1309in ²

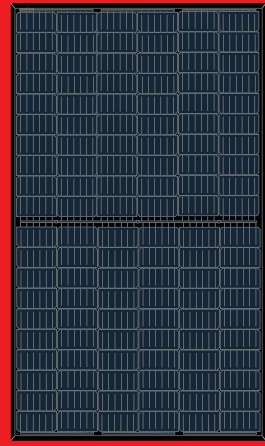
$0.1309in^2 / 0.4 = 0.3273in^2$ (Corresponding to a diameter of 0.75")

NEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) $50A \geq 37.5A \times 1.25 = true$	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4(B) and 240.4) $45.1A \geq 45A$ (Next Smaller OCPD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) $45.1A \geq 37.5A = true$	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) $55A > 37.5A \times 1.25 = true$	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) $50A \geq 37.5A \times 1.25 = true$	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) $10 AWG \geq 10 AWG = true$	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) $0.75in. \geq 0.75in. = true$	PASS

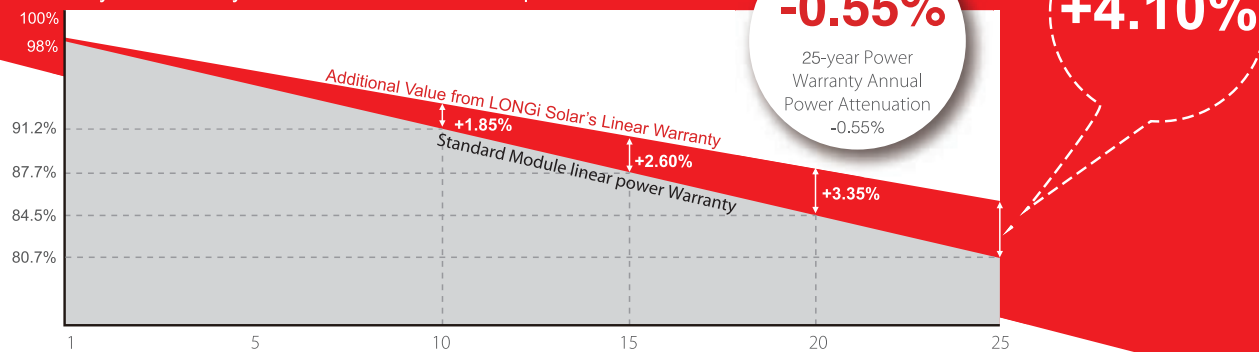
LR4-60HPB 345~365M

Hi-MO 4m
(Black)



**High Efficiency
Low LID Mono PERC with
Half-cut Technology**

10-year Warranty for Materials and Processing;
25-year Warranty for Extra Linear Power Output



Complete System and Product Certifications

IEC 61215, IEC61730, UL1703
ISO 9001:2008: ISO Quality Management System
ISO 14001: 2004: ISO Environment Management System
TS62941: Guideline for module design qualification and type approval
OHSAS 18001: 2007 Occupational Health and Safety



* Specifications subject to technical changes and tests. LONGi Solar reserves the right of interpretation.

Positive power tolerance (0 ~ +5W) guaranteed

High module conversion efficiency (up to 19.5%)

Slower power degradation enabled by Low LID Mono PERC technology: first year <2%, 0.55% year 2-25

Solid PID resistance ensured by solar cell process optimization and careful module BOM selection

Reduced resistive loss with lower operating current

Higher energy yield with lower operating temperature

Reduced hot spot risk with optimized electrical design and lower operating current

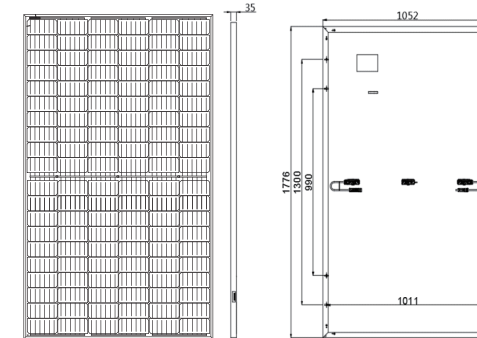
LONGi

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Note: Due to continuous technical innovation, R&D and improvement, technical data above mentioned may be of modification accordingly. LONGi Solar have the sole right to make such modification at anytime without further notice; Demanding party shall request for the latest datasheet for such as contract need, and make it a consisting and binding part of lawful documentation duly signed by both parties.

LR4-60HPB 345~365M

Design (mm)



Mechanical Parameters

Cell Orientation: 120 (6x20)
Junction Box: IP68, three diodes
Output Cable: 4mm², 300mm in length
length can be customized
Glass: Single glass
3.2mm coated tempered glass
Frame: Anodized aluminum alloy frame
Weight: 20 kg
Dimension: 1776x1052x35mm
Packaging: 30pcs per pallet
180pcs per 20'GP
720pcs per 40'HC

Operating Parameters

Operational Temperature: -40°C ~ +85°C
Power Output Tolerance: 0 ~ +5 W
Voc and Isc Tolerance: ±3%
Maximum System Voltage: DC1000V (IEC/UL)
Maximum Series Fuse Rating: 20A
Nominal Operating Cell Temperature: 45±2°C
Safety Class: Class II
Fire Rating: UL type 1 or type 2

Electrical Characteristics

Test uncertainty for Pmax: ±3%

Model Number	LR4-60HPB-345M		LR4-60HPB-350M		LR4-60HPB-355M		LR4-60HPB-360M		LR4-60HPB-365M	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	345	255.6	350	259.3	355	263.0	360	266.7	365	270.4
Open Circuit Voltage (Voc/V)	40.3	37.6	40.5	37.8	40.7	38.0	40.9	38.2	41.1	38.4
Short Circuit Current (Isc/A)	10.93	8.81	11.02	8.89	11.10	8.95	11.20	9.03	11.28	9.09
Voltage at Maximum Power (Vmp/V)	33.1	30.6	33.3	30.8	33.5	30.9	33.7	31.1	33.9	31.3
Current at Maximum Power (Imp/A)	10.43	8.36	10.52	8.44	10.60	8.50	10.69	8.57	10.77	8.64
Module Efficiency(%)	18.5		18.7		19.0		19.3		19.5	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25°C, Spectra at AM1.5

NOCT (Nominal Operating Cell Temperature): Irradiance 800W/m², Ambient Temperature 20°C, Spectra at AM1.5, Wind at 1m/s

Temperature Ratings (STC)

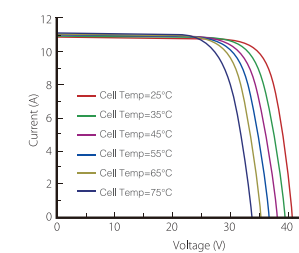
Temperature Coefficient of Isc: +0.057%/°C
Temperature Coefficient of Voc: -0.286%/°C
Temperature Coefficient of Pmax: -0.370%/°C

Mechanical Loading

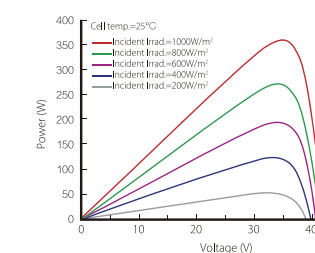
Front Side Maximum Static Loading: 5400Pa
Rear Side Maximum Static Loading: 2400Pa
Hailstone Test: 25mm Hailstone at the speed of 23m/s

I-V Curve

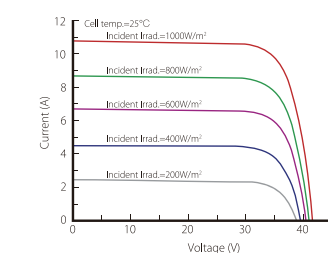
Current-Voltage Curve (LR4-60HPB-355M)



Power-Voltage Curve (LR4-60HPB-355M)



Current-Voltage Curve (LR4-60HPB-355M)



LONGi

Room 801, Tower 3, Lujiazui Financial Plaza, No.826 Century Avenue, Pudong Shanghai, 200120, China
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

Note: Due to continuous technical innovation, R&D and improvement, technical data above mentioned may be of modification accordingly. LONGi Solar have the sole right to make such modification at anytime without further notice; Demanding party shall request for the latest datasheet for such as contract need, and make it a consisting and binding part of lawful documentation duly signed by both parties.



TS4-A-O

PV Module Advanced Add-On

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

The TS4-A-O with UHD-Core technology and expanded specifications supports PV modules up to 500W.

Included Features



Optimization

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



Safety

Enhanced **safety** for NEC 690.12 rapid shutdown compliance



Monitoring

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

Easy Installation

Snap to standard module frame or remove brackets for rack mounting

Smart Commissioning

Configure and commission with your Android or iOS mobile device



TS4-A-O SPECIFICATIONS

Environmental

Operating Temperature Range -40°C to +85°C (-40°F to +185°F)

Outdoor Rating IP68, NEMA 3R

Mechanical

Dimensions 138.4mm x 139.7mm x 22.9mm

Weight 520g

Electrical

Total Max Input Voltage (V_{oc} @ Lowest Temperature) 90V

Voltage Range 16 - 90V

Maximum Current 12A

Maximum Power 500W

Output Cable Length 1.2m (standard)

Connectors MC4 (standard)

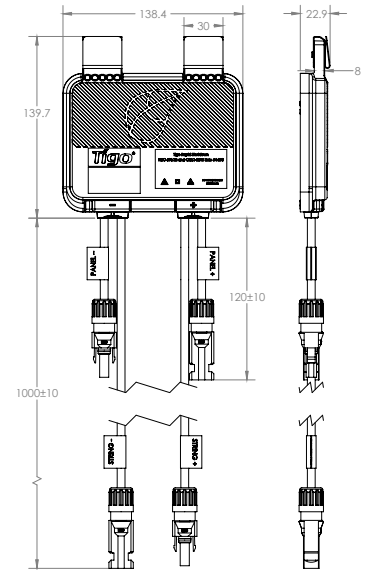
Communication Type Wireless

Rapid Shutdown UL Listed (NEC 2014 & 2017 690.12) Yes

Recommended fuse rating 15A

TAP required for rapid shutdown and CCA required for monitoring with TS4-A-O.

*Photovoltaic Rapid Shutdown Equipment NEC 690.12 and C22.1-2015 Rule 64-218
This rapid shutdown system is required to be connected to an automatic system which initiates rapid shutdown upon the activation of the AC system disconnect.*



ORDERING INFORMATION

Standard

451-00252-32 1500V UL / 1000V TÜV, 1.2m cable, MC4

Options

451-00257-12 1000V UL / TÜV, 1.2m cable, MC4 comparable

451-00252-12 1500V UL / 1000V TÜV, 1m cable, MC4

451-00261-32 1500V UL / TÜV, 1.2m cable, EVO2

For sales info:

sales@tigoenergy.com or 1.408.402.0802

For product info:

Visit tigoenergy.com/products

For technical info:

Visit support.tigoenergy.com

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



Tigo[®]

PV 2.0

Tigo Energy, Inc. 655 Campbell Technology Pkwy Suite 150, Campbell, California 95008 USA
www.tigoenergy.com P: +1.408.402.0802 F: +1.408.358.6279 | sales@tigoenergy.com



Powering Business Worldwide

pe.eaton.com

Product compliance: No Data

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Eaton general duty cartridge fuse safety switch

DG222NRB

UPC:782113144221

Dimensions:

- Height: 14.38 IN
- Length: 14.8 IN
- Width: 9.7 IN

Weight:10 LB

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.

Warranties:

- 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.

Specifications:

- **Type:** General duty, cartridge fused
- **Amperage Rating:** 60A
- **Enclosure:** NEMA 3R
- **Enclosure Material:** Painted galvanized steel
- **Fuse Class Provision:** Class H fuses
- **Fuse Configuration:** Fusible with neutral
- **Number Of Poles:** Two-pole
- **Number Of Wires:** Three-wire
- **Product Category:** General duty safety switch
- **Voltage Rating:** 240V

Supporting documents:

- [Eatons Volume 2-Commercial Distribution](#)
- [Eaton Specification Sheet - DG222NRB](#)

Certifications:

- UL Listed



Eaton general duty non-fusible safety switch

DG222URB

UPC:782113144238

Dimensions:

- **Height:** 14.38 IN
- **Length:** 7.38 IN
- **Width:** 8.69 IN

Weight:9 LB

Notes:WARNING! Switch is not approved for service entrance unless a neutral kit is installed.

Warranties:

- 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.

Specifications:

- **Type:** Non-fusible, single-throw
- **Amperage Rating:** 60A
- **Enclosure:** NEMA 3R, Rainproof
- **Enclosure Material:** Painted galvanized steel
- **Fuse Configuration:** Non-fusible
- **Number Of Poles:** Two-pole
- **Number Of Wires:** Two-wire
- **Product Category:** General duty safety switch
- **Voltage Rating:** 240V

Supporting documents:

- [Eatons Volume 2-Commercial Distribution](#)
- [Eaton Specification Sheet - DG222URB](#)

Certifications:

- UL Listed

Product compliance: No Data



12K-2P-N

UL Model:
"Sol-Ark 12K-P"



Solar Input Power 13,000W	
Max Allowed PV Power	6,500W + 6,500W = 13,000W
Max PV Power Delivered to Battery & AC Outputs	12,000W
Max DC Voltage (Voc)	500V @ 18A, 450V @ 20A
MPPT Voltage Range	150-425V
Starting Voltage	125V
Number of MPPT	2
Max Solar Strings Per MPPT	2
Max DC Current per MPPT (Self Limiting)	20A
Max AC Coupled Input (Micro/String Inverters)	9,600W

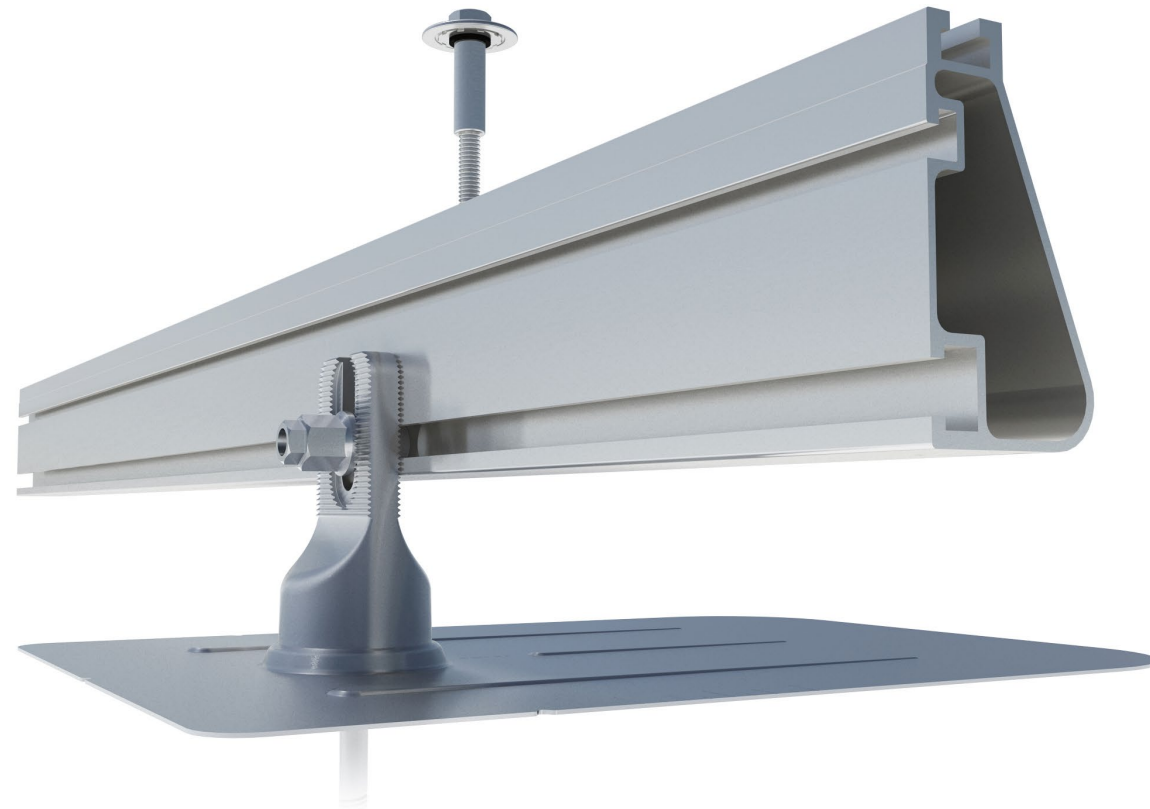
AC Output Power 9kW On-Grid & Off-Grid	
Connections	120/240/208V Split Phase
Continuous AC Power to Grid (On-Grid)	9,000W 37.5A-L (240V)
Continuous AC Power to Load (Off-Grid)	9,000W 37.5A-L (240V)
Surge AC Power 10sec	16,000VA L-L (240V)
Surge AC Power 100ms	25,000VA L-L(240V)
Fault Current 100ms	104A L-L (240V)
Parallel Stacking	Yes
Frequency	60/50Hz
Continuous AC Power with Grid or Generator	15,120W 63A L-L (240V) 7,560W 63A L-N (120V)
CEC Efficiency	96.5% (Peak 97.5%)
Idle Consumption Typical—No Load	60W
Sell Back Power Modes	Limited to Household/Fully Grid-Tied
Design (DC to AC)	Transformerless DC
Response Time (Grid-Tied to Off-Grid)	4ms
Power Factor	+/- 0.9 - 1.0

Battery (Optional) Output Power 9,000W	
Type	Lead-Acid or Li-Ion
Nominal DC Input	48V
Capacity	50 — 9900Ah
Voltage Range	43.0 — 63.0V
Continuous Battery Charging Output	185A
Charging Curve	3-Stage w/ Equalization
Grid to Batt Charging Efficiency	96.0%
External Temperature Sensor	Included
Current Shunt for Accurate % SOC	Integrated
External Gen Start Based on Voltage or %SOC	Integrated
Communication to Lithium Battery	CanBus & RS485

General	
Dimensions (H x W x D)	30.0" x 18.3" x 10.0"
Weight	78 lbs
Enclosure	NEMA 3R
Ambient Temperature	-25-55°C, >45°C Derating
Installation Style	Wall-Mounted
Wi-Fi & LAN Communication	Included
Standard Warranty (verified by HALT Testing)	10 Years

Protections & Certifications	
Electronics Certified Safety by SGS Labs to NEC & UL Specs - NEC 690.4B & NEC 705.4/6	Yes
Grid Sell Back — UL1741-2010/2018, IEE-E1547a-2003/2014, FCC 15 Class B, UL1741SA,	Yes
PV DC Disconnect Switch — NEC 240.15	Integrated
Ground Fault Detection — NEC 690.5	Integrated
PV Rapid Shutdown Control — NEC 690.12	Integrated
PV Arc Fault Detection — NEC 690.11	Integrated
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
AC Output Breakers - 63A	Integrated
250A Battery Breaker / Disconnect	Integrated
Surge Protection	DC Type II / AC Type II

Flush Mount System



Built for solar's toughest roofs.

IronRidge builds the strongest mounting system for pitched roofs in solar. Every component has been tested to the limit and proven in extreme environments.

Our rigorous approach has led to unique structural features, such as curved rails and reinforced flashings, and is also why our products are fully certified, code compliant and backed by a 25-year warranty.

Strength Tested
 All components evaluated for superior structural performance.

Class A Fire Rating
 Certified to maintain the fire resistance rating of the existing roof.

UL 2703 Listed System
 Entire system and components meet newest effective UL 2703 standard.

PE Certified
 Pre-stamped engineering letters available in most states.

Design Assistant
 Online software makes it simple to create, share, and price projects.

25-Year Warranty
 Products guaranteed to be free of impairing defects.

XR Rails ☺

XR10 Rail



A low-profile mounting rail for regions with light snow.

- 6' spanning capability
- Moderate load capability
- Clear and black finish

XR100 Rail



The ultimate residential solar mounting rail.

- 8' spanning capability
- Heavy load capability
- Clear and black finish

XR1000 Rail



A heavyweight mounting rail for commercial projects.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish

Bonded Splices



All rails use internal splices for seamless connections.

- Self-drilling screws
- Varying versions for rails
- Forms secure bonding

Clamps & Grounding ☺

UFOs



Universal Fastening Objects bond modules to rails.

- Fully assembled & lubed
- Single, universal size
- Clear and black finish

Stopper Sleeves



Snap onto the UFO to turn into a bonded end clamp.

- Bonds modules to rails
- Sized to match modules
- Clear and black finish

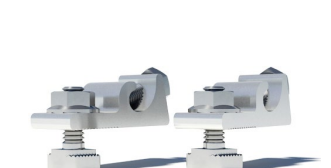
CAMO



Bond modules to rails while staying completely hidden.

- Universal end-cam clamp
- Tool-less installation
- Fully assembled

Grounding Lugs



Connect arrays to equipment ground.

- Low profile
- Single tool installation
- Mounts in any direction

Attachments ☺

FlashFoot2



Flash and mount XR Rails with superior waterproofing.

- Twist-on Cap eases install
- Wind-driven rain tested
- Mill and black finish

Conduit Mount



Flash and mount conduit, strut, or junction boxes.

- Twist-on Cap eases install
- Wind-driven rain tested
- Secures 3/4" or 1" conduit

Slotted L-Feet



Drop-in design for rapid rail attachment.

- Secure rail connections
- Slot for vertical adjusting
- Clear and black finish

Bonding Hardware



Bond and attach XR Rails to roof attachments.

- T & Square Bolt options
- Nut uses 7/16" socket
- Assembled and lubricated

Resources



Design Assistant
 Go from rough layout to fully engineered system. For free.
[Go to IronRidge.com/design](https://www.ironridge.com/design)



NABCEP Certified Training
 Earn free continuing education credits, while learning more about our systems.
[Go to IronRidge.com/training](https://www.ironridge.com/training)



1495 Zephyr Avenue
Hayward, CA 94544
1-800-227-9523
IronRidge.com



1495 Zephyr Avenue
Hayward, CA 94544
1-800-227-9523
IronRidge.com

Attn: Corey Geiger, COO, IronRidge Inc.

Date: September 7th, 2018

Re: Structural Certification and Span Tables for IronRidge Flush Mount System

This letter addresses the structural performance and code compliance of IronRidge's Flush Mount System. The Flush Mount System is a proprietary rooftop mounting system used to support photovoltaic (PV) modules installed in portrait or landscape orientation and set parallel to the underlying roof surface. PV modules are supported by extruded aluminum XR Rails and secured to the rails with IronRidge mounting clamps. The XR Rails are side mounted to a selected roof attachment with 3/8" stainless steel bonding hardware and then attached directly to the roof structure or to a stanchion that is fastened to the underlying roof structure. Assembly details of a typical Flush Mount installation and its core components are shown in Exhibit EX-0015.

The IronRidge Flush Mount System is designed and certified to the structural requirements of the reference standards listed below, for the load conditions and configurations tabulated in the attached span tables.

- ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)
- 2015 International Building Code (IBC-2015)
- 2015 Vermont Fire & Building Safety Code, Section 5: International Building Code, Amendments to the 2015 Edition
- 2015 Aluminum Design Manual (ADM-2015)

The tables included in this letter provide the maximum allowable spans of XR Rails in the Flush Mount System for the respective loads and configurations listed, covering wind exposure categories B, C, & D, roof zones 1, 2 & 3, and roof slopes from 0° to 45°. The span tables are applicable provided that the following conditions are met:

1. *Span* is the distance between two adjacent roof attachment points (measured at the center of the attachment fastener)
2. The underlying roof pitch, measured between roof surface and horizontal plane, is 45° or less.
3. The *mean roof height*, defined as the average of the roof eave height and the roof ridge height measured from grade, does not exceed 30 feet.
4. Module length shall not exceed the listed maximum dimension provided for the respective span table and module width shall not exceed 48".
5. All Flush Mount components shall be installed in a professional workmanlike manner per IronRidge's *Flush Mount installation manual* and other applicable standards for general roof construction practice.

The span tables provided in this letter are certified based on the structural performance of IronRidge XR Rails only with no consideration of the structural adequacy of the chosen roof attachments, PV modules, or the underlying roof supporting members. It is the responsibility of the installer or system designer to verify the structural capacity and adequacy of the aforementioned system components in regards to the applied or resultant loads of any chosen array configuration.

Sincerely,

Gang Xuan, PE, LEED AP
Senior Structural Engineer

RATINGS

UL 2703 LISTED



Conforms to STD UL 2703 Standard for Safety First Edition: Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

- Max Overcurrent Protective Device (OCPD) Rating: 40A
- Max Module Size: 30.5 ft²
- Module Orientation: Portrait or Landscape
- System Design Load Rating: 10 PSF downward, 5 PSF upward, 5 PSF lateral
- Actual system structural capacity including spans and cantilevers are defined by PE stamped [certification letters](#).
- CAMO Specific Design Load rating: 50 PSF downward, 50 PSF upward, 15 PSF lateral

Certified to CSA TIL No. A-40 Photovoltaic Module Racking Systems

- Load Rating: 2400 PA [50 PSF]

CLASS A SYSTEM FIRE RATING PER UL 2703

- Any Roof Slope with Module Types 1, 2, 3, 13, 19, 25 & 29.
- Any module-to-roof gap is permitted, with no perimeter guarding required. This rating is applicable with any third-party attachment.
- Class A rated PV systems can be installed on Class A, B, and C roofs without affecting the roof fire rating.

WATER SEAL RATINGS:

- UL 441 (Flashfoot2, All Tile Hook, Knockout Tile, Flashvue, L-Mount)
- TAS 100(A)-95 (Flashfoot2, All Tile Hook, Knockout Tile, Flashvue, L-Mount, Qbase)
- Tested and evaluated without sealant.
- Any roofing manufacturer approved sealant is allowed. Ratings applicable for roof slopes between 2:12 and 12:12

STRUCTURAL CERTIFICATION

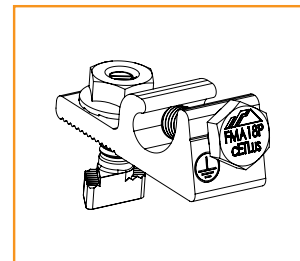
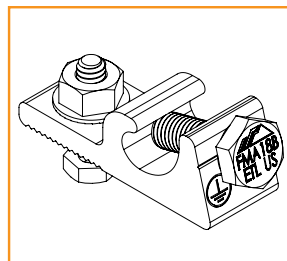
- Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7

FLORIDA PRODUCT APPROVAL #FL29843

- Conforms to TAS202, TAS100(A)
- Approved for installation both inside and outside High Velocity Hurricane Zones (HVHZ)
- Allowable design pressure up to +100/-100 PSF
- Additional details and full list of approved components can be found [Here](#).

MARKINGS

Product markings are located on the Grounding Lug bolt head.



Intertek

8431 Murphy Drive
Middleton, WI 53562 USA

Telephone: 608.836.4400
Facsimile: 608.831.9279
www.intertek.com

Test Verification of Conformity

In the basis of the tests undertaken, the sample(s) of the below product have been found to comply with the requirements of the referenced specifications at the time the tests were carried out.

Applicant Name & Address:	IronRidge, Inc. 28357 Industrial Blvd Hayward, CA 94545 USA
Product Description:	Flush Mount System with XR Rails.
Ratings & Principle Characteristics:	Fire Class Resistance Rating: -Flush Mount (Symmetrical). Class A Fire Rated for Low Slope applications when using Type 1, 2, 3, 13, 19, 25 and 29 listed photovoltaic modules. Class A Fire Rated for Steep Slope applications with Type1, 2 and 3, listed photovoltaic modules. Tested with a 5" gap (distance between the bottom the module frame and the roof covering), per the standard this system can be installed at any gap allowed by the manufacturers installation instructions. No perimeter guarding is required. This rating is applicable with any IronRidge or 3'rd party roof anchor.
Models:	IronRidge Flush Mount with XR Rails
Brand Name:	IronRidge Flush Mount
Relevant Standards:	UL 2703 (Section 15.2 and 15.3) Standard for Safety Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels, First Edition dated Jan. 28, 2015 Referencing UL1703 Third Edition dated Nov. 18, 2014, (Section 31.2) Standard for Safety for Flat-Plate Photovoltaic Modules and Panels.
Verification Issuing Office:	Intertek Testing Services NA, Inc. 8431 Murphy Drive Middleton, WI 53562
Date of Tests:	08/27/2014 to 03/17/2015
Test Report Number(s):	101769343MID-001r1, 101769343MID-001a, 101915978MID-001 & 101999492MID-001ar1-cr1, 104428358MID-001 EEV
Revision Summary	8/27/2020 Added type 13, 19, 25 and 29 to system, update address.

This verification is part of the full test report(s) and should be read in conjunction with them. This report does not automatically imply product certification.

Completed by:	Chris Zimbrich	Reviewed by:	Chad Naggs
Title:	Technician I, Fire Resistance	Title:	Technical Team Lead, Fire Resistance
Signature:		Signature:	
Date:	08/27/2020	Date:	08/27/2020

This Verification is for the exclusive use of Intertek's client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Verification. Only the Client is authorized to permit copying or distribution of this Verification. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test/inspection results referenced in this Verification are relevant only to the sample tested/inspected. This Verification by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

MODULE COMPATIBILITY

The Flush Mount System may be used to ground and/or mount a PV module complying with UL 2703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. Unless otherwise noted, "xxx" refers to the module power rating and both black and silver frames are included in the certification.

FRAMED MODULE LIST

MAKE	MODELS
Adani	Adani modules with 35 and 40mm frames ASX-Y-ZZ-xxx Where "X" can be B, M or P; "Y" can be 6 or 7, and "ZZ" can be blank, PERC, B-PERC, or AB-PERC
Aionrise	Aionrise modules with 35 and 40mm frames AIONyyG1-xxx Where "yy" can be 60 or 72
Amerisolar	Amerisolar modules with 35, 40 and 50 mm frames AS-bYxxxZ Where "b" can be 5 or 6; "Y" can be M, P, M27, P27, M30, or P30; and "Z" can be blank, W or WB
Aptos Solar	Aptos modules with 35 and 40 mm frames DNA-yy-zzaa-xxx Where "yy" can be 120 or 144; "zz" can be MF or BF; and "aa" can be 23 or 26
Astronergy Solar	Astronergy modules with 30, 35, 40, and 45 mm frames aaSMbbyyC/zz-xxx Where "aa" can be CH or A; "bb" can be 60, 66, or 72; "yy" can be blank, 10 or 12; "C" can M, P, M(BL), M-HC, M(BL)-HC, P-HC, M(DG), or M(DGT); and "zz" can be blank, HV, F-B, or F-BH
ASUN	ASUN modules with 35 and 40 mm frames ASUN-xxx-YYZZ-aa Where "YY" can be 60 or 72; "ZZ" can be M, or MH5; and "aa" can be blank or BB
Auxin	Auxin modules with 40 mm frames AXN6y6zAxxxB Where "y" can be M or P; "z" can be 08, 09, 10, 11, or 12; and "A" can be F, M or T; and "B" can be blank, A, B or C
Axitec	Axitec Modules with 30, 35 and 40 mm frames AC-xxxY/aaZZb Where "Y" can be M, P, MB or MH; "aa" can be blank, 125- or 156-; "ZZ" can be 54, 60, 72, 108, 120, or 144; "b" can be S, X, V, VB, XV, or MX
Boviet	Boviet modules with 35 and 40mm frames BVMZZaaYY-xxxBcc Where "ZZ" can be 66 or 76; "aa" can be 9, 10 or 12; "YY" is M or P; and "B" can be blank, L or S; and "cc" can be blank, H, H-BF, H-BF-DG, H-HC, H-HC-BF, H-HC-BF-DG, HC-BF or HC-BF-DG
BYD	BYD modules with 35 mm frames BYDxxxAY-ZZ Where "A" can be M6, P6, MH or PH; "Y" can be C or K; and "ZZ" can be 30 or 36
Canadian Solar	Canadian Solar modules with 30, 32, 35 and 40 mm frames CSbY-xxxZ Where "b" can be 1, 3 or 6; "Y" can be H, K, L, N, P, U, V, W, X or Y; and "Z" can be M, P, MS, PX, M-SD, P-AG, P-SD, MB-AG, PB-AG, MS-AG, or MS-SD
CertainTeed	CertainTeed modules with 35 and 40 frames CTxxxYZZ-AA Where "Y" can be M, P, or HC; "ZZ" can be 00, 01, 10, or 11; and "AA" can be 01, 02, 03, 04 or 06
CSUN	Csun modules with 35 and 40 mm frames YYxxx-zzAbb Where "YY" is CSUN or SST; "zz" is blank, 60, or 72; and "A" is blank, P, M or MM; "bb" is blank, BB, 5BB, BW, or ROOF
Dehui	Dehui modules with 30, 35 and 40mm frames DH-MYYYY-xxx Where "YYY" can be 760, 772, 860, 872; and "Z" can be B, F or W

MODULE COMPATIBILITY

Ecosolargy	Ecosolargy modules with 35, 40, and 50 mm frames ECOxxxYzzA-bbD Where "Y" can be A, H, S, or T; "zz" can be 125 or 156; "A" can be M or P; "bb" can be 60 or 72; and "D" can be blank or B
ET Solar	ET Solar modules with 30, 35, 40, and 50 mm frames ET-YZZZxxxAA Where "Y" can be P, L, or M; "ZZZ" can be 660, 660BH, 672, 672BH, 754BH, 766BH, 772BH; and "AA" can be GL, TB, TW, WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
Flex	Flex modules with 35, 40, and 50 mm frames FXS-xxxYY-ZZ; Where "YY" can be BB or BC; and "ZZ" can be MAA1B, MAA1W, MAB1W, SAA1B, SAA1W, SAC1B, SAC1W, SAD1W, SBA1B, SBA1W, SBC1B, or SBC1W
GCL	GCL modules with 35 mm and 40 mm frames GCL-ab/YY xxx Where "a" can be M or P; "b" can be 3 or 6; and "YY" can be 60, 72, 72H, or 72DH
GigaWatt Solar	Gigawatt modules with 40 mm frames GWxxxYY Where "YY" can be either PB or MB
Hansol	Hansol modules with 35 and 40 frames HSxxxYY-zz Where "YY" can be PB, PD, PE, TB, TD, UB, UD, or UE; and "zz" can be AH2, AN1, AN3, AN4, HH2, HV1, or JH2
Hanwa Solar	Hanwa Solar modules with 40, 45, and 50 mm frames HSLaaP6-YY-1-xxxZ Where "aa" can be either 60 or 72; "YY" can be PA or PB; and "Z" can be blank or B
Hanwa Q CELL	Hanwa Q CELLS Modules with 32, 35, 40, and 42mm frames aaYY-ZZ-xxx where "aa" can be Q, or B.; "YY" can be PLUS, PRO, PEAK, LINE PRO, LINE PLUS, PLUS DUO or PEAK DUO; and "ZZ" can be G3, G3.1, G4, G4.1, L-G2, L-G2.3, L-G3, L-G3.1, L-G3y, L-G4, L-G4.2, L-G4y, LG4.2/TAA, BFR-G3, BLK-G3, BFR-G3.1, BLK-G3.1, BFR-G4, BFR-G4.1, BFR G4.3, BLK-G4.1, G4/SC, G4.1/SC, G4.1/TAA, G4.1/MAX, BFR G4.1/TAA, BFR G4.1/MAX, BLK G4.1/TAA, BLK G4.1/SC, EC-G4.4, G5, G5/SC, G5/TS, BLK-G5, BLK-G5/SC, BLK-G5/TS, L-G5, L-G5.1, L-G5.2, L-G5.2/H, L-G5.3, G6, G6/SC, G6/TS, G6+/TS, G6+, BLK-G6, L-G6, L-G6.1, L-G6.2, L-G6.3, G7, BLK-G6+, BLK-G6+/AC, BLK-G6+/HL, BLK-G6+/SC, BLK-G6/TS, BLK-G6+/TS, BLK-G7, G7.2, G8, BLK-G8, G8+, BLK-G8+ L-G7, L-G7.1, L-G7.2, L-G7.3, L-G8, L-G8.1, L-G8.2, L-G8.3, L-G8.3/BFF, L-G8.3/BFG, L-G8.3/BGT, ML-G9, BLK ML-G9, ML-G9+, BLK ML-G9+, BLK-G10+, BLK G10+/AC, ML-G10, BLK ML-G10, ML-G10+, BLK ML-G10+, ML-G10.a, BLK ML-G10.a, ML-G10.a+, BLK ML-G10.a+, XL-G9, XL-G9.2, XL-G9.3, XL-G9.3/BFG, XL-G10.2, XL-G10.3, XL-G10.c, XL-G10.d, XL-G10.d/BFG or XL-G10.3/BFG
Heliene	Heliene modules with 40 mm frames YYZZxxxA Where "YY" can be 36, 60, 72, 96, 120 or 144; "ZZ" can be HC, M, P, or MBLK; and "A" can be blank, HomePV, Bifacial or M10 Bifacial
HT-SAAE	HT-SAAE modules with 35 and 40 mm frames HTyy-aaaZ-xxx Where "yy" can be 60, 66, 72 or 78, "aaa" can be 18, 156 or 166, "Z" can be M, P, M-C, P-C, M(S), M(VS), M(V), P(V), M(V)-C, P(V)-C, or X
Hyundai	Hyundai modules with 33, 35, 40 and 50 mm frames HiY-SxxxZZ Where "Y" can be A, D or S; "S" can be M or S; and "ZZ" can be GI, HG, HI, KI, MI, MF, MG, PI, RI, RG, RG(BF), RG(BK), SG, TI or TG
Itek	Itek Modules with 40 and 50 mm frames IT-xxx-YY Where "YY" can be blank, HE, or SE, or SE72

MODULE COMPATIBILITY

JA Solar	JA Solar modules with 30, 35, 40 and 45 mm frames JAyyzz-bbww-xxx/aa Where "yy" can be M, P, M6 or P6; "zz" can be blank, (K), (L), (R), (V), (BK), (FA), (TG), (FA)(R), (L)(BK), (L)(TG), (R)(BK), (R)(TG), (V)(BK), (BK)(TG), or (L)(BK)(TG); "bb" can be 48, 54, 60, 66, 72 or 78; "ww" can be D09, D10, D20, D30, S01, S02, S03, S06, S09, S10, S12, S17, S20, S30 or S31; and "aa" can be BP, MB, MR, SI, SC, PR, 3BB, 4BB, 4BB/RE, 5BB
Jinko	Jinko modules with 35 and 40 mm frames JKMYxxxZZ-aa Where "Y" can be either blank or S; "ZZ" can be M, P, or PP; and "aa" can be blank, 60, 60B, 60H, 60L, 60BL, 60HL, 60HB, 60HBL, 6HBL-EP, 60-J4, 60B-J4, 60B-EP, 60(Plus), 60-V, 60-MX, 6RL3, 6RL3-B, 6TL3-B, 7RL3-V, 7RL3-TV, 72, 72B, 72-J4, 72B-J4, 72(Plus), 72-V, 72H-V, 72L-V, 72HL-V, 72HL4-TV, 72-MX, 72H-BDVP, 72HL-TV, or 72HL-V-MX3
Kyocera	Kyocera Modules with 46mm frames KYxxxZZ-AA Where "Y" can be D or U; "ZZ" can be blank, GX, or SX; and "AA" can be LPU, LFU, UPU, LPS, LPB, LFB, LFBS, LFB2, LPB2, 3AC, 3BC, 3FC, 4AC, 4BC, 4FC, 4UC, 5AC, 5BC, 5FC, 5UC, 6BC, 6FC, 8BC, 6MCA, or 6MPA
LG	LG modules with 35, 40, and 46 mm frames LGxxxYaZ-bb Where "Y" can be A, E, M, N, Q, S; "a" can be A, 1, 2 or 3 "Z" can be C, K, T, or W; and "bb" can be A3, A5, A6, B3, B6, E6, E6.AW5, G3, G4, J5, K4, L5, N5, V5, V6
Longi	Longi modules with 30, 35 and 40 mm frames LRa-YYZZ-xxxM Where "a" can be 4, 5 or 6; "YY" can be blank, 60, 66, or 72; and "ZZ" can be blank, BK, BP, HV, PB, PE, PH, HBD, HIB, HIH, HPB, HPH, or HIBD
Mission Solar	Mission Solar modules with 33, 35 and 40 mm frames YYybb-xxxZZaa Where "YYY" can be MSE or TXS; "bb" can be blank, 6 or 60A; "ZZ" can be blank, MM, SE, SO, SQ, SR, SX, TS, 120 or 144; and "aa" can be blank, BB, BW, 1J, 4J, 4S, 5K, 5R, 5T, 60, 6J, 6S, 6W, 6Z, 8K, 8T, or 9S
Mitsubishi	Mitsubishi modules with 46 mm frames PV-MYYxxxZZ Where "YY" can be LE or JE; and "ZZ" can be either HD, HD2, or FB
Moltech	IM and XS series modules with 40, 45, and 50 mm frames
Next Energy Alliance	Next Energy Alliance modules with 35 and 40mm frames yyNEA-xxxZZ where "yy" can be blank or US; "ZZ" can be M, MB or M-60
Neo Solar Power	Neo Solar Power modules with 35 mm frames D6YxxxZZaa Where "Y" can be M or P; "ZZ" can be B3A, B4A, E3A, E4A, H3A, H4A; and "aa" can be blank, (TF), ME or ME (TF)
Panasonic (HIT)	Panasonic modules with 35 and 40 mm frames VBHNxxxYYzzA Where "YY" can be either KA, RA, SA or ZA; "zz" can be either 01, 02, 03, 04, 06, 06B, 11, 11B, 15, 15B, 16, 16B, 17, or 18; and "A" can be blank, E, G, or N
Panasonic (EverVolt)	Panasonic modules with 30 mm frames EVPVxxxA Where "A" can be blank or H, K or PK
Peimar	Peimar modules with 40 mm frames SbxxxYzz Where "b" can be G, M or P; "Y" can be M or P; and "zz" can be blank, (BF) or (FB)
Philadelphia Solar	Philadelphia modules with 35 and 40 mm frames PS-YzzAA-xxx Where "Y" can be M or P; "zz" can be 60, 72 or 144; and "AA" can be blank, (BF), (HC) or (HCBF)
Phono Solar	Phono Solar modules with 35, 40, and 45 mm frames PSxxxY-ZZ/A Where "Y" can be M, M1, MH, M1H, M4, M4H or P; "ZZ" can be 20 or 24; and "A" can be F, T, U, UH, or TH

MODULE COMPATIBILITY

Recom	Recom modules with 35 and 40 mm frames RCM-xxx-6yy Where "yy" can be MA, MB, ME or MF
REC Solar	REC modules with 30, 38 and 45 mm frames RECxxxYYZZ Where "YY" can be AA, M, NP, NP2, PE, PE72, TP, TP2, TP2M, TP2SM, TP2S, TP3M or TP4; and "ZZ" can be blank, Black, BLK, BLK2, SLV, 72, or Pure
Renesola	ReneSola modules with 35, 40 and 50 mm frames AAxxxY-ZZ Where "AA" can be SPM(SLP) or JC; "Y" can be blank, F, M or S; and "ZZ" can be blank, Ab, Ab-b, Abh, Abh-b, Abv, Abv-b, Bb, Bb-b, Bbh, Bbh-b, Bbv, Bbv-b, Db, Db-b, or 24/Bb
Renogy	Renogy Modules with 40 and 50 mm frames RNG-xxxY Where "xxx" is the module power rating; and "Y" can be D or P
Risen	Risen Modules with 30, 35 and 40 mm frames RSMyy-a-xxxZZ Where "yy" can be 60, 72, 110, 120, 132 or 144; "a" can be 6, 7 or 8; and "ZZ" can be M, P or BMDG
S-Energy	S-Energy modules with 35 and 40mm frames SABB-CCYYY-xxxZ Where "A" can be C, D, L or N; "BB" can be blank, 20, 25, 40 or 45; "CC" can be blank, 60 or 72; "YYY" can be blank, BDE, MAE, MAI, MBE, MBI, MCE or MCI; and "Z" can be V, M-10, P-10 or P-15
SEG Solar	SEG Solar with 30, 35 and 40 mm frames SEG-aYY-xxxZZ Where "a" can be blank, 6 or B; "YY" can be blank, MA, MB, PA, or PB; and "ZZ" can be blank, BB, BG, BW, HV, WB, WW, BMB, BMA-HV, BMA-BG, BMA-TB, BMB-TB, BMB-HV, BMD-HV, BMB-BG
Seraphim USA	Seraphim modules with 30, 35, 40 and 50 mm frames SRP-xxx-YYY-ZZ Where "xxx" is the module power rating; and "YYY" can be BMA, BMD, 6MA, 6MB, 6PA, 6PB, 6QA-XX-XX, and 6QB-XX-XX; ZZ is blank, BB, BG or HV
Sharp	Sharp modules with 35 and 40 mm frames NUYYxxx Where "YY" can be SA or SC
Silfab	Silfab Modules with 35 and 38 mm frames SYY-Z-xxxAb Where "YY" can be IL, SA, LA, SG or LG; "Z" can be blank, M, P, or X; "A" can be blank, B, H, M, N; and "b" can be A, C, G, K, L, N, T, U or X
Solaria	Solaria modules with 35 and 40 mm frames PowerXT-xxxY-ZZ Where "Y" can be R or C; and "ZZ" can be AC, BD, BX, BY, PD, PL, PM, PM-AC, PX, PZ, WX or WZ
Solarcity (Tesla)	Solarcity modules with 40 mm frames SCxxxYY Where "YY" can be blank, B1 or B2
SolarTech	SolarTech modules with 40 and 42 mm frames AAA-xxxYY Where "AAA" can be PERCB-B, PERCB-W, HJT-B, HJT-B-W or STU; "YY" can be blank, PERC or HJT
SolarWorld AG	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 31, 33 or 46 mm frames SW-xxx

MODULE COMPATIBILITY

SolarWorld Americas	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 33 mm frames SWA-xxx
Sonali	Sonali Modules with 40 mm frames SSxxx
Stion	Stion Thin film modules with 35 mm frames STO-xxx or STO-xxxA
SunEdison	SunEdison Modules with 35, 40 & 50 mm frames SE-YxxxZABCDE Where "Y" can be B, F, H, P, R, or Z; "Z" can be 0 or 4; "A" can be B,C,D,E,H,I,J,K,L,M, or N; "B" can be B or W; "C" can be A or C; "D" can be 3, 7, 8, or 9; and "E" can be 0, 1 or 2
Suniva	Suniva modules with 35, 38, 40, 46, and 50 mm frames OPTxxx-AA-B-YYY-Z MVXxxx-AA-B-YYY-Z Where "AA" is either 60 or 72; "B" is either 4 or 5; "YYY" is either 100,101,700,1B0, or 1B1; and "Z" is blank or B
Sunpower	Sunpower standard (G3 or G4) or InvisiMount (G5) 35, 40 and 46 mm frames SPR-zb-xxx-YY Where "Z" is either A, E, P, M or X; "b" can be blank, 17, 18, 19, 20, 21, or 22; and "YY" can be blank, BLK, COM, C-AC, D-AC, E-AC, BLK-E-AC, G-AC, BLK-C-AC, or BLK-D-AC
Sunspark	Sunspark modules with 40 mm frames SYY-xxxZ-A Where "YY" can be MX or ST; and "Z" can be M, MB, M3, M3B, P or W; and "A" can be 60 or 72
Suntech	Suntech Modules with 35, 40 and 50mm frames STPxxx-zz/aa Where "y" is blank or S; and "zz" can be 20, 24, A60 or A72U; and "aa" can be Vd, Vem, Vfw, Vfh, Wdb, Wde, Wd, or Wfhh
Talesun	Talesun modules with 30, 35 and 40mm frames TAByZZaa-xxx-b Where "A" can be D or P; "B" can be 6 or 7; "y" can be blank, F, G, H, I or L; "ZZ" can be 60, 66, 72 or 78; "aa" can be M, M(H), or P; and "b" can be blank, B, T, or (H)
Tesla	Tesla modules with 40 mm frames TxxxY Where "Y" can be H or S
Trina	Trina Modules with 30, 35, 40 and 46mm frames TSM-xxxYYZZ Where "YY" can be DD05, DD06, DD14, DE14, DE15, DE15V, DEG15, DEG15VC, DE18M, DEG18MC, DE09, DE19, DEG19C.20, DE06X, PA05, PC05, PD05, PD06, PA14, PC14, PD14, PE14, or PE15; and "ZZ" can be blank, .05, .05(II), .08, .08(II), .10, .18, .08D, .18D, 0.82, .002, .00S, 05S, 08S, .20(II), A, A.05, A.08, A.10, A.18, (II), A(II), A.05(II), A.08(II), A.082(II), A.10(II), A.18(II), H, H(II), H.05(II), H.08(II), HC.20(II), HC.20(II), M, M(II), M.05(II), MC.20(II)
URE	URE modules with 35 mm frames DyZxxxaa Where "D" can be D or F, "y" can be A, 6 or 7; "Z" can be K or M; and "aa" can be H3A, H4A, H8A, E7G-BB, E8G or E8G-BB
Vikram	Vikram solar modules with 40 mm frames VSyy.ZZ.AAA.bb Where "yy" can be M, P, MBB, MH, MS, MHBB, or PBB; "ZZ" can be 60 or 72; "AAA" is the module power rating; and "bb" can be 03, 04 or 05
VSUN	VSUN modules with 30, 35 and 40 mm frames VSUNxxx-YYz-aa Where "YY" can be 60, 72, 108, 120, or 144; "z" can be M, P, MH, PH, or BMH; and "aa" can be blank, BB, BW, or DG

MODULE COMPATIBILITY

Waaree	Waaree modules with 40mm frames WSyy-xxx where "yy" can be blank, M, or MB
Winaico	Winaico modules with 35 and 40 mm frames Wsy-xxxZa Where "y" can be either P or T; "Z" can be either M, P, or MX; and "a" can be blank or 6
Yingli	Yingli modules with 35 and 40 mm frames YLxxxZ-yy Where "Z" can be D or P; "yy" can be 29b, 30b, 34d, 35b, 36b or 40d
ZN Shine	ZN Shine modules with 35mm frames ZXY-AAA-xxx/M Where "Y" can be 6 or 7, "AAA" can be 72, NH120, NH144, NHDB144, NHLDD144, SH144, SHDB144 or SHLDD144

FRAMELESS MODULE LIST

MAKE	MODELS
Astronergy Solar	Astronergy frameless modules CHSM6610P(DG)-xxx
Canadian Solar	Canadian Solar frameless modules CSbY-xxx-Z Where "b" can be 3 or 6; "Y" is K, P, U, or X; and "Z" can be M-FG, MS-FG, P-FG, MB-FG, or PB-FG
Heliene	Heliene frameless modules YYZZxxxA Where "YY" can be 72; "ZZ" can be M; and "A" can be GH
Jinko	Jinko frameless modules JKMxxxPP-DV
Prism Solar	Prism Solar frameless modules BZYY-xxxAAA Where "Z" can be i or N; "YY" can be 48, 60, 60S, 72 or 72S; and "AAA" can be blank or BSTC
Risen	Risen frameless modules RSMyy-6-xxxZZ Where "yy" can be 60, 72, 120 or 144; and "ZZ" can be MDG or PDG
Stion	Stion frameless modules STL-xxx or STL-xxxA
Sunpreme	Sunpreme frameless modules GXB-xxxYY Where "YY" can be blank or SL
Trina	Trina frameless modules TSM-xxxYY Where "YY" can be either DEG5(II), DEG5.07(II), DEG5.40(II), DEG5.47(II), DEG14(II), DEG14C(II), DEG14C.07(II), DEG14.40(II), PEG5, PEG5.07, PEG5.40, PEG5.47, PEG14, or PEG14.40

The right way to attach almost anything to metal roofs!

S-5![®] The Right Way!

S-5-U Clamp

The S-5-U clamp is by far our most popular and most versatile clamp. It fits about 85% of the standing seam profiles manufactured in North America—including most structural and architectural profiles. It can be used on vertically oriented seams and, by rotating the clamp 90 degrees, it can also be used on most horizontal 2" seam profiles.

Its simple design, generous dimensioning, and multiple hole orientations are what make the S-5-U clamp so versatile for use with the S-5![®] snow retention products, such as ColorGard[®], as well as with other heavy-duty applications.

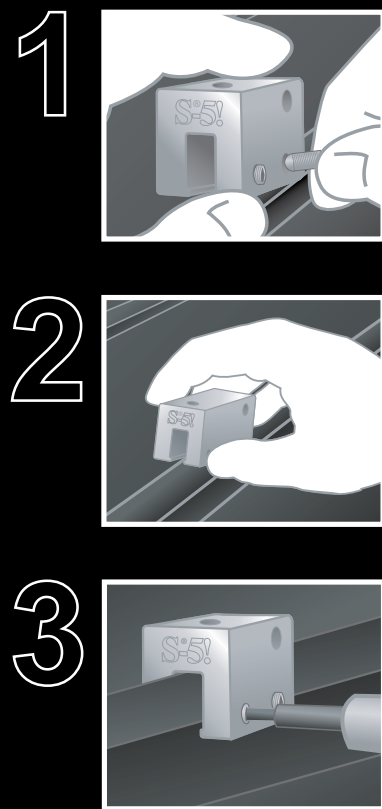
Installation is as simple as setting the specially patented round-point setscrews into the clamp, placing the clamp on the seam, and tightening them to the specified tension. Then, affix ancillary items using the bolt provided with the product. Go to www.S-5.com/tools for information and tools available for properly attaching and tensioning S-5! clamps.

S-5-U Mini Clamp

The S-5-U Mini is a bit shorter than the S-5-U 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-U clamp is our most popular and versatile clamp, fitting about 85% of the standing seam profiles in North America.



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



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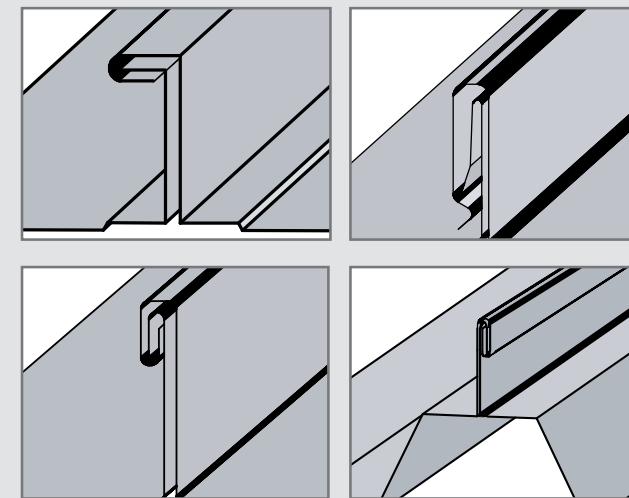
S-5![®] The Right Way!

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

The S-5-U and S-5-U 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-U 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.

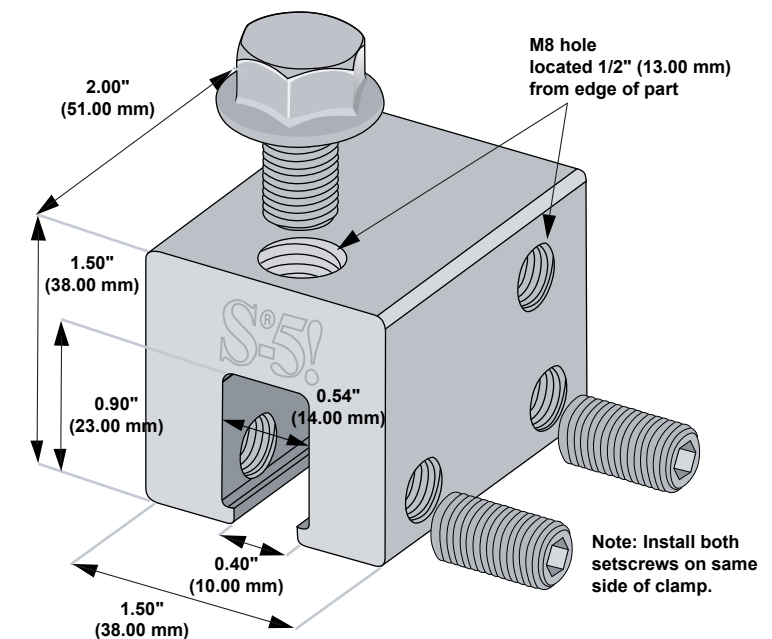
The S-5-U clamp has been tested for load-to-failure results on most major brands and profiles of standing seam roofing. The independent lab test data found at www.S-5.com can be used for load-critical designs and applications. S-5![®] holding strength is unmatched in the industry.

Example Profiles

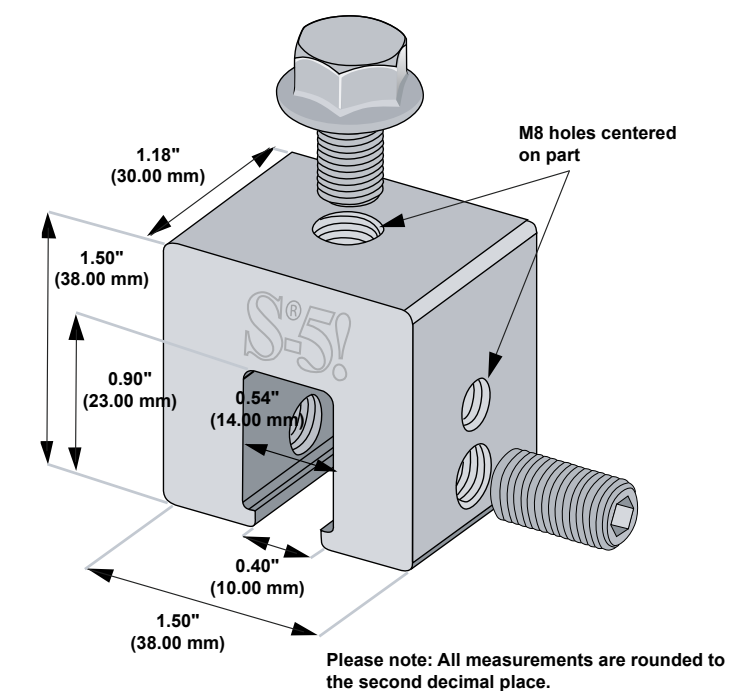


For horizontal seams under 0.65", do not use this clamp. Visit www.S-5.com for more detailed information and proper clamp usage.

S-5-U Clamp



S-5-U Mini Clamp



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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