

SUPPLEMENTAL INFORMATION #1

For Planning Commission Agenda of:
July 15th, 2021

- ☒ Consent Agenda Item **No. C-12**
- ☐ Continued Hearing Item
- ☐ Public Hearing Item
- ☐ Department Report
- ☐ Old Business

Re: Barryland Farm

Record Number PLN-12259-CUP

Assessor's Parcel Number (APN): 210-131-020

Dinsmore area

Attached for the Planning Commission's record and review is the following supplementary information item:

Applicant's agent notified the Department (7/12/2021) after legal notice was published that one element of the project need additional documentation regarding energy and generator use. This information is to be added to the Staff Report Attachment Package, and includes the following information:

- Power is supplied by an existing 5kW battery-operated 10-panel solar array system, and a 45 k Whisper Watt backup generator. The Staff Report stated that that power to the project was provided 'partially by existing solar panels', so the updated description provides exact detail about existing solar use.
- Applicant proposed to upgrade to a 20kW solar array system with a 45kW battery storage system, which will be completed by August 2021 (previously stated in staff report that this upgrade would occur within two (2) years of permit approval).
- The generator and fuel are stored in a secondary containment shed (1,506 SF) to ensure noise levels are below 50dB.

The applicant's agent has requested that the revised Cultivation and Operations plan and the Solar Power System Plans & Permit be submitted for the Planning Commission's review before the Planning Commission Hearing on July 15th, 2021.

CULTIVATION & OPERATIONS PLAN

Barryland Farm LLC
Proposed Commercial Cannabis
Cultivation

APN: 210-131-020
County Application #: 12259
CDFA State License #: CCL18-0005635, CCL18-0005636



Prepared For:
Humboldt County Planning & Building Department

Prepared By:
Elevated Solutions Inc.

Revised July, 2021

Project Summary

Project Objective

Barryland Farm LLC is proposing to permit existing cannabis cultivation activities in accordance with the County of Humboldt Commercial Medical Marijuana Land Use Ordinance (CMMMLUO). The project requires a Conditional Use Permit (CUP), for a total of 11,250 square feet of mixed light cultivation and 9,255 of outdoor cultivation. Mixed light cultivation takes place in (3) 30'x100' and (1) 30'x75' greenhouse structures. Outdoor cultivation takes place in (4) 20'x100' light deprivation hoop houses. Ancillary nursery space is proposed in (2) 20'x50' greenhouse structures. Power is supplied by an existing 5kW, 10 panel, solar array with a backup generator. The applicant has contracted Sunboldt Solar & Design, and is currently in the application process to implement a proposed, upgraded 20kW solar solar system with 45kWh battery storage. The completion of the upgraded system is expected in August of 2021. The generator and fuel are stored in a 1506 SF enclosed shed with secondary containment. Water for cultivation is supplied by a permitted well. Domestic use water is sourced from a point of diversion in Little Thompson Creek. There is currently 98,450 gallons of water storage in the form of hard water tanks to facilitate the project during the forbearance period. Drying/curing occurs in (1) 399 SF and (1) 1489 SF buildings. There are (2) 90 SF sheds, (1) 64 SF shed and (1) 643 SF shed s utilized for storage of nutrients, pesticides, and tools.

Site Description

The project site is located approximately 63 miles southeast of Eureka, CA. To reach the site from Eureka, take US-101 South for 17 miles to exit 685 to Hwy 36. Continue on Hwy 36 for 36.3 miles. Turn right onto Burr Valley Rd. for 5.3 miles.

The destination will be on the right 5136 Burr Valley Rd. Bridgeville, CA. Approximate drive time from Eureka, CA is 1 hour and 55 minutes with a distance of 55 miles. The site is located in section 34, township site is located at 40.4238, - 123.6062. The subject parcel is approximately 16.11 acres in size (per Humboldt County WebGIS).

Land Use

The subject has a general plan designation of dispersed housing, as identified by the Northern Humboldt General Plan (NHGP) and is zoned T:U (Unclassified). The purpose for which either land or structure is designated, arranged, or intended, or for which is or may be occupied or maintained (former section INL #312-72) a; ord. 1104, sec. 210576 by ord. 2166 section 9 on 4-7-2008.

Compliance

State of California Commercial Cannabis Activity License

There are currently two active Provisional Licenses correlated with this project. CCL19-0005635 is a small outdoor license and CCL19-0005636 is a medium mixed light tier 1 cultivation license. Upon approval from Humboldt County Planning & Building Department, the applicant will transition the license to an Annual State License.

North Coast Regional Water Quality Control Board

Barryland Farm LLC is currently enrolled with the NCRWQCB for coverage under Tier 2 of Order No. 2015-0023 Waiver of Waste Discharge Requirements and General Water Quality Certification for Discharges of Waste Resulting from Cannabis Cultivation & Associated Activities or Operations, With Similar Environmental Effects. A Water Resource Protection Plan and Site Management Plan have been developed for the project by Six Rivers Construction & Consulting and has been implemented for activities

associated with onsite cultivation since August 2016. The associated WDID Number is 1_12CC400884.

State Water Resource Control Board

A total of 2 watercourses exists on the property. Water for domestic uses is provided by a point of diversion in Little Thompson Creek and permitted well. A steel pipe, 2.5in. in diameter, is buried under large borders at the base of a large pool. The buried water line gravity feeds the residence. Water for cultivation is provided by a permitted groundwater well. The applicant has enrolled transitioned to the State Water Resource Control Board, under Order WQ 2017-0023-DWQ.

Humboldt County Building Department

All necessary building permits will be obtained from the Humboldt County Building Department for all existing and proposed structures and supporting infrastructure upon approval of the Conditional Use Permit. The Humboldt County Planning Department application # is 12259.

Humboldt County Agriculture Department

The applicant of Barryland Farm LLC will be assigned an Operator Identification number in order to identify specific areas that have been treated with pesticides and report monthly use of EPA regulated pesticides. Barryland Farm LLC adheres to all agriculture safety requirements for employers, including posting necessary pesticides safety forms on site and conducting pertinent training for employees. Please refer to section 2.6-3 for further information.

Cal Fire

The subject property is located within a State Responsibility Area (SRA) for fire protection. Several improvements are proposed in order to meet SRA requirements, including designation of a fire turn out area for emergency vehicles, and management of trees and vegetation around existing structures to maintain the required 150 ft. defensible space. All structures on the property meet the 30 ft. SRA setback requirement from property lines. Fire extinguishers are located at all greenhouse structures, structures and fuel areas. There is a 3,000-gallon fire suppression tank located on the parcel marked with a blue reflector for fire suppression.

California Department of Fish & Wildlife

A Lake Streambed Alteration Agreement (LSAA) has been completed by Chris Carroll from Timberland Resource Consultants. There are two upgrades on the project that will be completed in the 2022 season. The Burr Valley Road Association was granted a Trillius Grant to install a 45-ft. steel bridge will be installed over Thompson Creek. The current instream pond will have a new upgraded 18" x 30' long CMP installed and realigned.

Cultivation & Processing

Cultivation Plan & Schedule

Mixed light cultivation takes place in (3) 30'x100' and (1) 30'x75' greenhouse structures, for a combined mixed light cultivation of 11,250 sq. ft. The 9,225 sq. ft. of outdoor cultivation takes place in (4) 20'x100' light deprivation hoop houses. The greenhouses consist of heavy gauge steel tubing, covered with a woven poly translucent opaque tarp. Greenhouse flooring will be upgraded to black polyurethane petromat, covered in rock. Plants are grown in 25-gallon plastic pots. Each greenhouse is ventilated by intake and

exhaust fans. The greenhouses utilize a combination of artificial light and light deprivation to produce up to (2) flowering cycles per year by pulling tarps over greenhouses, adhering to the International Dark Sky Standards, which are further detailed in *Appendix G: Light Management Plan for International Dark Sky Policy*. The monthly *Cultivation Schedule in Appendix F* details the cultivation activities associated with the mixed light cultivation operation for a typical two cycle year.

Harvesting, Drying & Trimming

When plants have reached the maturity, they are harvested, and wet weights are taken and recorded into metric. Depending on the strain and plant development particle harvest maybe done to remove top flowers. Plants are hung in the drying and curing structure for approximately 2 weeks. The dried flowers are then bucked off the stem and placed into totes. Plant waste is recorded and moved to the compost area. Unprocessed flower is storage until it is taken to a licensed processing facility to be processed.

Employee Plan

Barryland Farm LLC is an “agricultural employer” as defined in Alatorre-Zenovich- Dunlap-Berman Agricultural Labor Relations Act of 1975 [Part 3.5 (commencing with Section 1140) of Division 2 of the Labor Code], and complies with all applicable federal, state and local laws and regulations governing California Agricultural Employers. Barryland Farm is owner operated with 2 full time seasonal employees for a total of 3 people for operations.

Employee Training & Safety

The employees are trained on each aspect of the procedure including cultivation and harvesting techniques, use of pruning tools, proper application and storage of pesticides and fertilizers. Access to the onsite cultivation, drying and processing facilities is limited to authorized and trained staff.

All employees are trained on proper safety procedure including fire safety; use of rubber gloves and respirators; proper hand washing guidelines, and protocol in the event of an emergency, Pesticide and Nutrient training is provided to each person using or exposed to these products. All employees are required to complete sexual harassment prevention training in compliance with SB 1343. The site manager will be trained in CPR and First Aid. Site manager and owner are required to complete the Private Applicator Certification (PAC) through the County of Humboldt Agriculture Department and a 30-hour general industry training for Cal-Osha. A copy of these training records is available onsite upon request.

The owner and at least (1) employee on site hold a weigh master certification. All staff involved in harvesting activities will undergo METRC track & trace training, as well as any third-party track & trace training that may be implemented in the future. Employees involved in track & trace duties are required to stay current with corresponding regulations and attend any future training or refresher courses.

Toilet & Handwashing Facilities

Portable toilets and hand washing stations are available on-site, as well as a bathroom inside the residence. Antibacterial liquid soap and paper hand towels are made readily available. Six Rivers Portable Toilets supplies and services the portable toilets. Employees will work at a distance typically no greater than 250 ft. from the restroom.

On-Site Housing

The existing single-family residence on-site is used to house the 2 full time employees. The residence is non-cannabis related and is leased separately.

Security Plan & Hours of Operation

Facility Security

The cultivation facilities including the greenhouses and processing buildings are enclosed in a secure privacy fence. An entry gate is located off of Burr Valley Rd. approximately 200 ft. on the North side of Burr Valley Rd. The entry gates remain locked at all times and access to the cultivation areas is limited to exclusively to employees. Restricted access signs are posted conspicuously at the entry gates. The cultivation and drying and curing area will have low intensity exterior lighting to illuminate the entrances and will include a small number of solar motion activated security lights. All lighting will be designed and located, so that direct rays are confined to the property. Barryland Farm LLC will adhere to the International Dark Sky Associations' recommendations by using downward facing, warm colored, Low-pressure Sodium, High-pressure Sodium or low color-temperature LED's with a shield over the light source to minimize glare and light pollution. Please refer to *Appendix G: Lighting Management Plan for International Dark Sky Policy* for further information. Security cameras will be installed at the main access gates and entrances to the facilities, which will include an alarm system. There are motion alarms posted at various locations on the property to ensure that trespassers are not on the premises.

Environment

Water Source and Projected Water Use

Domestic water is provided by a point of diversion in Little Thompson Creek, under Small Domestic Use Registration number D033139. Water for cannabis irrigation is provided by a permitted well. The location of the well is over 200' away from an unnamed class II stream. Water is then pumped and stored in hard storage tanks during the winter months to maintain water levels throughout the year.

Barryland Farm LLC utilizes water management strategies to conserve and reuse onsite water and fertilizers to achieve net zero discharge.

The table below outlines the estimated irrigation water usage for cultivation during a typical year. Variables such as weather conditions and specific cannabis strains will have a slightly different effect on water use.

Table 3.1 Estimated Annual Irrigation Water Usage (gal/month)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10,000	12,000	14,000	30,000	30,000	16,000	10,000	0	0

Water Storage

Water storage for irrigation use is provided in the form of water storage tanks. The property currently has (7) 350-gal, (2) 3,000-gal, and (18) 5,000-gal storage tanks for a total of 98,450 gallons of hard water storage.

Site Drainage, Runoff, & Erosion Control

Barryland Farm LLC is enrolled with the North Coast Regional Water Quality Control Board (NCRWQCB) for Tier 2 coverage, and a Water Resource Protection Plan (WRPP) has been developed utilizing Best Management Practices (BMP's) in accordance with the North Coast Regional Water Quality Control Board and the State Water Resources Control Board recommendations. The drainage and erosion control measures described are referenced from the WRPP in *Appendix H*.

Erosion Control

The Water Resource Protection Plan (WRPP) and Site Management Plan (SMP) include erosion and sediment control BMP's designed to prevent contain and reduce sources of sediment. They also include corrective actions to access road maintenance. Additionally, the WRPP and SMP requires mulch piles and spoils from any grading to be stored in a designated location away from the watercourse. Please refer to the WRPP section titled *Best Management Practices for Discharges of Waste Resulting from Cannabis Cultivation and Associated Activities* located in *Appendix H* for complete BMP recommendations and specifications.

Watershed and Habitat Protection

Adherence to the Water Resource Protection Plan ensures that the watershed and surrounding habitat are protected. The cultivation activities and associated structures are > 150 ft. from the nearest watercourse, providing a suitable buffer between cultivation operation and habitat. Additionally, site development and maintenance activities utilize BMP's in accordance with the NCRWQB/SWRCB recommendations. Any grading and earthwork activities will be conducted by a licensed contractor in accordance with approved grading permits, signed Lake and Streambed Alteration Agreement with CDFW and the WRPP. Refer to *Appendix H* for detailed descriptions of watershed and habitat protection measures.

Monitoring & Reporting

Monitoring will be conducted to confirm the effectiveness of corrected measures listed in the Water Resource Protection Plan (WRPP) and determine if the site meets all standard conditions. Inspections will include photographic documentation of any controllable sediment discharge sites as identified in the site map. Visual inspection will occur at those locations on the site where pollutants or wastes, if uncontained, could be transported into receiving waters, and those locations where runoff from roads or developed areas drain into or toward surface water. The inspection will also document the progress of any planned contingency subject to a time schedule, or in the process of being implemented. A monitoring plan is included in the WRPP with photo points identified on WRPP map.

On-site monitoring shall occur:

- Before and after any significant alteration or upgrade to a given stream crossing, road segment, or controllable sediment discharge site. Inspection should include photogenic documentation with photo records to be kept on sight.
- Prior to October 15th and December 15th to evaluate site preparedness for storm events and storm water runoff.
- Following any rainfall event with an intensity of 3" precipitation in 24 hours.

Precipitation data are obtained from the National Weather Service by entering the site zip code at <http://www.noaa.gov/forecast>.

A monitoring and Reporting Forms are submitted annually under State Water Resource Control Board Order WQ 2017-0023-DWQ. The annual report will include data from the monitoring reports.

Water use reporting is reported to CDFW on an annual basis in December of each year. Any work being performed and work that has been completed is reported to CDFW 7 days before work begins and no later than 7 days after work is completed.

Energy & Generator Use

Power is supplied by an existing 5kW, 10 panel solar array with a 45k Whisper Watt backup generator. The applicant proposes to upgrade the system to a 20kW solar array with 45kWh battery storage which is expected to be completed by August 2021. The generator and fuel are stored in a 1506 SF enclosed shed with secondary containment to ensure the noise levels do not exceed 50 dB at within 50' of the generator. Decibel readings at the property line were recorded at 39.9dB. The generator/fuel storage shed is also equipped with eye wash stations, and fire extinguishers. Refer to *Appendix D* for more detailed generator specifications.

Use and Storage of Regulated Products

Best Management Practices

Best Management Practices (BMP's) are employed when storing, handling, mixing, application, and disposal of all fertilizers, pesticides, and fungicides. All nutrients, pesticides, and fungicides are located in a locked storage room, and contained within water-tight, locked and labeled containers, in accordance with manufacturers instruction. Application rates will be tracked and reported with the end of the year monitoring report required in the WRPP. Employees are trained to safely handle such pesticides, as before stated in section 2.6-3. See *Appendix H, WRPP* for complete BMP specifications for the use and storage of regulated products.

Fertilizers

Nutrients and biological inoculants used for cultivation include:

- Max Sea (16-16-16)
- Botanicare Cal-Mag Plus
- Verde
- Monster Bloom
- Bio Marine

Please see *Appendix B, MSDS* for complete product data.

Pesticides & Fungicides

Pesticides and fungicides used for cultivation include:

- Plant Therapy
- Dr Zhymes
- Triefecta

Waste Management Plan

Solid Waste Management

Trash and recycling containers are located near the processing building in a safe, enclosed location. Solid waste and recycling are hauled off-site to 965 Riverwalk Dr. Fortuna, CA 95540. Cultivation waste and stalks composted or hauled to Eel River Transportation and Salvage. Spent potting soil is stored in a contained area with environmental measures in place and covered during the wet months. All packaging from soil amendments and fertilizers are collected and disposed at the appropriate facility.

Wastewater Management

There is currently a working septic system on-site. The applicant will move forward with permitting the septic system when the application is approved. There is currently a portable toilet onsite that is serviced by Six Rivers Portable Toilets.

Cultivation Schedule

January -March:

Monitor site. Divert water for use during forbearance period.

April- May:

Prepare for season. Plants are received from licensed nursery and propagation of plant stock occurs.

May-June:

Plants are placed in greenhouse in a vegetative state. Mother plants are placed in the ancillary nursery area. Propagation for 2nd run starts.

July-August:

Plants from 1st run are harvested. Pots are amended and prepared for replanting.

September-October:

Plants are flipped into flower and remain in this state until they are ready for harvest.

October:

Plants are harvested from 2nd Run. Pots of soil are placed in the compost area for storage during winter months. Site is prepped for winterization, traps are removed from greenhouses, erosion control measure are applied.

November:

Monitoring & Water diversion if allowed

December:
Monitoring & Water diversion if allowed.

LIGHTING MANAGEMENT PLAN FOR INTERNATIONAL DARK SKY

1. Purpose and Philosophy

This Lighting Management Plan (LMP) is intended to be used by Barryland Farm, LLC as a guide in the selection, placement, installation and operation of all Mixed Light Cultivation area. Its function is to regulate the use of Artificial Light At Night (ALAN) at Barryland Farm, LLC in a way that prioritizes the safety of staff while minimizing the impact of such light on protected wildlife. Therefore, all instances of the use of ALAN at Barryland Farm, LLC will adhere to the principle that any artificial light will be deployed only: (1) when it is strictly needed; (2) where it is needed; (3) in the appropriate amount for a specific task; and (4) with the appropriate spectrum and in accordance with Humboldt County Medical Marijuana Land Use Ordinance (CMMLUO) Section 55.4.1 (V) et. seq. Performance Standard for Mixed Light Cultivation and Processing Operations and the State of California Department Medicinal And Adult-Use Cannabis Regulation and Safety Act (MAUCRSA) and the California Department of Food Administration (CDFA) Regulation Code Article 4. Section 8304 Cultivation Site Requirements. General Environmental Protection Measures (c) & (g).

2. Applicability

Barryland Farm, LLC represents that this Lighting Management Plan (LMP) meets or exceeds all applicable agency and/or departmental policies regarding outdoor lighting and conforms to all local, regional, and national laws. Humboldt County Medical Marijuana Land Use Ordinance (CMMLUO) Section 55.4.1 (V) et. seq. Performance Standard for Mixed Light Cultivation and Processing Operations and the State of California Department Medicinal And Adult-Use Cannabis Regulation and Safety Act (MAUCRSA) and the California Department of Food Administration (CDFA) Regulation Code Article 4. Section 8304 Cultivation Site Requirements. General Environmental Protection Measures (c) & (g).

Those cultivators using artificial lighting for mixed-light cultivation shall shield greenhouses so that little to no light escapes. Light shall not escape at a level that is visible from neighboring properties between sunset and sunrise.

The light source should comply with the International Dark Sky Association standards for Lighting Zone 0 and Lighting Zone 1, and be designed to regulate light spillage onto neighboring properties resulting from backlight, uplight, or glare (BUG). Should the Humboldt County Planning Division receive complaints that the lighting is out of alignment or not complying with these standards, within ten (10) working days of receiving written notification that a complaint has been filed, the applicant shall submit written verification that the lights' shielding and alignment has been repaired, inspected and corrected as necessary.

All outdoor lighting used for security purposes shall be shielded and downward facing

Mixed-Light license types of all tiers and sizes shall ensure that lights used for cultivation are shielded from sunset to sunrise to avoid nighttime glare.

5. Shielding

Barryland Farm, LLC currently has manual Blackout curtains that shield the night and early morning sky from light pollution. Black out curtains are pulled before dusk prior to any artificial light use in Greenhouse structures. Further, to the greatest possible extent, Barryland Farm, LLC will endeavor to limit the inadvertent or incidental emission of light from Greenhouse Structures to the outdoors through the use of automated deprivation curtains, indoor lighting timers/switches, and other appropriate measures.

In all applications, outdoor lighting deployed throughout the developed area at Barryland Farm, LLC will use the most energy efficient lamp technology that minimizes the emission of short-wavelength light into the nighttime environment. This will including outdoor lighting on all structures, including but not limited to House, Processing facility, Sheds, etc.

8. Application

Artificial lighting will only be used when needed and limited to times of the year when the natural light cycle will not be significant for vegetative plant growth.

9. Curfew

Barryland Farm, LLC will follow the Dusk to Dawn International Dark Sky Standard. All Greenhouse curtains will be pulled and secured prior to any artificial light use. When possible lighting at Barryland Farm, LLC will be extinguished between the hours of 10pm and one hour before sunrise except in cases where staff safety is at risk.

10. Adaptive Controls

To the greatest practical extent possible, all lighting at Barryland Farm, LLC will make appropriate use of adaptive controls to limit the duration, intensity, and/or extent of outdoor lighting. Barryland Farm, LLC is proposing to install automated black out curtains and automated lighting timer to reduce the human error factor. Staff will be required to do mandatory inspections of all Greenhouse Structures to reduce mechanical error. All staff will be required as a part of the employment training program regarding the International Dark Sky Standards and this Lighting Management Plan will be added to the Operation Plan and Employee Handbook.

References:

- a) Humboldt County Medical Marijuana Land Use Ordinance (CMMLUO) Section 55.4.1 (V) et. seq. Performance Standard for Mixed Light Cultivation and Processing Operations
 - i. <https://humboldt.gov.org/2124/Medical-Marijuana-Land-Use-Ordinance>
- b) State of California Department Medicinal And Adult-Use Cannabis Regulation and Safety Act (MAUCRSA) and the California Department of Food Administration (CDFA) Regulation Code

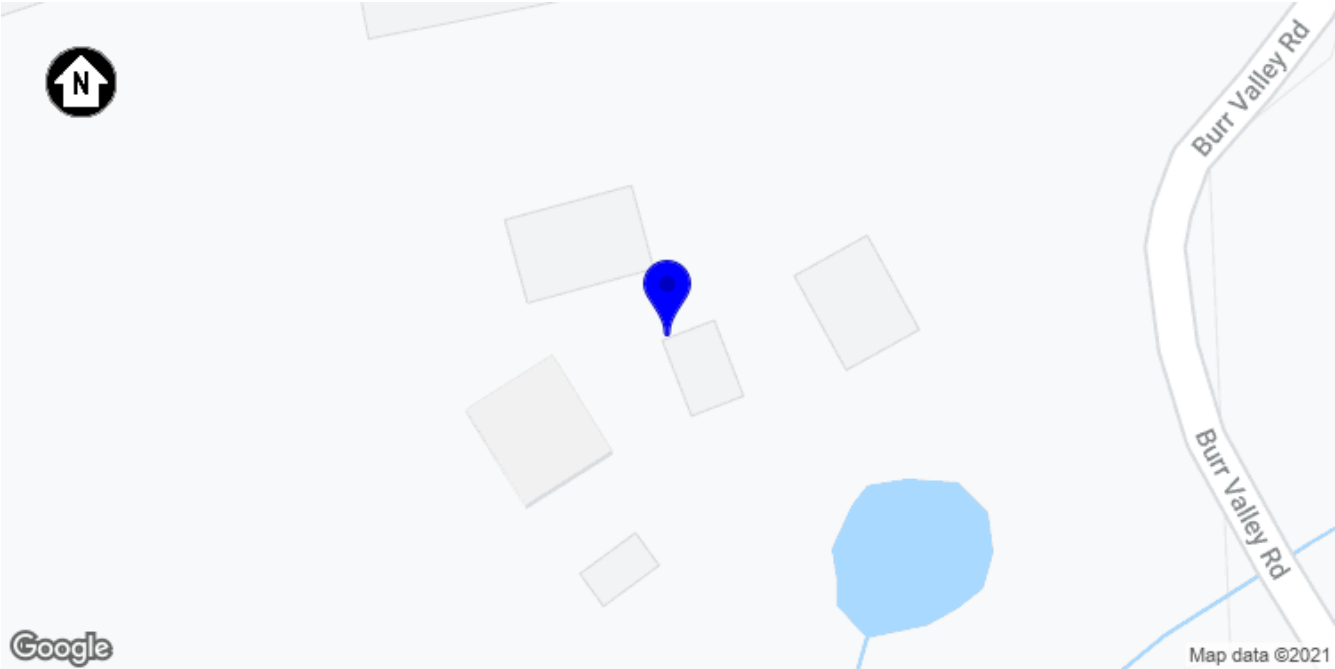
Article 4. Section 8304 Cultivation Site Requirements. General Environmental Protection Measures (c) & (g).

- i. https://static.cdfa.ca.gov/MCCP/document/CDFA%20Final%20Regulation%20Text_01162019_Clean.pdf
- c) California Cannabis Laws and Regulations 2019 Edition- ©2019 Omar Figueroa, ALL rights reserved ISBN 978-0-9984215-3-7
 - i. A Review of the Potential Impacts of Cannabis Cultivation on Fish and Wildlife Resources California Department of Fish and Wildlife Habitat Conservation Planning Branch *July 2018*
<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=160552&inline>
Pages: 14-16

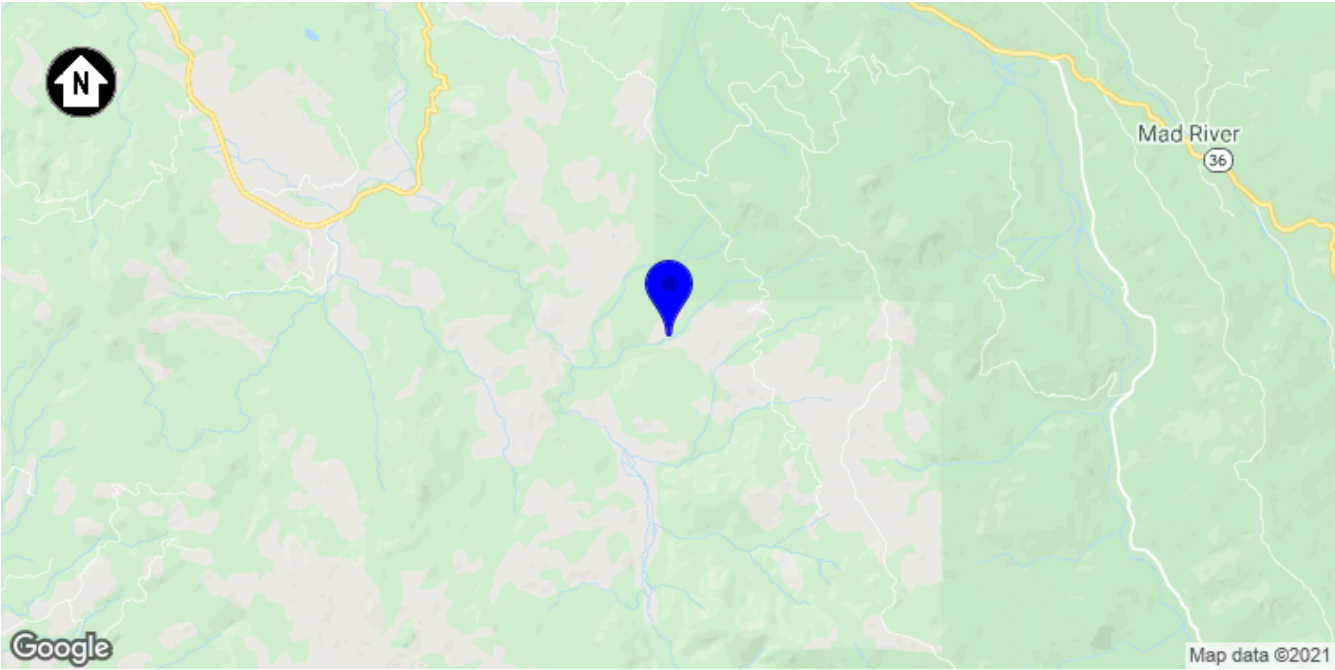
DIRECTORY OF PAGES	
PV-1	PROJECT SUMMARY
PV-2	SITE PLAN
PV-3	SINGLE-LINE DIAGRAM
PV-4	SAFETY LABELS
PV-5.1	ATTACHMENT PLAN 5.1
PV-5.2	ATTACHMENT PLAN 5.2
PV-6	ATTACHMENT DETAILS
PV-7	FIRE SAFETY PLAN
APPENDIX	ELECTRICAL CALCULATIONS
	MODULE DATASHEET
	DISCONNECT DATASHEETS
	INVERTER DATASHEET
	MOUNTING SYSTEM DATASHEET
	MOUNTING SYSTEM ENGINEERING LETTER
	UL 1703 CLASS A FIRE CERTIFICATION
	UL 2703 GROUND AND BONDING CERTIFICATION
	ANCHOR DATASHEET
	BATTERY DATASHEET

PROJECT DETAILS	
PROPERTY OWNER	STOYAN BARAKOV
PROPERTY ADDRESS	0 BURR VANLLEY ROAD, CA 95526 US
APN	210-131-020
ZONING	U
USE AND OCCUPANCY CLASSIFICATION	AL40 (FRWK)
AHJ	COUNTY OF HUMBOLDT
UTILITY COMPANY	N/A
ELECTRICAL CODE	2019 CEC
FIRE CODE	2019 CFC
OTHER BUILDING CODES	2019 CA BUILDING CODE 2019 CA RES. BUILDING CODE 2019 CA PLUMBING CODE 2019 CA MECHANICAL CODE 2019 CA FUEL GAS CODE 2019 CA ENERGY CODE

CONTRACTOR INFORMATION	
COMPANY	SUNBOLT CONSTRUCTION
LICENSE NUMBER	1038679 (GENERAL BUILDING-B)
ADDRESS	64 DAVENPORT RD., FIELDBROOK, CA 95519
PHONE NUMBER	(707) 481-7279
CONTRACTOR SIGNATURE	



1 PLOT
PV-1 SCALE: NTS



2 LOCALE
PV-1 SCALE: NTS

SCOPE OF WORK
THIS PROJECT INVOLVES THE INSTALLATION OF AN OFF-GRID PV SYSTEM WITH BATTERIES. 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 BATTERY BANK 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 OFF-GRID PV SYSTEM WITH ENERGY STORAGE
DC RATING OF SYSTEM	20.74KW
AC RATING OF SYSTEM	19.20KW
AC OUTPUT CURRENT	75.0A
INVERTER(S)	2 X SOL-ARK 12K
MODULE	CANADIAN SOLAR CS3K-305MS
ARRAY WIRING	(2) STRINGS OF 8 (MPPT A) (INV 1) (2) STRINGS OF 8 (MPPT B) (INV 1) (2) STRINGS OF 9 (MPPT A) (INV 2) (2) STRINGS OF 9 (MPPT B) (INV 2)
BATTERIES	12 X SIMPLIPHI - AMPLIPHI 3.8KW, 48V

INTERCONNECTION DETAILS	
POINT OF CONNECTION	NEW SUPPLY SIDE AC CONNECTION PER CEC 705.12(A)
PROPERTY SERVICE	120/240V 1φ
LOCATION	INSIDE PANELBOARD, PROTECTED BY FUSED EATON DG223NRB , 2-POLE, 100A, 240VAC

SITE DETAILS	
ASHRAE EXTREME LOW	-4°C (25°F)
ASHRAE 2% HIGH	40°C (104°F)
CLIMATE DATA SOURCE	REDDING MUNICIPAL AIRPORT (KRDD)
RISK CATEGORY	II
WIND EXPOSURE CATEGORY	C

P-160083



OFF-GRID SOLAR POWER SYSTEM

BURR VALLEYROAD
BRIDGEVILLE, CA 95526
APN: 210-131-020

PROJECT SUMMARY

DOC ID: 160083-197372-0
DATE: 7/9/21
CREATOR: P.B.
REVIEWER: P.B.

REVISIONS	

PV-1



1 SITE PLAN
PV-2 SCALE: 1" = 20'

GENERAL NOTES	
1	EQUIPMENT LIKELY TO BE WORKED UPON WHILE ENERGIZED SHALL BE INSTALLED IN LOCATIONS THAT SATISFY MINIMUM WORKING CLEARANCES PER CEC 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 CEC 690.31(G).
5	ALL EMT CONDUIT FITTINGS SHALL BE LISTED AS WEATHERPROOF FITTINGS AND INSTALLED TO ENSURE A RAINTIGHT FIT, PER CEC 358.42.

- 1 (N) VISIBLE, LOCKABLE, READILY-ACCESSIBLE AC DISCONNECT, OUTDOOR
- 2 (N) RAPID SHUTDOWN DEVICE, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT OVER ROOF NO CLOSER THAN 0.5" ABOVE ROOF SURFACE
- 3 (N) PROPOSED ROOF-MOUNTED PHOTOVOLTAIC ARRAY. 4:12 (18°) SLOPED ROOF, 48 PV MODULES (SILVER FRAME, WHITE BACKSHEET), 166° AZIMUTH
- 4 (N) RAPID SHUTDOWN DEVICE, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT OVER ROOF NO CLOSER THAN 0.5" ABOVE ROOF SURFACE
- 5 (N) DISCONNECT, INDOOR
- 6 (N) INVERTER, INDOOR
- 7 (N) DISCONNECT, INDOOR
- 8 (N) RAPID SHUTDOWN DEVICE, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT OVER ROOF NO CLOSER THAN 0.5" ABOVE ROOF SURFACE
- 9 (N) INVERTER, INDOOR
- 10 (N) RAPID SHUTDOWN DEVICE, OUTDOOR , OUTPUT CIRCUIT CONDUCTORS SHALL BE RUN IN EMT CONDUIT OVER ROOF NO CLOSER THAN 0.5" ABOVE ROOF SURFACE
- 11 (N) PROPOSED ROOF-MOUNTED PHOTOVOLTAIC ARRAY. 4:12 (18°) SLOPED ROOF, 20 PV MODULES (SILVER FRAME, WHITE BACKSHEET), 247° AZIMUTH
- 12 (N) PROPOSED ENERGY STORAGE, INDOOR

P-160083

SUNBOLT
SOLAR & CONSTRUCTION

OFF-GRID SOLAR POWER SYSTEM

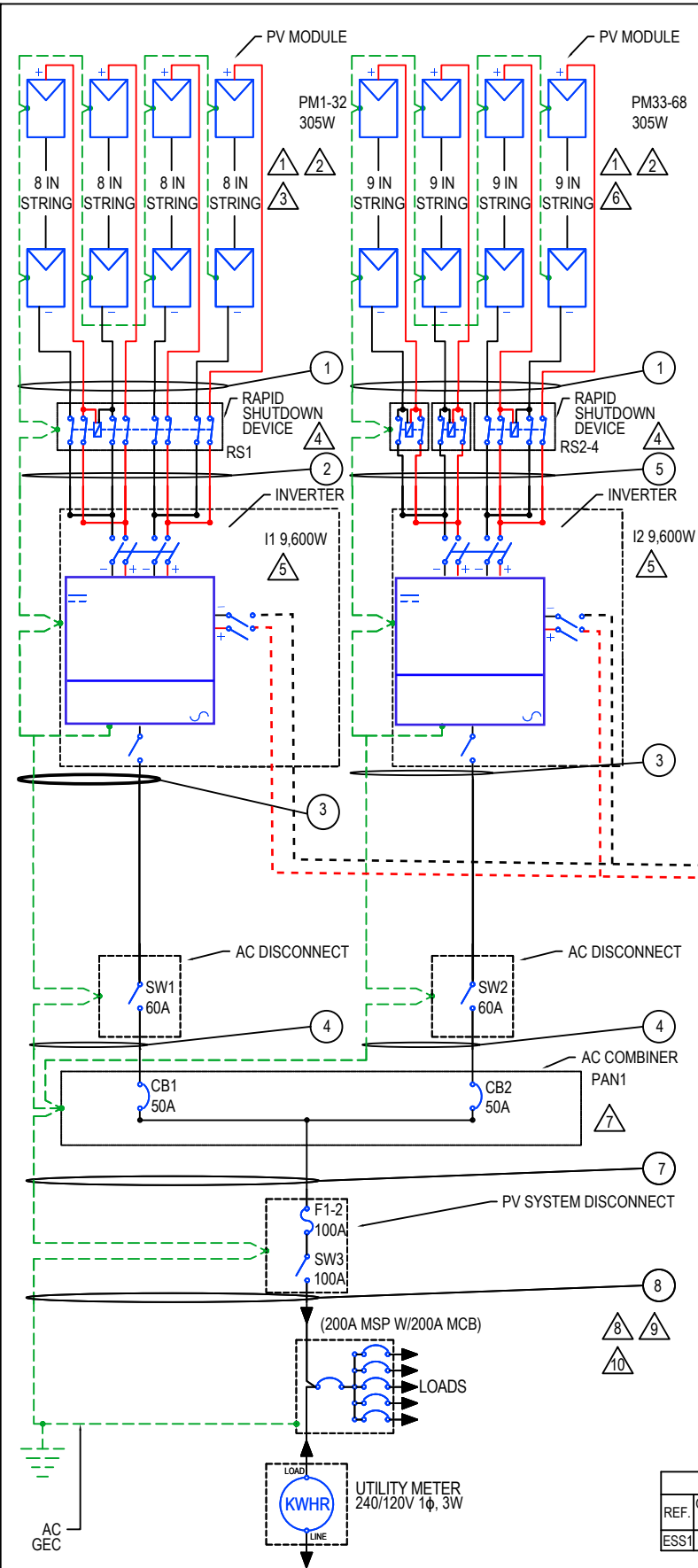
BURR VALLEYROAD
BRIDGEVILLE, CA 95526
APN: 210-131-020

SITE PLAN

DOC ID: 160083-197372-0
DATE: 7/9/21
CREATOR: P.B.
REVIEWER: P.B.

REVISIONS

PV-2



MODULES											
REF.	QTY.	MAKE AND MODEL		PMAX	PTC	ISC	IMP	VOC	VMP	TEMP. COEFF. OF VOC	FUSE RATING
PM1-68	68	CANADIAN SOLAR CS3K-305MS		305W	284W	9.90A	9.33A	39.5V	32.7V	-0.115V/°C (-0.29%/°C)	30A

INVERTERS								
REF.	QTY.	MAKE AND MODEL	AC VOLTAGE	GROUND	RATED POWER	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX INPUT VOLTAGE
I1-2	2	SOL-ARK 12K	240V	NOT SOLIDLY GROUNDED	9,600W	37.5A	40.0A	500V

RAPID SHUTDOWN DEVICES			
REF.	QTY.	MAKE AND MODEL	MAX. INPUT CURRENT (CONTINUOUS)
RS4	1	TBD	30A
RS1	1	TBD	30A
RS2-3	2	TBD	30A

DISCONNECTS			
REF.	QTY.	MAKE AND MODEL	RATED CURRENT
SW1-2	2	EATON DG222URB OR EQUIV.	60A
SW3	1	EATON DG223NRB OR EQUIV.	100A

OCPDS			
REF.	QTY.	RATED CURRENT	MAX VOLTAGE
CB1-2	2	50A	240VAC
F1-2	2	100A	0VAC

SYSTEM SUMMARY				
	INV. 1		INV. 2	
	MPPT 1	MPPT 2	MPPT 1	MPPT 2
ARRAY STC POWER	4,880W	4,880W	5,490W	5,490W
ARRAY PTC POWER	4,541W	4,541W	5,108W	5,108W
MODULES IN SERIES	8	8	9	9
ARRAY VMP	261.6V	261.6V	294.3V	294.3V
ARRAY IMP	18.7A	18.7A	18.7A	18.7A
ARRAY MAX VOC	342.7V	342.7V	385.5V	385.5V
ARRAY ISC	19.8A	19.8A	19.8A	19.8A
ARRAY STC POWER	9,760W		10,980W	
ARRAY PTC POWER	9,082W		10,217W	
MAX AC CURRENT	38A		38A	
MAX AC POWER OUTPUT	9,600W		9,600W	
DERATED AC POWER OUTPUT	8,718W		9,600W	
ARRAY STC POWER	20,740W			
ARRAY PTC POWER	19,298W			
MAX AC CURRENT	75A			
MAX AC POWER OUTPUT	19,200W			
DERATED AC POWER OUTPUT	18,526W			

- NOTES**
- ⚠ DC PV CONDUCTORS ARE NOT SOLIDLY-GROUNDED. NO DC PV CONDUCTOR SHALL BE WHITE- OR GRAY-COLORED
- ⚠ ALL METAL ENCLOSURES, RACEWAYS, CABLES AND EXPOSED NONCURRENT-CARRYING METAL PARTS OF EQUIPMENT SHALL BE GROUNDED TO EARTH AS REQUIRED BY CEC 250.4(A) AND PART III OF ARTICLE 250 AND EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO CEC 690.45. THE GROUNDING ELECTRODE SYSTEM SHALL ADHERE TO CEC 690.47(A) AND CEC 250.169. THE DC GROUNDING ELECTRODE SHALL BE SIZED ACCORDING TO CEC 250.166 AND INSTALLED IN COMPLIANCE WITH CEC 250.64.
- ⚠ MAX DC VOLTAGE OF ARRAY IS 342.7V AT -4°C ((-4°C - 25°C) X -0.115V/C + 39.5V) X 8 MODULES = 342.7V).
- ⚠ RAPID SHUTDOWN DEVICES COMPLIANT WITH REQUIREMENTS AS PER CEC 690.12(B). PV CIRCUIT CONDUCTORS LOCATED OUTSIDE THE ARRAY BOUNDARY (DEFINED AS 3 FEET FROM THE POINT OF PENETRATION INTO A BUILDING OR MORE THAN 3 FEET FROM AN ARRAY) SHALL BE LIMITED TO NOT MORE THAN 30V WITHIN 30 SECONDS OF RAPID SHUTDOWN INITIATION. CONDUCTORS LOCATED INSIDE OF THE ARRAY BOUNDARY SHALL BE LIMITED TO NOT MORE THAN 80 VOLTS WITHIN 30 SECONDS OF SHUTDOWN.
- ⚠ INVERTER IS COMPLIANT WITH CALIFORNIA PUBLIC UTILITIES COMMISSION RULE 21 FOR SMART INVERTERS. INSTALLER SHALL CONFIGURE INVERTER TO OPERATE IN REACTIVE POWER PRIORITY MODE.
- ⚠ MAX DC VOLTAGE OF ARRAY IS 385.5V AT -4°C ((-4°C - 25°C) X -0.115V/C + 39.5V) X 9 MODULES = 385.5V).
- ⚠ AC AGGREGATION PANEL BUSBAR AND THE OVERCURRENT PROTECTION PROTECTING THE BUSBAR SHALL BE SIZED IN ACCORDANCE WITH CEC 705.12(B)(2)(3)(C)
- ⚠ POINT-OF-CONNECTION IS ON THE SUPPLY SIDE OF SERVICE DISCONNECT, INSIDE PANELBOARD ENCLOSURE USING UNUSED TERMINALS, TERMINALS THAT ARE SUITABLE FOR DOUBLE LUGGING, OR USING OTHER LOCALLY-APPROVED METHODS AND HARDWARE, IN COMPLIANCE WITH CEC 705.12(A). THE PANELBOARD SHALL HAVE SUFFICIENT SPACE TO ALLOW FOR ANY TAP HARDWARE AS REQUIRED BY CEC 110.3 AND CEC 300.17
- ⚠ PV SYSTEM DISCONNECT SHALL BE A VISIBLE KNIFE-BLADE TYPE DISCONNECT THAT IS ACCESSIBLE AND LOCKABLE BY THE UTILITY. THE DISCONNECT SHALL BE LOCATED WITHIN 10 FT OF UTILITY METER. DISCONNECT SHALL BE GROUPED IN ACCORDANCE WITH CEC 230.72.
- ⚠ DISCONNECT SW3 MEETS CEC 690.12(C) REQUIREMENT FOR A RAPID SHUTDOWN INITIATION DEVICE

CONDUCTOR AND CONDUIT SCHEDULE W/ELECTRICAL CALCULATIONS																
ID	TYPICAL	CONDUCTOR	CONDUIT / CABLE	CURRENT-CARRYING CONDUCTORS IN CONDUIT / CABLE	OCPD	EGC	TEMP. CORR. FACTOR	FILL FACTOR	CONT. CURRENT	MAX. CURRENT (125%)	BASE AMP.	DERATED AMP.	TERM. TEMP. RATING	AMP. @ TERM. TEMP. RATING	LENGTH	VOLTAGE DROP
1	8	10 AWG PV WIRE, COPPER	FREE AIR	N/A	N/A	6 AWG BARE, COPPER	0.65 (62°C)	1.0	12.37A	15.46A	55A	35.75A	75°C	50A	444FT	0.49%
2	1	10 AWG THWN-2, COPPER	1" DIA. EMT	8	N/A	10 AWG THWN-2, COPPER	0.91 (40°C)	0.7	12.37A	15.46A	40A	25.48A	60°C	30A	25.3FT	0.06%
3	1	6 AWG THWN-2, COPPER	1" DIA. EMT	4	50A	10 AWG THWN-2, COPPER	0.91 (40°C)	0.8	37.5A	46.87A	75A	54.6A	60°C	55A	38FT	0.29%
4	2	8 AWG THWN-2, COPPER	0.5" DIA. EMT	2	50A	10 AWG THWN-2, COPPER	0.91 (40°C)	1.0	37.5A	46.87A	55A	50.05A	75°C	50A	20FT	0.24%
5	2	8 AWG THWN-2, COPPER	0.5" DIA. EMT	2	N/A	10 AWG THWN-2, COPPER	0.91 (40°C)	1.0	12.37A	15.46A	55A	50.05A	60°C	40A	102FT	0.43%
6	1	8 AWG THWN-2, COPPER	0.75" DIA. EMT	4	N/A	10 AWG THWN-2, COPPER	0.91 (40°C)	0.8	12.37A	15.46A	55A	40.04A	60°C	40A	172FT	0.45%
7	1	3 AWG THWN-2, COPPER	1" DIA. EMT	2	100A	8 AWG THWN-2, COPPER	0.91 (40°C)	1.0	75A	93.75A	115A	104.65A	75°C	100A	50FT	0.77%
8	1	3 AWG THWN-2, COPPER	1" DIA. EMT	2	100A	8 AWG THWN-2, COPPER	0.91 (40°C)	1.0	75A	93.75A	115A	104.65A	75°C	100A	10FT	0.15%
9	1	4/0 AWG THWN-2, COPPER	3" DIA. EMT	2	N/A	N/A	0.91 (40°C)	1.0	60A	75A	115A	104.65A	75°C	100A	10FT	0.15%

ENERGY STORAGE SYSTEMS					
REF.	QTY.	MAKE AND MODEL	CHEMISTRY	CONTINUOUS POWER OUTPUT	VOLTAGE RANGE
ESS1	12	AmpliPHI-3.8-48V	Li-Ion	22,800W	458A DC

- GENERAL ELECTRICAL NOTES**
- 1 UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
- 2 CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.10 (D).
- 3 CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).

- GROUNDING NOTES**
- 1 ALL EQUIPMENT SHALL BE PROPERLY GROUNDED PER THE REQUIREMENTS OF NEC ARTICLES 250 & 690
- 2 PV MODULES SHALL BE GROUNDED TO MOUNTING RAILS USING MODULE LUGS OR RACKING INTEGRATED GROUNDING CLAMPS AS ALLOWED BY LOCAL JURISDICTION. ALL OTHER EXPOSED METAL PARTS SHALL BE GROUNDED USING UL-LISTED LAY-IN LUGS.
- 3 INSTALLER SHALL CONFIRM THAT MOUNTING SYSTEM HAS BEEN EVALUATED FOR COMPLIANCE WITH UL 2703 "GROUNDING AND BONDING" WHEN USED WITH PROPOSED PV MODULE.
- 4 IF THE EXISTING MAIN SERVICE PANEL DOES NOT HAVE A VERIFIABLE GROUNDING ELECTRODE, IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL A SUPPLEMENTAL GROUNDING ELECTRODE.
- 5 AC SYSTEM GROUNDING ELECTRODE CONDUCTOR (GEC) SHALL BE A MINIMUM SIZE #8AWG WHEN INSULATED, #6AWG IF BARE WIRE.
- 6 EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO NEC ARTICLE 690.45, AND BE A MINIMUM OF #10AWG WHEN NOT EXPOSED TO DAMAGE, AND #6AWG SHALL BE USED WHEN EXPOSED TO DAMAGE
- 7 GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLOR CODED GREEN, OR MARKED GREEN IF #4AWG OR LARGER

1 SINGLE-LINE DIAGRAM
PV-3 SCALE: NTS

P-160083

SUNBOLT

SOLAR & CONSTRUCTION

OFF-GRID SOLAR POWER SYSTEM

BURR VALLEYROAD

BRIDGEVILLE, CA 95526

APN: 210-131-020

SINGLE-LINE DIAGRAM

PROJECT ID: 160083

DATE: 07/09/21

CREATED BY: P.B.

CHECKED BY: P.B.

REVISIONS

PV-3

DC RACEWAYS

3

SW1 - DISCONNECT
(EATON DG222URB)

4 7

SW2 - DISCONNECT
(EATON DG222URB)

4 7

SW3 - DISCONNECT
(EATON DG223NRB)

4 8 9

I1 - INVERTER
(SOL-ARK 12K)

4 5 7

I2 - INVERTER
(SOL-ARK 12K)

4 6 7

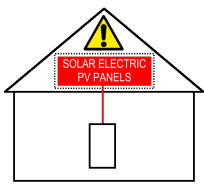
MSP - MAIN SERVICE PANEL

1 2 10

1 SEE NOTE NO. 5 (MSP)

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE 'OFF' POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT.



CEC690.56(C)(1) AND CFC1204.5.1,1204.5.1

3 SEE NOTE NO. 6 (DC RACEWAYS)

WARNING PHOTOVOLTAIC POWER SOURCE

CEC690.31(G)(3)

4 EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT (SW1, SW2, SW3, I1, I2)

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

CEC690.13(B)

7 AC DISCONNECT (SW1, SW2, I1, I2)

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

CEC690.54

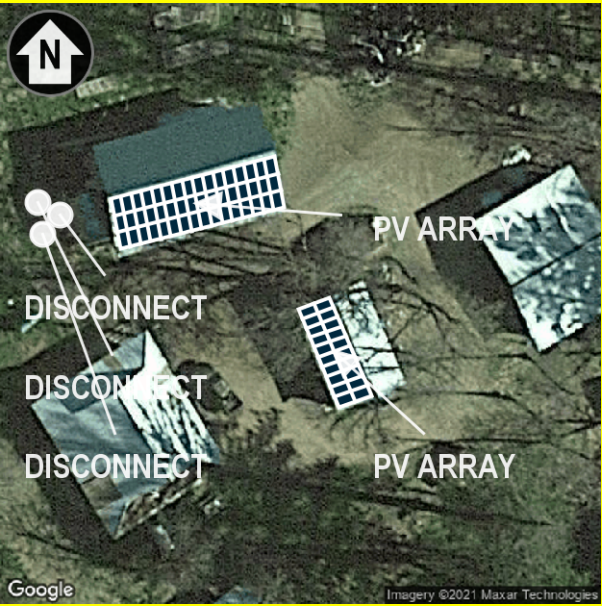
10 ANY AC ELECTRICAL PANEL THAT IS FED BY BOTH THE UTILITY AND THE PHOTOVOLTAIC SYSTEM (MSP)

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

CEC705.12(B)(3)

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

! CAUTION !
POWER TO THIS BUILDING IS ALSO FROM ROOF ARRAYS WITH DISCONNECTS AS SHOWN



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CEC690.56(B),705.10

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

DIRECT-CURRENT PHOTOVOLTAIC POWER SOURCE
MAXIMUM VOLTAGE: 343V
MAX CIRCUIT-CURRENT: 30.9A

CEC690.53

8 AC SOLAR DISCONNECT (SW3)

PV SYSTEM DISCONNECT

CEC690.13(B)

6 DC DISCONNECT (MPPT CHANNEL A OF I2, MPPT CHANNEL B OF I2) (I2)

DIRECT-CURRENT PHOTOVOLTAIC POWER SOURCE
MAXIMUM VOLTAGE: 386V
MAX CIRCUIT-CURRENT: 30.9A

CEC690.53

9 AC DISCONNECT (SW3)

MAXIMUM AC OPERATING CURRENT: 75.0A
MAXIMUM AC OPERATING VOLTAGE: 240V

CEC690.54

LABELING NOTES	
1	ALL PLAQUES AND SIGNAGE REQUIRED BY 2019 CEC AND 2019 CFC 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 CEC 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 CEC 690.56(B).
4	WHERE THE INVERTERS ARE REMOTELY LOCATED FROM EACH OTHER, A DIRECTORY IN SHALL BE INSTALLED AT EACH DC PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS, AT EACH AC DISCONNECTING MEANS, AND AT THE MAIN SERVICE DISCONNECTING MEANS SHOWING THE LOCATION OF ALL AC AND DC PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS IN THE BUILDING, IN ACCORDANCE WITH CEC 690.4(D).
5	LABEL(S) WITH MARKING, "TURN RAPID SHUTDOWN SWITCH TO THE 'OFF' POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT," SHALL BE LOCATED WITHIN 3 FT OF SERVICE DISCONNECTING MEANS THE TITLE SHALL UTILIZE CAPITALIZED LETTERS WITH A MINIMUM HEIGHT OF 3/8" IN WHITE ON A RED BACKGROUND, AND REMAINING TEXT SHALL BE CAPITALIZED WITH A MINIMUM HEIGHT OF 3/16" IN BLACK ON WHITE BACKGROUND
6	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

P-1600083

SUNBOLT
SOLAR & CONSTRUCTION

OFF-GRID SOLAR POWER SYSTEM

BURR VALLEYROAD
BRIDGEVILLE, CA 95526
APN: 210-131-020

SAFETY LABELS

DOC ID: 160083-197372-0
DATE: 7/9/21
CREATOR: P.B.
REVIEWER: P.B.

REVISIONS	

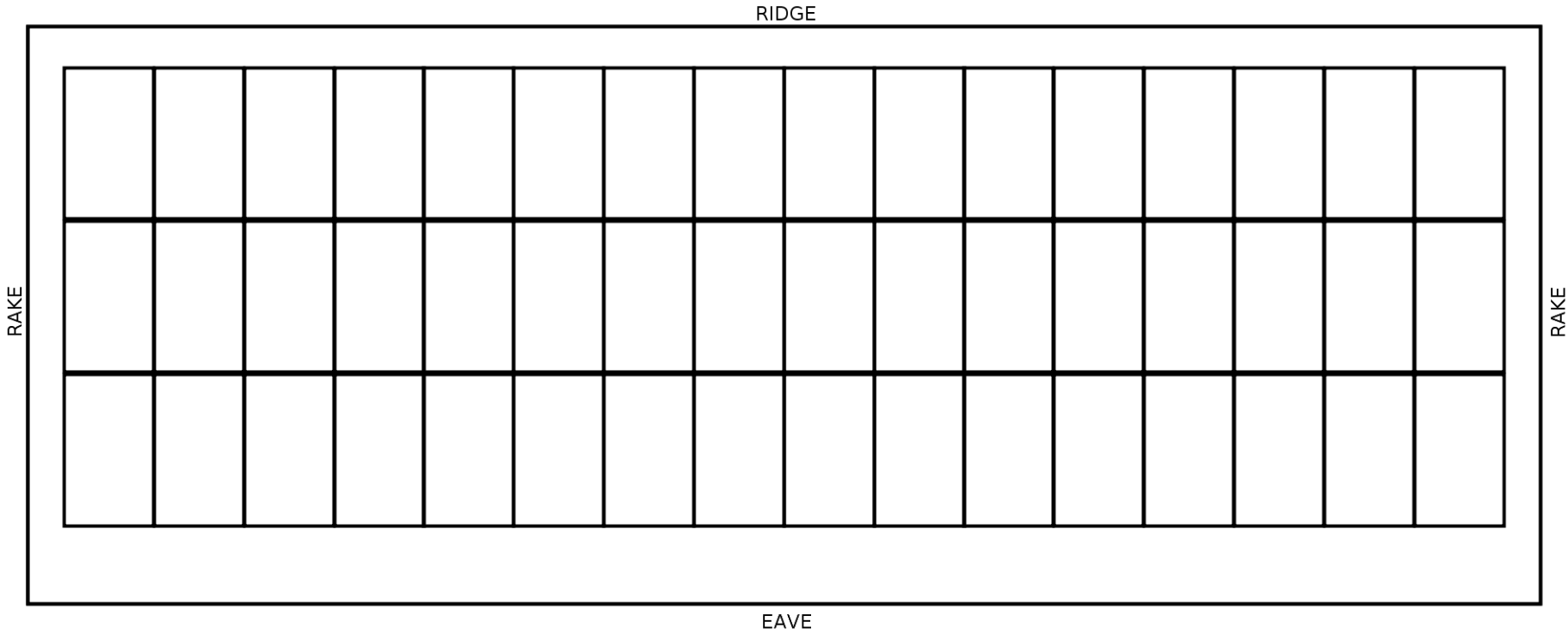
PV-4

ROOF PROPERTIES	
ROOF MATERIAL	COMPOSITION SHINGLE (1 LAYER)
SLOPE	4/12 (18.4°)
MEAN ROOF HEIGHT	23.3FT
DECK SHEATHING	15/32" OSB
CONSTRUCTION	TRUSSES (2X4 TOP-CHORD), 24IN OC

MODULE MECHANICAL PROPERTIES	
MODEL	CANADIAN SOLAR CS3K-305MS
DIMENSIONS (AREA)	65.9IN X 39.1IN X 1.4IN (17.9 SQ FT)
WEIGHT	40.8LB

MOUNTING SYSTEM PROPERTIES	
MAX. ALLOW. RAIL SPAN	60.0IN (ZONES 1, 2, AND 3)
MAX. MOUNT SPACING	48.0IN (ZONES 1, 2, AND 3)
MAX. ALLOW. CANTILEVER	24.0IN (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"



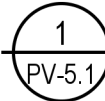
WIND ZONE I



WIND ZONE II



WIND ZONE III



ATTACHMENT PLAN (ORTHOGONAL PROJECTION)

SCALE: 1/8" = 1'

P-160083



OFF-GRID SOLAR POWER SYSTEM

BURR VALLEYROAD
BRIDGEVILLE, CA 95526
APN: 210-131-020

ATTACHMENT
PLAN

DOC ID: 160083-197372-0

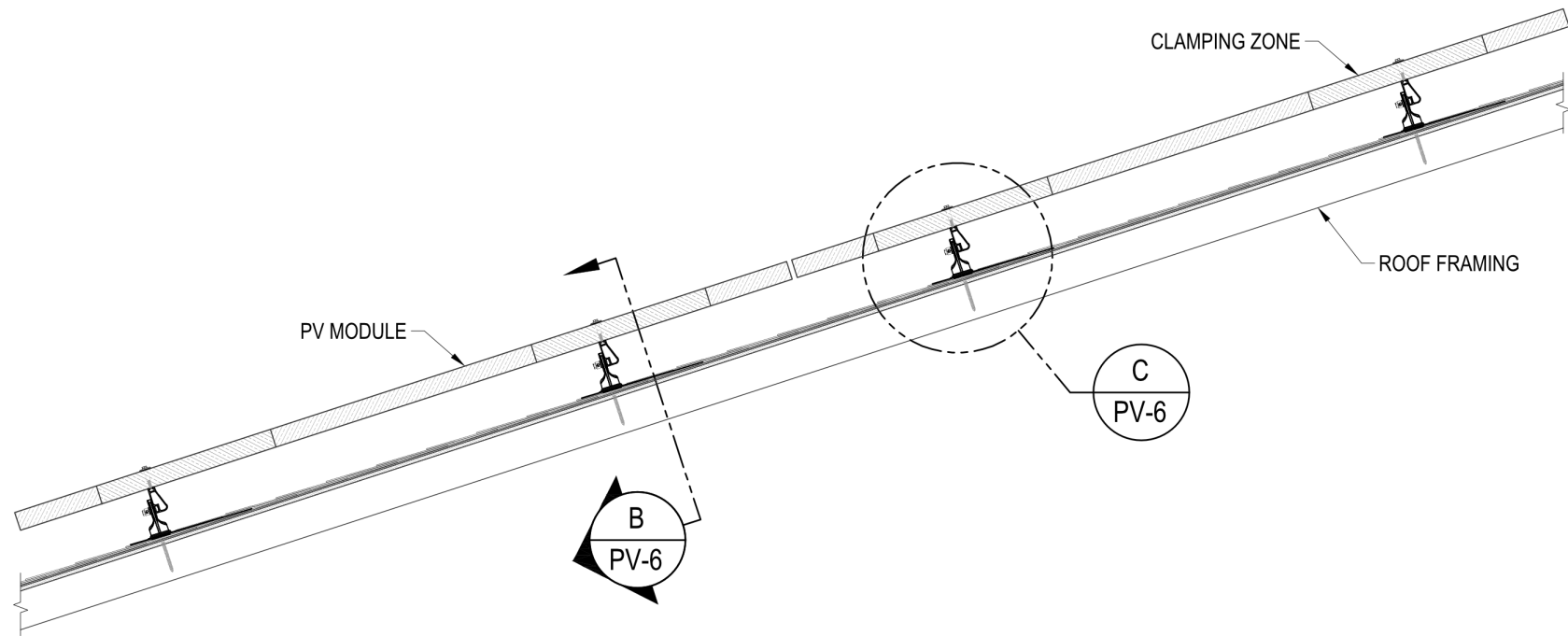
DATE: 7/9/21

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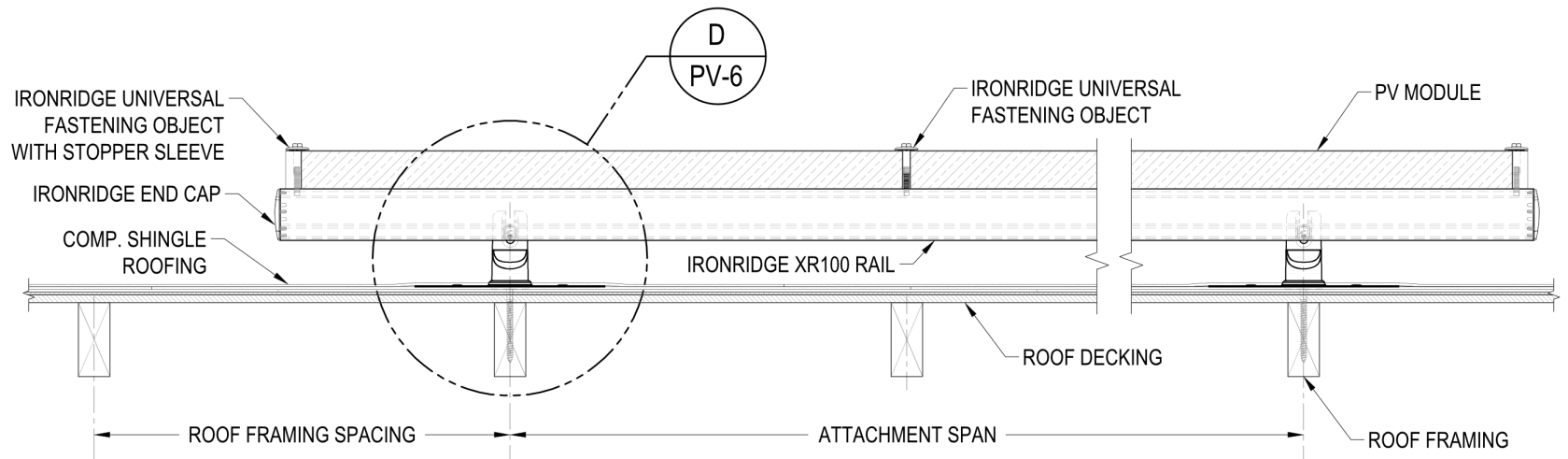
REVIEWER: P.B.

REVISIONS

PV-5.1

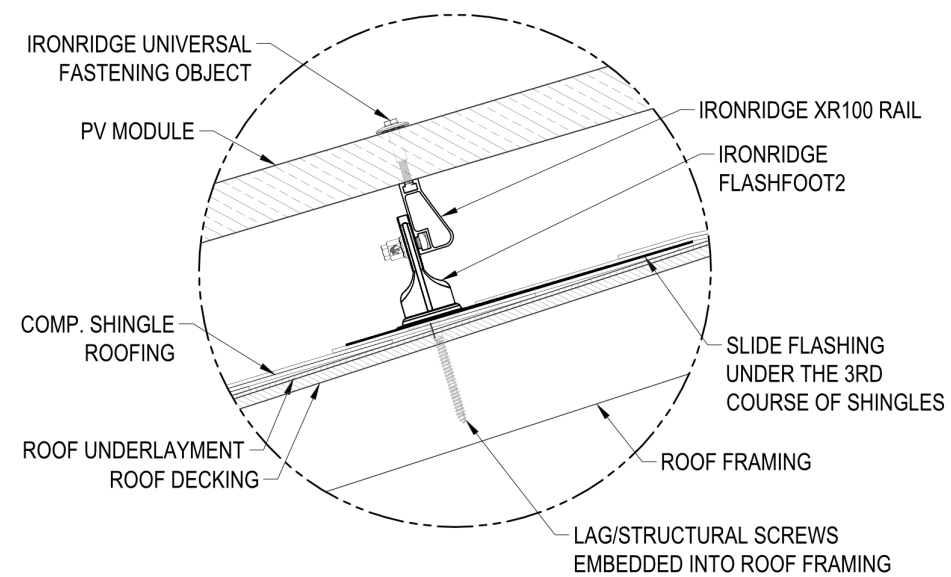


A
PV-6 RACKING ELEVATION (TRANSVERSE VIEW)
SCALE: NTS

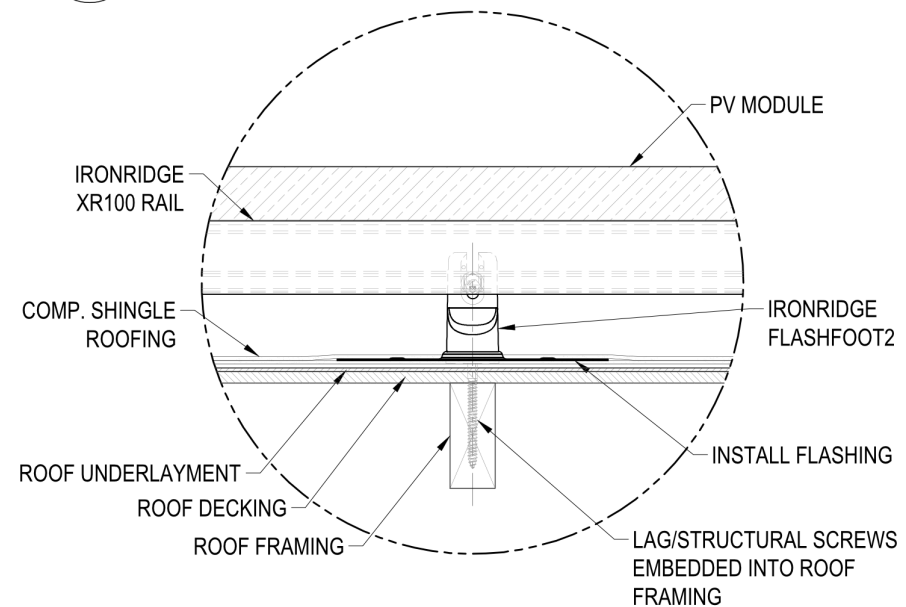


B
PV-6 RACKING ELEVATION (LONGITUDINAL VIEW)
SCALE: NTS

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.



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



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

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SUNBOLT
SOLAR & CONSTRUCTION

OFF-GRID SOLAR POWER SYSTEM

BURR VALLEY ROAD
BRIDGEVILLE, CA 95526
APN: 210-131-020

ATTACHMENT DETAILS

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REVISIONS

PV-6



1 FIRE SAFETY PLAN
PV-7 SCALE: 1" = 20'

GENERAL NOTES	
1	CONDUIT, WIRING SYSTEMS AND RACEWAYS FOR PV CIRCUITS SHALL BE LOCATED AS CLOSE AS POSSIBLE TO RIDGES, HIPs OR VALLEYS AND SHALL TAKE THE SHORTEST PATHS POSSIBLE BETWEEN ARRAYS AND ELECTRICAL EQUIPMENT TO REDUCE TRIP HAZARDS AND MAXIMIZE VENTILATION OPPORTUNITIES. PV ELECTRICAL EQUIPMENT BE LOCATED SUCH THAT CONDUIT RUNS ARE MINIMIZED IN THE PATHWAYS BETWEEN ARRAYS. DC WIRING SHALL BE INSTALLED IN METALLIC CONDUIT OR RACEWAYS WHEN LOCATED WITHIN ENCLOSED SPACES IN A BUILDING. CONDUIT SHALL RUN ALONG THE BOTTOM OF LOAD BEARING MEMBERS. (CFC 1204.2.3)
2	AT LEAST TWO 36"-WIDE PATHWAYS ON SEPARATE ROOF PLANES, FROM LOWEST ROOF EDGE TO RIDGE, SHALL BE PROVIDED ON ALL BUILDINGS. THERE SHALL BE AT LEAST ONE PATHWAY ON THE STREET OR DRIVEWAY SIDE OF THE ROOF. FOR EACH ROOF PLANE WITH A PV ARRAY, AT LEAST ONE SUCH PATHWAY SHALL BE PROVIDED ON THE SAME ROOF PLANE, OR ON AN ADJACENT ROOF PLANE, OR STRADDLING THE SAME AND ADJACENT ROOF PLANES. (CFC 1204.2.1.1)
3	FOR PV ARRAYS OCCUPYING MORE THAN 1/3 OF THE PLAN VIEW TOTAL ROOF AREA, A MIN. 3'-WIDE SETBACK IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE. (CFC 1204.2.1.2)
4	PV MODULES SHALL NOT BE INSTALLED ON THE PORTION OF A ROOF THAT IS BELOW AN EMERGENCY ESCAPE AND RESCUE OPENING. A 36"-WIDE PATHWAY SHALL BE PROVIDED TO THE EMERGENCY ESCAPE AND RESCUE OPENING. (CFC 1204.2.2)

- 1 1.5 FT. WIDE SMOKE-VENTILATION SETBACK
PV MODULES INSTALLED ON ROOF WITH IRONRIDGE ROOF MOUNTING SYSTEM. THE MOUNTING SYSTEM IS UL 1703 CLASS A FIRE RATED ON A 4/12 SLOPED ROOF WHEN INSTALLED WITH TYPE 1 OR 2 MODULES. THE CANADIAN SOLAR CS3K-305MS IS TYPE 1.
- 2 PV MODULES INSTALLED ON ROOF WITH IRONRIDGE ROOF MOUNTING SYSTEM. THE MOUNTING SYSTEM IS UL 1703 CLASS A FIRE RATED ON A 4/12 SLOPED ROOF WHEN INSTALLED WITH TYPE 1 OR 2 MODULES. THE CANADIAN SOLAR CS3K-305MS IS TYPE 1.
- 3 ROOF ACCESS POINT
- 4 ROOF ACCESS POINT
- 5 ROOF ACCESS POINT
- 6 PV MODULES INSTALLED ON ROOF WITH IRONRIDGE ROOF MOUNTING SYSTEM. THE MOUNTING SYSTEM IS UL 1703 CLASS A FIRE RATED ON A 4/12 SLOPED ROOF WHEN INSTALLED WITH TYPE 1 OR 2 MODULES. THE CANADIAN SOLAR CS3K-305MS IS TYPE 1.
- 7 1.5 FT. WIDE SMOKE-VENTILATION SETBACK
- 8 ROOF ACCESS POINT
- 9 CABLES, WHEN RUN BETWEEN ARRAYS, SHALL BE ENCLOSED IN CONDUIT.

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SUNBOLT

SOLAR & CONSTRUCTION

OFF-GRID SOLAR POWER SYSTEM

BURR VALLEYROAD

BRIDGEVILLE, CA 95526

APN: 210-131-020

FIRE SAFETY PLAN

DOC ID: 160083-197372-0

DATE: 7/9/21

CREATOR: P.B.

REVIEWER: P.B.

REVISIONS

PV-7

Conductor, Conduit, and OCPD Sizing Validation

1. Maximum System Voltage Test

1.1. Sol-Ark inverter w/32 Canadian Solar CS3K-305MS (305W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/32 Canadian Solar CS3K-305MS (305W)s
Module	CS3K-305MS (305W)
Highest number of modules in series in a PV Source Circuit	8
Design Low Temp.	-4°C
Module Voc	39.5V
Temp. Coefficient Voc	-0.115V/C

CEC Code Calculations

A. Maximum Voltage of PV Source Circuit	342.68V
see 690.7(A)	

CEC 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 (39.5V) will increase to 42.83V at the design low temperature (-4°C).

$(-4^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 39.5\text{V} = 42.83\text{V}$

The string Voc at the design low temperature is 342.68V.

$42.83\text{V} \times 8 = 342.68\text{V}$

CEC Code Validation Tests

1.	PV Source Circuit maximum Voc must not exceed 600V	PASS
342.68V < 600V = true		

1.2. Sol-Ark inverter w/32 Canadian Solar CS3K-305MS (305W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/32 Canadian Solar CS3K-305MS (305W)s
Module	CS3K-305MS (305W)
Highest number of modules in series in a PV Source Circuit	8
Design Low Temp.	-4°C
Module Voc	39.5V
Temp. Coefficient Voc	-0.115V/C

CEC Code Calculations

A. Maximum Voltage of PV Source Circuit	342.68V
see 690.7(A)	

CEC 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 (39.5V) will increase to 42.83V at the design low temperature (-4°C).

$(-4^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 39.5\text{V} = 42.83\text{V}$

The string Voc at the design low temperature is 342.68V.

$42.83\text{V} \times 8 = 342.68\text{V}$

CEC Code Validation Tests

1.	PV Source Circuit maximum Voc must not exceed 600V	PASS
342.68V < 600V = true		

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1.3. Sol-Ark inverter w/36 Canadian Solar CS3K-305MS (305W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/36 Canadian Solar CS3K-305MS (305W)s
Module	CS3K-305MS (305W)
Highest number of modules in series in a PV Source Circuit	9
Design Low Temp.	-4°C
Module Voc	39.5V
Temp. Coefficient Voc	-0.115V/C

CEC Code Calculations

A. Maximum Voltage of PV Source Circuit	385.51V
see 690.7(A)	

CEC 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 (39.5V) will increase to 42.83V at the design low temperature (-4°C).

$(-4^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 39.5\text{V} = 42.83\text{V}$

The string Voc at the design low temperature is 385.51V.

$42.83\text{V} \times 9 = 385.51\text{V}$

CEC Code Validation Tests

1.	PV Source Circuit maximum Voc must not exceed 600V 385.51V < 600V = true	PASS
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1.4. Sol-Ark inverter w/36 Canadian Solar CS3K-305MS (305W)s

Array Properties

Array Type	String Inverter Array
System Description	Sol-Ark inverter w/36 Canadian Solar CS3K-305MS (305W)s
Module	CS3K-305MS (305W)
Highest number of modules in series in a PV Source Circuit	9
Design Low Temp.	-4°C
Module Voc	39.5V
Temp. Coefficient Voc	-0.115V/C

CEC Code Calculations

A. Maximum Voltage of PV Source Circuit	385.51V
see 690.7(A)	

CEC 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 (39.5V) will increase to 42.83V at the design low temperature (-4°C).

$(-4^{\circ}\text{C} - 25^{\circ}\text{C}) \times -0.115\text{V/C} + 39.5\text{V} = 42.83\text{V}$

The string Voc at the design low temperature is 385.51V.

$42.83\text{V} \times 9 = 385.51\text{V}$

2. Wire, Conduit, and OCPD Code Compliance Validation

2.1. #1: String of PV Modules: PV Source to Rapid Shutdown Device

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	62°C
Power Source Description	PV Source Circuit of 8 CS3K-305MS (305W) PV modules
Power Source Current	9.9A
Voltage	261.6V
Module Series Fuse Rating	30A
Total Number of Series Strings	4

CEC Code Calculations

A. Continuous Current	12.37A
see 690.8(A)(1)	

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (9.9A) multiplied by 1.25
9.9A X 1.25 = 12.37A

B. Continuous Current of All Other Strings	12.37A
see 690.8(A)(2)	

Current of all other strings = 9.9A X 1.25 = 12.37A

C. Ampacity of Conductor	55A
see Table 310.15(B)(17)	

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

D. Derated Ampacity of Conductor	35.75A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 62°C is 0.65.
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 (0.65) and by the fill factor (1).
55A X 0.65 X 1 = 35.75A

E. Max Current for Terminal Temp. Rating	35A
see 110.14(C)	

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	10 AWG
see 690.45 and Table 250.122	

No OCPD is used in circuit and an assumed rating of 30A has been calculated in accordance with 690.45
The smallest EGC size allowed is 10 AWG for OCPD rating 30A according to Table 250.122.

CEC 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) 35.75A >= 12.37A = true	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 55A > 12.37A x 1.25 = true	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 35A >= 12.37A X 1.25 = true	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) 6 AWG >= 10 AWG = true	PASS
6.	EGC must meet code requirements for physical protection (690.46) 6 AWG >= 6 AWG = true	PASS

2.2. #2: String PV Modules: Rapid Shutdown Device to Inverter

Circuit Section Properties

Conductor	10 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	N/A
Raceway/Cable	1" dia. EMT
Lowest Terminal Temperature Rating	60°C
Maximum Wire Temperature	40°C
Power Source Description	PV Source Circuit of 8 CS3K-305MS (305W) PV modules
Power Source Current	9.9A
Voltage	261.6V
Module Series Fuse Rating	30A
Total Number of Series Strings	4

CEC Code Calculations

A. Continuous Current	12.37A
see 690.8(A)(1)	

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (9.9A) multiplied by 1.25
9.9A X 1.25 = 12.37A

B. Continuous Current of All Other Strings	12.37A
see 690.8(A)(2)	

Current of all other strings = 9.9A X 1.25 = 12.37A

C. Ampacity of Conductor	40A
see Table 310.15(B)(16)	

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 40A.

D. Derated Ampacity of Conductor	25.48A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 40°C is 0.91.
The fill factor for a conduit/cable that has 8 wires is 0.7.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (40A) multiplied by the temperature factor (0.91) and by the fill factor (0.7).
40A X 0.91 X 0.7 = 25.48A

E. Max Current for Terminal Temp. Rating	30A
see 110.14(C)	

The lowest temperature rating for this conductor at any termination is 60°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 60°C rating would be the amount referenced in the 60°C column in Table 310.15(B)(16), which is 30A.

F. Minimum Required EGC Size	10 AWG
see 690.45 and Table 250.122	

No OCPD is used in circuit and an assumed rating of 30A has been calculated in accordance with 690.45
The smallest EGC size allowed is 10 AWG for OCPD rating 30A according to Table 250.122.

G. Minimum Recommended Conduit Size	1" dia.
see 300.17	

The total area of all conductors is 0.2532in². With a maximum fill rate of 0.4, the recommended conduit diameter is 1.

Qty	Description	Size	Type	Area	Total Area
8	Conductor	10 AWG	THWN-2	0.0211in²	0.1688in²
4	Equipment Ground	10 AWG	THWN-2	0.0211in²	0.0844in²
12					0.2532in²

0.2532in² / 0.4 = 0.633in² (Corresponding to a diameter of 1")

CEC 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) 25.48A >= 12.37A = true	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 40A > 12.37A x 1.25 = true	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 30A >= 12.37A X 1.25 = true	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) 10 AWG >= 10 AWG = true	PASS
6.	Conduit must meet code recommendation for minimum size (300.17) 1in. >= 1in. = true	PASS

2.3. #3: Inverter Output: Inverter to AC Disconnect

Circuit Section Properties

Conductor	6 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	1" dia. EMT
Lowest Terminal Temperature Rating	60°C
Maximum Wire Temperature	40°C
Power Source Description	Sol-Ark 12K 9600W Inverter
Power Source Current	37.5A
Voltage	240V
Inverter Max OCPD rating	No Data

CEC Code Calculations

A. Continuous Current	37.5A
see Article 100	

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor	75A
see Table 310.15(B)(16)	

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 75A.

C. Derated Ampacity of Conductor	54.6A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 40°C is 0.91.
The fill factor for a conduit/cable that has 4 wires is 0.8.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (75A) multiplied by the temperature factor (0.91) and by the fill factor (0.8).
75A X 0.91 X 0.8 = 54.6A

D. Max Current for Terminal Temp. Rating	55A
see 110.14(C)	

The lowest temperature rating for this conductor at any termination is 60°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 60°C rating would be the amount referenced in the 60°C column in Table 310.15(B)(16), which is 55A.

E. Minimum Allowed OCPD Rating	47A
see 240.4	

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

F. Minimum Required EGC Size	10 AWG
see Table 250.122	

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

G. Minimum Recommended Conduit Size	1" dia.
see 300.17	

The total area of all conductors is 0.3182in². With a maximum fill rate of 0.4, the recommended conduit diameter is 1.

Qty	Description	Size	Type	Area	Total Area
4	Conductor	6 AWG	THWN-2	0.0507in²	0.2028in²
2	Neutral	8 AWG	THWN-2	0.0366in²	0.0732in²
2	Equipment Ground	10 AWG	THWN-2	0.0211in²	0.0422in²
8					0.3182in²

0.3182in² / 0.4 = 0.7955in² (Corresponding to a diameter of 1")

CEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) 50A >= 37.5A X 1.25 = true	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4) 54.6A >= 50A (OC PD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) 54.6A >= 37.5A = true	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 75A > 37.5A x 1.25 = true	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 55A >= 37.5A X 1.25 = true	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) 10 AWG >= 10 AWG = true	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) 1in. >= 1in. = true	PASS

2.4. #4: AC Disconnect Output: AC Disconnect to AC Aggregation Panel

Circuit Section Properties

Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	50A
Raceway/Cable	0.5" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	40°C
Power Source Description	Sol-Ark 12K 9600W Inverter
Power Source Current	37.5A
Voltage	240V

CEC Code Calculations

A. Continuous Current	37.5A
see Article 100	

Equipment maximum rated output current is 37.5A

B. Ampacity of Conductor	55A
see Table 310.15(B)(16)	

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

C. Derated Ampacity of Conductor	50.05A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 40°C is 0.91.
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 (0.91) and by the fill factor (1).
55A X 0.91 X 1 = 50.05A

D. Max Current for Terminal Temp. Rating	50A
see 110.14(C)	

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
see 240.4	

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

F. Minimum Required EGC Size	10 AWG
see 250.122(B)	

Where conductors are oversized, the EGC must be oversized by the same rate. Table 250.122, gives a minimum EGC size of 10 AWG. Multiplied by the oversize rate, this yields 6.53101kcmil corresponding to 10 AWG.
(16.51kcmil / 26.24kcmil) X 10.38kcmil = 6.53101kcmil

G. Minimum Recommended Conduit Size	0.5" dia.
see 300.17	

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	0.0366in²	0.0732in²
1	Equipment Ground	10 AWG	THWN-2	0.0211in²	0.0211in²
3					0.0943in²

0.0943in² / 0.4 = 0.2358in² (Corresponding to a diameter of 0.5")

CEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) 50A >= 37.5A X 1.25 = true	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4) 50.05A >= 50A (OC PD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) 50.05A >= 37.5A = true	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 55A > 37.5A x 1.25 = true	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 50A >= 37.5A X 1.25 = true	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) 10 AWG >= 10 AWG = true	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) 0.5in. >= 0.5in. = true	PASS

2.5. #5: String PV Modules: Rapid Shutdown Device to Inverter

Circuit Section Properties	
Conductor	8 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	10 AWG THWN-2, Copper
OCPD(s)	N/A
Raceway/Cable	0.5" dia. EMT
Lowest Terminal Temperature Rating	60°C
Maximum Wire Temperature	40°C
Power Source Description	PV Source Circuit of 9 CS3K-305MS (305W) PV modules
Power Source Current	9.9A
Voltage	294.3V
Module Series Fuse Rating	30A
Total Number of Series Strings	4

CEC Code Calculations

A. Continuous Current	12.37A
see 690.8(A)(1)	

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (9.9A) multiplied by 1.25
9.9A X 1.25 = 12.37A

B. Continuous Current of All Other Strings	12.37A
see 690.8(A)(2)	

Current of all other strings = 9.9A X 1.25 = 12.37A

C. Ampacity of Conductor	55A
see Table 310.15(B)(16)	

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

D. Derated Ampacity of Conductor	50.05A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 40°C is 0.91.
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 (0.91) and by the fill factor (1).
55A X 0.91 X 1 = 50.05A

E. Max Current for Terminal Temp. Rating	40A
see 110.14(C)	

The lowest temperature rating for this conductor at any termination is 60°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 60°C rating would be the amount referenced in the 60°C column in Table 310.15(B)(16), which is 40A.

F. Minimum Required EGC Size	10 AWG
see 690.45 and Table 250.122	

No OCPD is used in circuit and an assumed rating of 30A has been calculated in accordance with 690.45
The smallest EGC size allowed is 10 AWG for OCPD rating 30A 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	0.5" dia.
see 300.17	

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	0.0366in²	0.0732in²
1	Equipment Ground	10 AWG	THWN-2	0.0211in²	0.0211in²
3					0.0943in²

0.0943in² / 0.4 = 0.2358in² (Corresponding to a diameter of 0.5")

CEC 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) 50.05A >= 12.37A = true	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 55A > 12.37A x 1.25 = true	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 40A >= 12.37A X 1.25 = true	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) 10 AWG >= 10 AWG = true	PASS
6.	Conduit must meet code recommendation for minimum size (300.17) 0.5in. >= 0.5in. = true	PASS

2.6. #6: String PV Modules: Rapid Shutdown Device to Inverter

Circuit Section Properties	
Conductor	8 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	60°C
Maximum Wire Temperature	40°C
Power Source Description	PV Source Circuit of 9 CS3K-305MS (305W) PV modules
Power Source Current	9.9A
Voltage	294.3V
Module Series Fuse Rating	30A
Total Number of Series Strings	4

CEC Code Calculations

A. Continuous Current	12.37A
see 690.8(A)(1)	

The continuous current for this PV source circuit is equal to the short circuit current of the PV module (9.9A) multiplied by 1.25
9.9A X 1.25 = 12.37A

B. Continuous Current of All Other Strings	12.37A
see 690.8(A)(2)	

Current of all other strings = 19.8A X 1.25 = 24.75A

C. Ampacity of Conductor	55A
see Table 310.15(B)(16)	

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

D. Derated Ampacity of Conductor	40.04A
see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100	

The temperature factor for 90°C insulation at 40°C is 0.91.
The fill factor for a conduit/cable that has 4 wires is 0.8.
The ampacity derated for Conditions of Use is the product of the conductor ampacity (55A) multiplied by the temperature factor (0.91) and by the fill factor (0.8).
55A X 0.91 X 0.8 = 40.04A

E. Max Current for Terminal Temp. Rating	40A
see 110.14(C)	

The lowest temperature rating for this conductor at any termination is 60°C.
Using the method specified in 110.14(C), the maximum current permitted to ensure that the device terminal temperature does not exceed its 60°C rating would be the amount referenced in the 60°C column in Table 310.15(B)(16), which is 40A.

F. Minimum Required EGC Size	10 AWG
see 690.45 and Table 250.122	

No OCPD is used in circuit and an assumed rating of 30A has been calculated in accordance with 690.45
The smallest EGC size allowed is 10 AWG for OCPD rating 30A 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	0.75" dia.
see 300.17	

The total area of all conductors is 0.1886in². With a maximum fill rate of 0.4, the recommended conduit diameter is 0.75.

Qty	Description	Size	Type	Area	Total Area
4	Conductor	8 AWG	THWN-2	0.0366in²	0.1464in²
2	Equipment Ground	10 AWG	THWN-2	0.0211in²	0.0422in²
6					0.1886in²

0.1886in² / 0.4 = 0.4715in² (Corresponding to a diameter of 0.75")

CEC 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) 40.04A >= 12.37A = true	PASS
3.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 55A > 12.37A x 1.25 = true	PASS
4.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 40A >= 12.37A X 1.25 = true	PASS
5.	EGC must meet code requirements for minimum size (Table 250.122) 10 AWG >= 10 AWG = true	PASS
6.	Conduit must meet code recommendation for minimum size (300.17) 0.75in. >= 0.75in. = true	PASS

2.7. #7: Combined Output of Inverters: AC Aggregation Panel to Utility Disconnect

Circuit Section Properties

Conductor	3 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	8 AWG THWN-2, Copper
OCPD(s)	100A
Raceway/Cable	1" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	40°C
Power Source Description	2 Sol-Ark inverters w/68 Canadian Solar CS3K-305MS (305W)s
Power Source Current	75A
Voltage	240V

CEC Code Calculations

A. Continuous Current <i>see Article 100</i>	75A
---	-----

Equipment maximum rated output current is 2 X 37.5A = 75A

B. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	115A
--	------

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 115A.

C. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	104.65A
--	---------

The temperature factor for 90°C insulation at 40°C is 0.91.
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 (115A) multiplied by the temperature factor (0.91) and by the fill factor (1).
115A X 0.91 X 1 = 104.65A

D. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	100A
--	------

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 100A.

E. Minimum Allowed OCPD Rating <i>see 240.4</i>	94A
--	-----

CEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
75A X 1.25 = 93.75A

F. Minimum Required EGC Size <i>see Table 250.122</i>	8 AWG
--	-------

The smallest EGC size allowed is 8 AWG for OCPD rating 100A according to Table 250.122.

G. Minimum Recommended Conduit Size <i>see 300.17</i>	1" dia.
--	---------

The total area of all conductors is 0.3136in². With a maximum fill rate of 0.4, the recommended conduit diameter is 1.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	3 AWG	THWN-2	0.0973in²	0.1946in²
1	Neutral	4 AWG	THWN-2	0.0824in²	0.0824in²
1	Equipment Ground	8 AWG	THWN-2	0.0366in²	0.0366in²
4					0.3136in²

0.3136in² / 0.4 = 0.784in² (Corresponding to a diameter of 1")

CEC Code Validation Tests

1.	OCPD rating must be at least 125% of Continuous Current (240.4) 100A >= 75A X 1.25 = true	PASS
2.	Derated ampacity must exceed OCPD rating, or rating of next smaller OCPD (240.4) 104.65A >= 100A (OCPD Rating) = true	PASS
3.	Derated Ampacity must be greater than or equal to the Continuous Current (Article 100) 104.65A >= 75A = true	PASS
4.	Conductor Ampacity must be at least 125% of Continuous Current (215.2(A)(1)) 115A > 75A x 1.25 = true	PASS
5.	Max current for terminal must be at least 125% of the Continuous Current. (110.14(C)) 100A >= 75A X 1.25 = true	PASS
6.	EGC must meet code requirements for minimum size (Table 250.122) 8 AWG >= 8 AWG = true	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) 1in. >= 1in. = true	PASS

2.8. #8: Utility Disconnect Output: Utility Disconnect to Main Service Panel

Circuit Section Properties

Conductor	3 AWG THWN-2, Copper
Equipment Ground Conductor (EGC)	8 AWG THWN-2, Copper
OCPD(s)	100A
Raceway/Cable	1" dia. EMT
Lowest Terminal Temperature Rating	75°C
Maximum Wire Temperature	40°C
Power Source Description	2 Sol-Ark inverters w/68 Canadian Solar CS3K-305MS (305W)s
Power Source Current	75A
Voltage	240V

CEC Code Calculations

A. Continuous Current <i>see Article 100</i>	75A
---	-----

Equipment maximum rated output current is 2 X 37.5A = 75A

B. Ampacity of Conductor <i>see Table 310.15(B)(16)</i>	115A
--	------

Ampacity (30°C) for a copper conductor with 90°C insulation in conduit/cable is 115A.

C. Derated Ampacity of Conductor <i>see Table 310.15(B)(3)(c), Table 310.15(B)(3)(a), and Article 100</i>	104.65A
--	---------

The temperature factor for 90°C insulation at 40°C is 0.91.
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 (115A) multiplied by the temperature factor (0.91) and by the fill factor (1).
115A X 0.91 X 1 = 104.65A

D. Max Current for Terminal Temp. Rating <i>see 110.14(C)</i>	100A
--	------

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 100A.

E. Minimum Allowed OCPD Rating <i>see 240.4</i>	94A
--	-----

CEC 690.9(B) requires that the OCPD be rated for no less than 1.25 times the Continuous Current of the circuit.
75A X 1.25 = 93.75A

F. Minimum Required EGC Size <i>see Table 250.122</i>	8 AWG
--	-------

The smallest EGC size allowed is 8 AWG for OCPD rating 100A according to Table 250.122.

G. Minimum Recommended Conduit Size <i>see 300.17</i>	1" dia.
--	---------

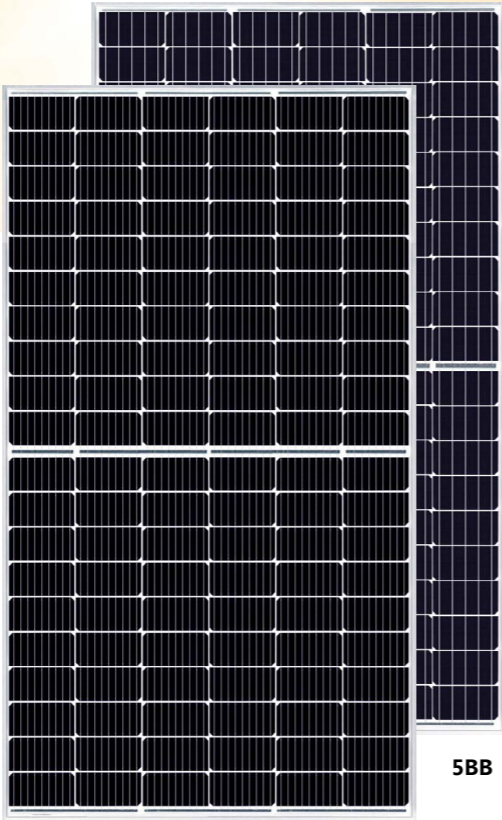
The total area of all conductors is 0.3136in². With a maximum fill rate of 0.4, the recommended conduit diameter is 1.

Qty	Description	Size	Type	Area	Total Area
2	Conductor	3 AWG	THWN-2	0.0973in²	0.1946in²
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6.	EGC must meet code requirements for minimum size (Table 250.122) 8 AWG >= 8 AWG = true	PASS
7.	Conduit must meet code recommendation for minimum size (300.17) 1in. >= 1in. = true	PASS



MBB
5BB
*Black frame product can be provided upon request.

KuPower

HIGH EFFICIENCY MONO PERC MODULE

CS3K-300 | 305 | 310 | 315MS

(1000 V / 1500 V)

With Canadian Solar's industry leading mono-PERC cell technology and the innovative LIC (Low Internal Current) module technology, we are now able to offer our global customers high power mono modules up to 315 W.

The KuPower mono modules with a dimension of 1675 × 992 mm, close to our 60 cell SuperPower modules, have the following unique features:

MORE POWER

- Low power loss in cell connection
- Low NMOT: 41 ± 3 °C
Low temperature coefficient (Pmax): -0.37 % / °C
- Better shading tolerance
- High PTC
High PTC rating of up to: 93.13 %

MORE RELIABLE

- Lower hot spot temperature
- Minimizes micro-cracks
- Heavy snow load up to 6000 Pa, wind load up to 4000 Pa*

25 years linear power output warranty

10 years product warranty on materials and workmanship

MANAGEMENT SYSTEM CERTIFICATES*
ISO 9001:2008 / Quality management system
ISO 14001:2004 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*
IEC 61215 / IEC 61730: VDE / CE
UL 1703: CSA

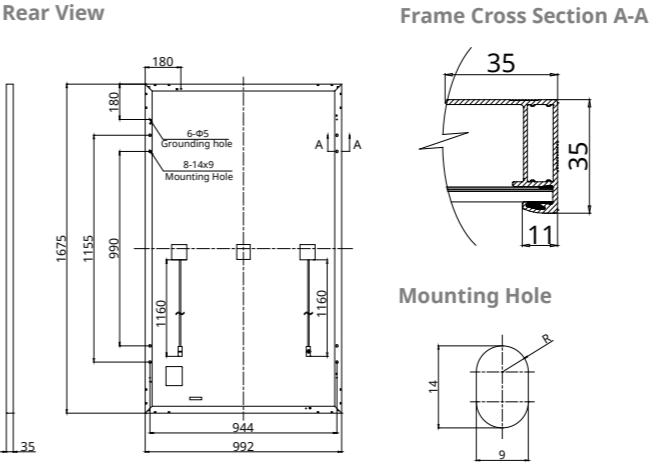


* If you need specific product certificates, and if module installations are to deviate from our guidance specified in our installation manual, please contact your local Canadian Solar sales and technical representatives.

CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading PV project developer and manufacturer of solar modules with over 25 GW deployed around the world since 2001, Canadian Solar Inc. is one of the most bankable solar companies worldwide.

* For detailed information, please refer to Installation Manual.

ENGINEERING DRAWING (mm)



ELECTRICAL DATA | STC*

CS3K	300MS	305MS	310MS	315MS
Nominal Max. Power (Pmax)	300 W	305 W	310 W	315 W
Opt. Operating Voltage (Vmp)	32.5 V	32.7 V	32.9 V	33.1 V
Opt. Operating Current (Imp)	9.24 A	9.33 A	9.43 A	9.52 A
Open Circuit Voltage (Voc)	39.3 V	39.5 V	39.7 V	39.9 V
Short Circuit Current (Isc)	9.82 A	9.90 A	9.98 A	10.06 A
Module Efficiency	18.05%	18.36%	18.66%	18.96%
Operating Temperature	-40°C ~ +85°C			
Max. System Voltage	1500V (IEC/UL) or 1000V (IEC/UL)			
Module Fire Performance	TYPE 1 (UL 1703) or CLASS C (IEC 61730)			
Max. Series Fuse Rating	30 A			
Application Classification	Class A			
Power Tolerance	0 ~ + 5 W			

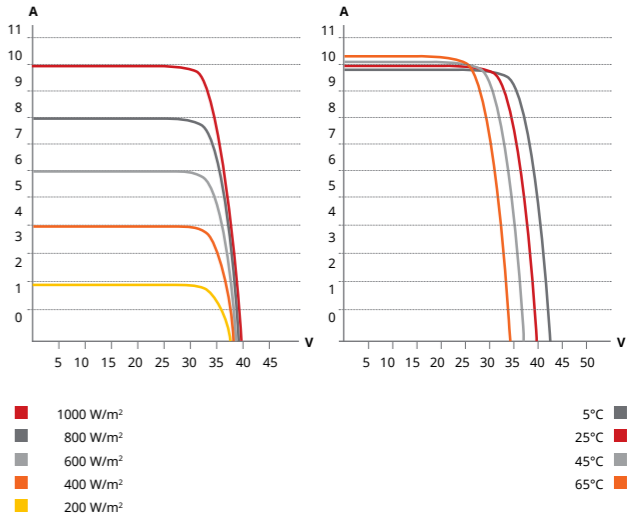
* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

ELECTRICAL DATA | NMOT*

CS3K	300MS	305MS	310MS	315MS
Nominal Max. Power (Pmax)	224 W	228 W	231 W	235 W
Opt. Operating Voltage (Vmp)	30.2 V	30.3 V	30.5 V	30.7 V
Opt. Operating Current (Imp)	7.42 A	7.50 A	7.58 A	7.65 A
Open Circuit Voltage (Voc)	37.0 V	37.1 V	37.3 V	37.5 V
Short Circuit Current (Isc)	7.92 A	7.98 A	8.05 A	8.11 A

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

CS3K-305MS / I-V CURVES



MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline, 156.75 X 78.38 mm
Cell Arrangement	120 [2 X (10 X 6)]
Dimensions	1675 X 992 X 35 mm (65.9 X 39.1 X 1.38 in)
Weight	18.5 kg (40.8 lbs)
Front Cover	3.2 mm tempered glass
Frame	Anodized aluminium alloy
J-Box	IP68, 3 bypass diodes
Cable	4.0 mm² (IEC), 12 AWG (UL) , 1160 mm (45.7 in)
Connector	T4 series
Per Pallet	30 pieces
Per Container (40' HQ)	840 pieces

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.37 % / °C
Temperature Coefficient (Voc)	-0.29 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	41 ± 3°C

PARTNER SECTION



* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Canadian Solar Inc. reserves the right to make necessary adjustment to the information described herein at any time without further notice.

General Duty Cartridge Fuse Safety Switch

DG223NRB

UPC:782113144252

Dimensions:

- **Height:** 7 IN
- **Length:** 6.42 IN
- **Width:** 8.82 IN

Weight:9 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 Fuse
- **Amperage Rating:** 100A
- **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:

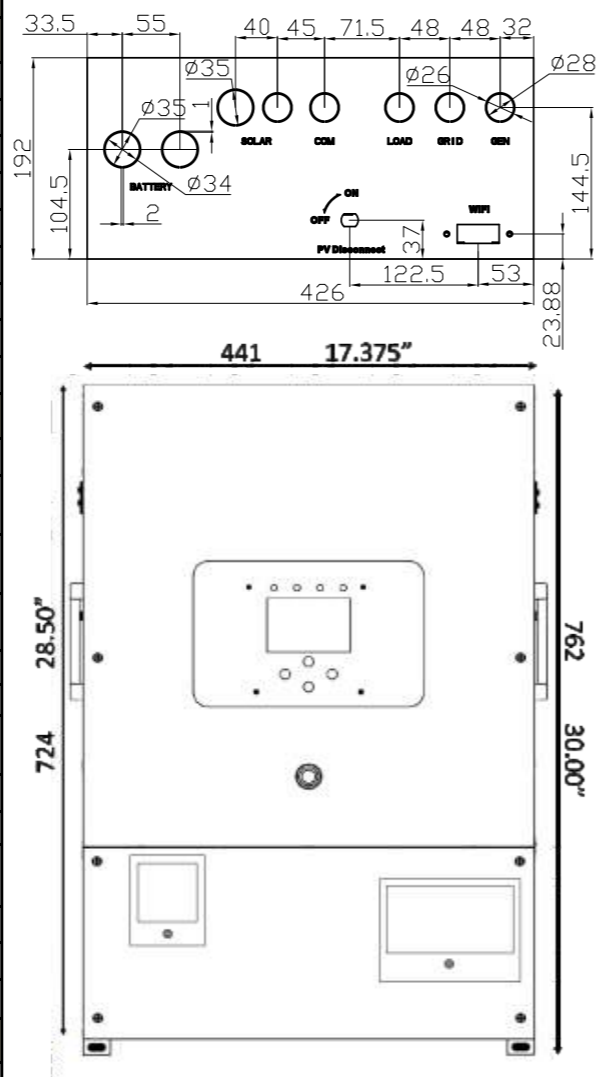
- [Eatons Volume 2-Commercial Distribution](#)
- [Eaton Specification Sheet - DG223NRB](#)

Certifications:

- UL Listed



Sol-Ark-12K-P Specifications	
Solar Output Power 12000W	
Max allowed PV DC Capacity	8,250W+8,250W = 16,500W
Max PV power delivered to Battery & AC outputs	12000W
Max DC voltage	500V@18A, 450V@20A
MPPT voltage range	150-425V
MPPT Starting voltage	175V
Number of MPPT	2
Solar Strings per MPPT	2 w/o fuses, 3 w/ fuses
Max DC current per MPPT (self limiting)	20A@300V, 18A@400V
Max AC Coupling (Gen Breaker / Load Breaker)	7,600W / 9,600W
AC Output Power 9000W On Grid & 8000W Off Grid	
Connections	120/240/208V split phase
Continuous AC power to Grid (On Grid)	9000W 37.5A L-L (255V) 4800W 40A L-N (120V)
Continuous AC power to Loads (Off Grid)	8000W 33A L-L (240V) 4800W 40A L-N (120V)
Surge AC power 10sec	16,000VA L-L (240V)
Surge AC power 100ms	25,000VA L-L (240V)
Parallel Stacking	2-8 (240V), 3-9 (208V)
Frequency	60/50Hz
Continuous AC power with Grid or Generator	12000W 50A L-L (240V) 6000W 50A L-N (120V)
CEC Efficiency	96.5% (Peak 97.5%)
Idle Consumption typical – no load	60W
Sell back power modes	Limited to Household or Full 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 9000W	
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 Battery Charging Efficiency	96.0%
External temperature sensor	included
Current shunt for accurate % SOC	integrated
External Generator Start based on voltage or % SOC	integrated
Communication to Lithium battery	CanBus & RS485
General	
Dimensions (H x W x D)	30.0" x 16.75" x 9.37"
Weight	74 lbs
Enclosure	NEMA type 1 (Indoor Use)
Ambient Temperature (3 variable speed fans)	-25 to 55C, >45C derating
Display	Color touch screen
Wi-Fi Communication (monitoring or SW updates)	included
Snap on sensors for limited selling to Household	included
Standard Warranty (verified by HALT testing)	10 years



Protection & 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, IEEE1547a-2003/2014, FCC 15 class B, UL1741SA, CA Rule 21, HECO Rule 14H	Yes	
PV DC disconnect switch – NEC 240.15	integrated	
Ground Fault Detection – NEC 690.5	integrated	
PV rapid shutdown control – NEC 690.12	integrated	
PV Arc Fault detection – NEC 690.11/UL1699B	integrated	
PV input lightning protection	integrated	
AC input/output 50A breakers	integrated	
250A Battery breaker / disconnect	integrated	
User wiring enclosure w/ ¾" & 1" knock-outs	integrated	
Solar Flare/EMP Hardened to 2015 MIL-STD-461G (Independently tested June 2018)	optional	

SOL-ARK 12K



+



+



COMMERCIAL / MEDICAL
No Glitch Transfer



MILITARY
Cage Code: 7U4P4



GRID SELL
+Time of Use



OFF-GRID
Battery Agnostic



RETRO-FIT
AC Coupling

www.Sol-Ark.com

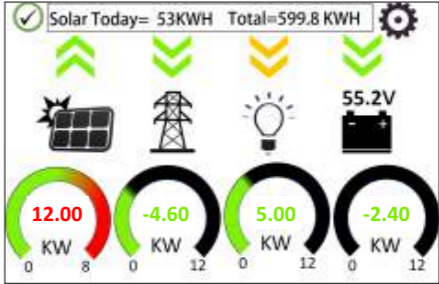
Sales@Sol-Ark.com

972-575-8875

Competitor Comparison

Design Type	DC Transformerless				DC Coupled				AC Coupled				
	Sol-Ark 12K	Sol-Ark 8K	Outback Skybox 2x5BX5048	Generac PWRcell 7.6 +4x52500	SolarEdge StorEdge 7.6 32xP400	Panasonic (Daifon) 2xH5001	Outback Radian FPR-8048A	Schneider XWPRo6.8 + 3xMPP180	Victron 2xQuattro5K +3xMPP150	SMA 11000TL + 2x4548	Enphase 2x10 +36xIQ7P	Sonnen ECO-20 + String Inv	Tesla 2x Powerwall12 + String Inv
Brand & Model													
MSRP Price	\$6,850	\$6,100	\$10,000	\$6,500	\$6,900	\$6,200	\$8,000	\$9,900	\$9,200	\$9,800	\$36,500	\$24,000	\$19,400
Solar PV Continuous Power	12KW	9KW	2x5.5KW	8KW	7.6KW	2x6KW	7.7KW	11.6KW	12KW	11KW	10.4KW	12KW	12KW
Inverter AC Continuous Power	9KW	9KW	2x5KW	7.6KW	7.6KW	2x5KW	8KW	6.8KW	8KW	11KW	10.4KW	8KW	2x5KW
Inverter Battery Continuous Power	9KW	9KW	2x5KW	6.7KW	5KW	2x5.5KW	8KW	6.8KW	8KW	2x4.5KW	2x3.8KW	8KW	2x5KW
Off Grid Inverter AC Peak Power (5s)	20KW	20KW	10KW	12KW	7.6KW	13KW	12KW	12KW	20KW	20KW	8.8KW	12KW	14KW
System Idle Power	60W	60W	280W	12KW	7.6KW	200W	76W	48W	75W	50W	60W	60W	78W
AC to DC Charger	185A	185A	200A	6.7KW	5KW	120A	115A	140A	255A	170A	N/A	115A	N/A
User Interface	color touch	color touch	color touch	Text	Text	Text	Text	Text	color touch	Text	color touch	color touch	X
	97.5%	97.5%	81.0%	92.0%	91.0%	91.0%	97.5%	96.0%	97.5%	78.0%	92.0%	82.0%	92.5%
	96.0%	96.0%	80.0%	93.0%	91.0%	90.0%	85.0%	91.5%	85.0%	80.0%	95.0%	85.0%	95.0%
	95.5%	95.5%	94.5%	93.0%	88.0%	90.0%	93.0%	92.5%	91.5%	94.5%	95.0%	93.0%	95.0%
On Grid PV to AC Efficiency @ CEC	96.5%	96.5%	94.0%	95.5%	96.5%	95.5%	90.2%	88.5%	89.2%	98.0%	97.0%	97.0%	97.0%
Time of Use or Off Grid	7%	7%	24%	15%	21%	19%	10%	12%	11%	28%	13%	25%	13%
PV -> Batt -> AC Losses @ 65%	4ms	8ms	20ms	1000ms	2000ms	20ms	8ms	8ms	20ms	5000ms	2000ms	100ms	2000ms
Grid Failure UPS Transfer Time	optional +\$1.5K	opt +\$1.2K	X	X	X	X	X	X	X	X	X	X	X
EMP/Solar Flare Hardened to >100KV/m	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	✓
Low Cost Easy Install	10 yr	5/10 yr	5/10 yr	10 yr	12/20/25 yr	5/10 yr	5/10 yr	10 yr	5yr	10 yr	10 yr	10 yr	10 yr
Warranty	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	X	✓	✓
AC Coupling to existing Inverters	✓	X	✓	X	X	✓	✓	✓	✓	✓	✓	X	✓
Parallel Stacking	✓	X	X	✓	X	X	X	✓	✓	✓	X	X	✓
120/240/208V 3phase	✓	X	X	✓	X	X	X	✓	✓	✓	X	X	✓
Generator Support	✓	✓	✓	X	X	X	✓	✓	✓	✓	X	✓	X
AC Load Shedding for TOU & Off Grid	✓	✓	✓	X	X	X	X	X	✓	X	X	✓	X
UL1741SA/Rule 21 & 14H (Grid Sell only)	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓
NEC UL1699B Arc Fault	✓	✓	✓	✓	✓	X	✓	X	X	✓	✓	✓	✓
Outdoor Enclosure	X	X	✓	✓	✓	X	X	X	X	✓	✓	X	✓
Battery Bank	22KWh/2400cycles +\$5.2K	22KWh +\$5.2K	26KWh +\$7.2K	20.3KWh 3500c +\$14K	2x9.8KWh 3000c +\$12K	19.4KWh 6000c +\$19K	26KWh +\$7.2K	26KWh +\$7.2K	26KWh +\$7.2K	26KWh +\$7.2K	21.0KWh 6000cycles	20KWh 6000cycles	28KWh 3500cycles

STACKABLE, No Glitch, ALL-IN-ONE HYBRID



Color Touch Display

What's Inside

Two Built-In 500V Charge Controllers

1 - 6 PV Strings

Battery Disconnect

48V Battery Input

Battery Temp Sensor

Auto-Generator Start

Rapid Shut Down Signal

Current Sensors Included

Battery Communication

PV Disconnect

Wiring Knockouts & WiFi

50A AC In/Out

50A AC Load Out

40A AC Gen In/Smart Load Out



Limitless

PARALLEL STACKING (1-9), GRID SELL, METER ZERO, TIME OF USE, SMART LOAD, PEAK SHAVING, 20 kW PEAK POWER, 9.6kW AC COUPLING

Highly Accelerated Life Testing

PROVEN TO LAST WELL BEYOND THE STANDARD 10 YEAR WARRANTY

Engineered, Tested, Serviced in U.S.A

TALK TO A US BASED ENGINEER 7 DAYS A WEEK

No Glitch Switch

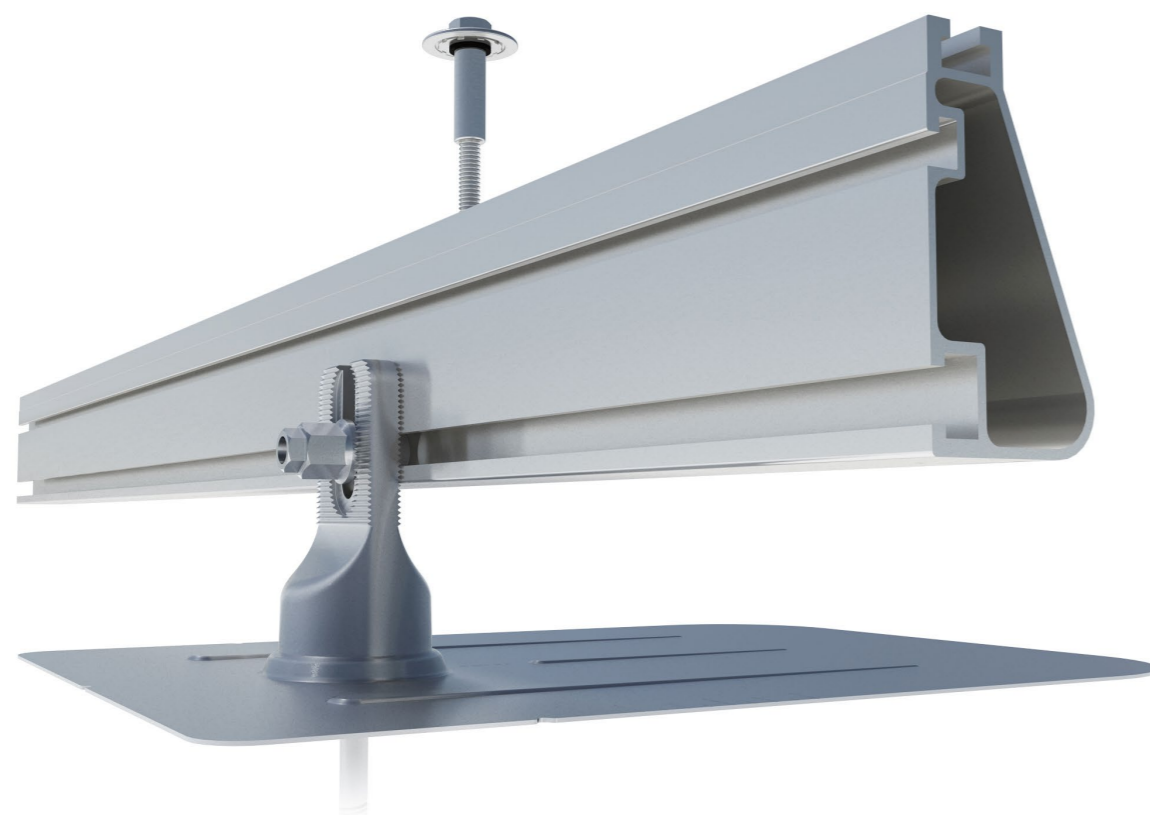
FASTEST TRANSFER TIME

Free Remote Monitoring / Programming



[Datasheet](#)

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 warrant .



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.

[Datasheet](#)

XR Rails ☺

XR10 Rail



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

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

XR100 Rail



The ultimate residential solar mounting rail.

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

XR1000 Rail



A heavyweight mounting rail for commercial projects.

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

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 finis

Stopper Sleeves



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

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

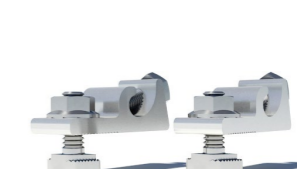
CAMO



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 profil
- 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 finis

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 finis

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)



28375 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

Attn: Corey Geiger, COO, IronRidge Inc.
Date: May 18th, 2020

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 contents of the letter shall be read in its entirety before being applied to any project design. 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)
- 2016 California Building Code (CBC-2016)
- 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 8° 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 42".
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.



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Hayward, CA 94545
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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,



Date:
2020.05.22
12:25:32 -07'00'

Gang Xuan, SE
Senior Structural Engineer

Class A Fire Rating

Background

All roofing products are tested and classified for their ability to resist fire.

Recently, these fire resistance standards were expanded to include solar equipment as part of the roof system. Specifically, this requires the modules, mounting hardware and roof covering to be tested together as a system to ensure they achieve the same fire rating as the original roof covering.

These new requirements are being adopted throughout the country in 2016.

IronRidge Certification

IronRidge was the first company to receive a Class A Fire Rating—the highest possible rating—from Intertek Group plc., a Nationally Recognized Testing Laboratory.

IronRidge Flush Mount and Tilt Mount Systems were tested on sloped and flat roofs in accordance with the new UL 1703 & UL 2703 test standards. The testing evaluated the system’s ability to resist flame spread, burning material and structural damage to the roof.

Refer to the table below to determine the requirements for achieving a Class A Fire Rating on your next project.

Fire Testing Process

Test Setup

Solar Modules

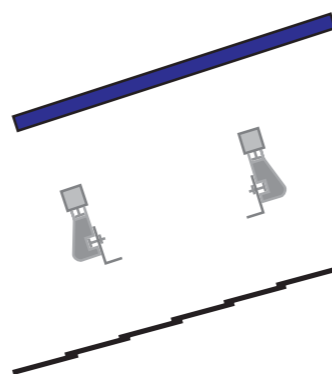
Solar modules are given a Type classification based on their materials and construction.

Mounting System

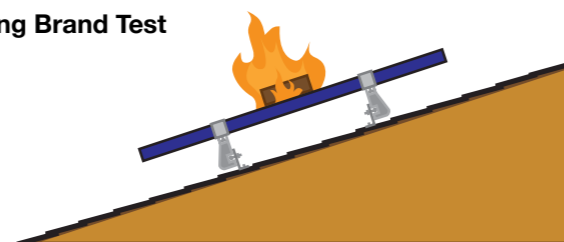
Mounting is tested as part of a system that includes type-tested modules and fire-rated roof covering.

Roof Covering

Roof covering products are given a Fire Class Rating of A, B or C based on their tested fire resistance.

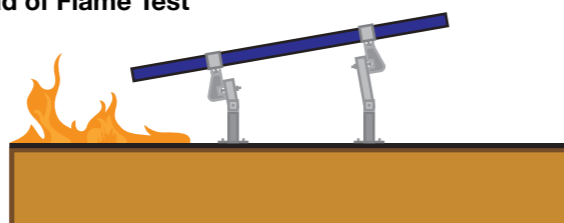


Burning Brand Test





A burning wooden block is placed on module as a fan blows at 12 mph. Flame cannot be seen on underside of roof within 90 minutes.

Spread of Flame Test



Flame at southern edge of roof is aimed up the roof as a fan blows at 12 mph. The flame cannot spread 6 feet or more in 10 minutes.

System	Roof Slope	Module	Fire Rating*
 Flush Mount	Any Slope	Type 1, 2, & 3	Class A
 Tilt Mount	≤ 6 Degrees	Type 1, 2, & 3	Class A

*Class A rated PV systems can be installed on Class A, B, and C roofs.

Frequently Asked Questions

What is a “module type”?

The new UL1703 standard introduces the concept of a PV module type, based on 4 construction parameters and 2 fire performance parameters. The purpose of this classification is to certify mounting systems without needing to test it with every module.

What roofing materials are covered?

All fire rated roofing materials are covered within this certification including composition shingle, clay and cement tile, metal, and membrane roofs.

What if I have a Class C roof, but the jurisdiction now requires Class A or B?

Generally, older roofs will typically be “grandfathered in”, and will not require re-roofing. However, if 50% or more of the roofing material is replaced for the solar installation the code requirement will be enforced.

Where is the new fire rating requirement code listed?

2012 IBC: 1509.7.2 Fire classification. Rooftop mounted photovoltaic systems shall have the same fire classification as the roof assembly required by Section 1505.

Where is a Class A Fire Rating required?

The general requirement for roofing systems in the IBC refers to a Class C fire rating. Class A or B is required for areas such as Wildland Urban Interface areas (WUI) and for very high fire severity areas. Many of these areas are found throughout the western United States. California has the most Class A and B roof fire rating requirements, due to wild fire concerns.

Are standard mid clamps covered?

Mid clamps and end clamps are considered part of the PV “system”, and are covered in the certification.

What attachments and flashings are deemed compatible with Class A?

Attachments and their respective flashings are not constituents of the rating at this time. All code-compliant flashing methods are acceptable from a fire rating standpoint.

What mounting height is acceptable?

UL fire testing was performed with a gap of 5”, which is considered worst case in the standard. Therefore, the rating is applicable to any module to roof gap.

Am I required to install skirting to meet the fire code?

No, IronRidge achieved a Class A fire rating without any additional racking components.

What determines Fire Classification?

Fire Classification refers to a fire-resistance rating system for roof covering materials based on their ability to withstand fire exposure.

Class A - effective against severe fire exposure
Class B - effective against moderate fire exposure
Class C - effective against light fire exposure

What if the roof covering is not Class A rated?

The IronRidge Class A rating will not diminish the fire rating of the roof, whether Class A, B, or C.

What tilts is the tilt mount system fire rated for?

The tilt mount system is rated for 1 degree and up and any roof to module gap, or mounting height.

More Resources



Installation Manuals

Visit our website for manuals that include UL 2703 Listing and Fire Rating Classification.

[Go to IronRidge.com](http://www.ironridge.com)



Engineering Certification Letters

We offer complete engineering resources and pre-stamped certification letters.

[Go to IronRidge.com](http://www.ironridge.com)

FRAMELESS MODULE KITS

Insert Frameless Kit T-bolt in top rail slot. Place star washer over T-bolt, allowing it to rest on top of rail. Secure module clamps with a hex nut and torque to **80 in-lbs**.

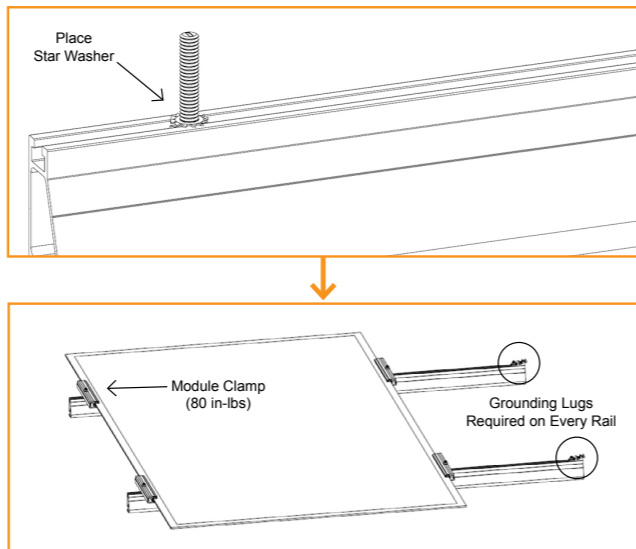
🔧 **Tested or evaluated module clamps:**

- Sunforson silver or black SFS-UTMC-200(B) mid and SFS-UTEC-200(B) end clamps.
- Sunpreme silver or black mid and end clamps with part numbers 7500105X where "X" is 1, 5, 6 or 7.
- IronRidge silver or black mid and end clamps with part numbers FMLS-XC-001-Y where "X" is E or M and "Y" is B or blank.

🔧 **Follow module manufacturer's installation instructions to install the module clamps.**

🔧 **Frameless modules require using a Grounding Lug on every rail.**

🔧 **For Sunpreme Modules Only: If required to use slide prevention hardware, see Module Slide Prevention Addendum (Version 1.10).**



MODULE COMPATIBILITY

The Flush Mount 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. Unless otherwise noted, “xxx” refers to the module power rating and both black and silver frames are included in the certification

MAKE	MODELS
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; "xxx" is the module power rating; and "Z" can be blank, W or WB
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, (DG), or (DGT); "zz" can be blank, HV, F-B, or F-BH ; and "xxx" is the module power rating Astronergy frameless modules CHSM6610P(DG)-xxx Where "xxx" is the module power rating
Auxin	Auxin modules with 40 mm frames AXN6y6zAxxx Where "y" can be M or P; "z" can be 08, 09, 10, 11, or 12; "A" can be F or T; and "xxx" is the module power rating
Axitec	Axitec Modules with 35 and 40 mm frames AC-xxxY/aaZZb Where "xxx" is the module power rating; "Y" can be M, P or MH; "aa" can be blank, 125- or 156-; "ZZ" can be 54, 60, 72, 120, or 144; "b" can be S or SB
Boviet	Boviet modules with 40mm frames BVM66aaYY-xxx Where "aa" can be 9, 10 or 12; "YY" is M or P; and "xxx" is the module power rating
BYD	Where "xxx" is the module power rating; "Y" can be M, P or MH; "aa" can be blank, 125- or 156-; "ZZ" can be 54, 60, 72, 120, or 144; "b" can be S or SB
Canadian Solar	Canadian Solar modules with 30, 35 and 40 mm frames CSbY-xxxZ Where "b" can be 1, 3 or 6; "Y" can be H, K, P, U, V, W, or X; "xxx" refers to the module power rating; and "Z" can be M, P, MS, PX , M-SD, P-AG, P-SD, MB-AG, PB-AG, MS-AG, or MS-SD Canadian Solar frameless modules CSbY-xxx-Z Where "b" can be 3 or 6; "Y" is K, P, U, or X; "xxx" is the module power rating, and "Z" can be M-FG, MS-FG, P-FG, MB-FG, or PB-FG
CertainTeed	CertainTeed modules with 35 and 40 frames CTxxxYZZ-AA Where "xxx" is the module power rating; "Y" can be M, P or HC; "ZZ" can be 00,01, 10, or 11; and "AA" can be 01, 02, 03 or 04
CSUN	Csun modules with 35 and 40 mm frames YYxxx-zzAbb Where "YY" is CSUN or SST; xxx is the module power rating; "zz" is blank, 60, or 72; and "A" is blank, P or M; "bb" is blank, BB, BW, or ROOF
Ecosolargy	Ecosolargy modules with 35, 40 and 50 mm frames ECOxxxYzzA-bbD Where "xxx" is the module power rating; "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

MODULE COMPATIBILITY

ET Solar	ET Solar modules with 35, 40 and 50 mm frames ET-Y6ZZxxxAA Where “Y” can be P, L, or M; “ZZ” can be 60 or 72; “xxx” refers to the module power rating; and “AA” can be WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
Flex	Flex modules with 35, 40 and 50 mm frames and model identifier XS-xxxYY-ZZ; where "xxx" is the module power rating; "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-a6/YY xxx Where "a" can be M or P; "YY" can be 60, 72, or 72H; and xxx is the module power rating
GigaWatt Solar	Gigawatt modules with 40 mm frames GWxxxYY Where “xxx” refers to the module power rating; and “YY” can be either PB or MB
Hansol	Hansol modules with 35 and 40 frames HSxxxYY-zz Where "xxx" is the module power rating; "YY" can be PB, PD, PE, TB, TD, UB, UD, or UE; and "zz" can be AN1, AN3, AN4, HV1, or JH2
Hanwha Solar	Hanwha 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; "xxx" refers to the module power rating; and "Z" can be blank or B
Hanwha Q CELLS	Hanwha Q CELLS Modules with 32, 35, 40 and 42mm frames and model identifier aaY -ZZ-xxx where "aa" can be Q. or B.; "YY" can be PLUS, PRO, PEAK, LINE PRO, LINE PLUS, 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, BLK-G5, L-G5, L-G5.1, L-G5.2, L-G5.2/H, L-G5.3, G6, G6+, BLK-G6, L-G6, L-G6.1, L-G6.2, L-G6.3, G7, BLK-G6+, 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, or L-G8.3; and "xxx" is the module power rating
Heliene	Heliene modules with 40 mm frames YYZZxxx Where "YY" can be 36, 60, 72, or 96; "ZZ" can be M, P, or MBLK; and "xxx" is the module power rating
HT-SAAE	HT-SAAE modules with 40 mm frames HT72-156Z-xxx Where "Z" can be M, P, M-C, P-C, M(S), M(VS), M(V), P(V), M(V)-C, P(V)-C; and "xxx" is the module power rating
Hyundai	Hyundai modules with 33, 35, 40 and 50 mm frames HiY-SxxxZZ Where "Y" can be A, M or S; "xxx" refers to the module power rating; and "ZZ" can be HG, HI, KI, MI, MF, MG, RI, RG(BF), RG(BK), SG, TI, or TG
Itek	Itek Modules with 40 and 50 mm frames IT-xxx-YY Where "xxx" is the module power rating; and "YY" can be blank, HE, or SE, or SE72
JA Solar	JA Solar modules with 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, 60, or 72; "ww" can be S01, S02, S03, S09, or S10; "xxx" is the module power rating; and "aa" can be MP, SI, SC, PR, 3BB, 4BB, 4BB/RE, 5BB
Jinko	Jinko modules with 35 and 40 mm frames JKMYxxxZZ-aa Where "Y" can either be blank or S; "xxx" is the module power rating; "ZZ" can be P, PP, M; and "aa" can be blank, 60, 60B, 60H, 60L, 60BL, 60HL, 60HBL, 60-J4, 60B-J4, 60B-EP, 60(Plus), 60-V, 60-MX, 72, 72-V, 72H-V, 72L-V, 72HL-V or 72-MX Jinko frameless modules JKMxxxPP-DV Where "xxx" is the module power rating
Kyocera	Kyocera Modules with 46mm frames KYxxxZZ-AA Where "Y" can be D or U; "xxx" is the module power rating; "ZZ" can be blank, GX, or SX; and "AA" can be LPU, LPU, LPU, LPS, LPB, LFB, LFB2, 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 "xxx" is the module power rating; "Y" can be A, E, N, Q, S; "a" can be 1 or 2; "Z" can be C, K, T, or W; and "bb" can be A3, A5, B3, G3, G4, K4, or V5
Longi	Longi modules with 30, 35 and 40 mm frames LRA-YYZZ-xxxM Where "a" can be 4 or 6; "YY" can be blank, 60 or 72; "ZZ" can be blank, BK, BP, HV, PB, PE, PH, HBD, HPB, or HPH; "xxx" is the module power rating
Mission Solar	Mission Solar modules with 40 mm frames MSEbbxxxZZaa Where "bb" can be blank or 60A; "xxx" is the module power rating; "ZZ" can be blank, MM, SE, SO or SQ, and "aa" can be blank, 1J, 4J, 4S, 5K, 5T, 6J, 6S, 6W, 8K, 8T, or 9S
Mitsubishi	Mitsubishi modules with 46 mm frames PV-MYYxxxZZ Where "YY" can be LE or JE; xxx is the module power rating; and "ZZ" can be either HD, HD2, or FB

MODULE COMPATIBILITY

Motech	IM and XS series modules with 40, 45 and 50 mm frames
Neo Solar Power	Neo Solar Power modules with 35 mm frames D6YxxxZZaa Where "Y" can be M or P; xxx is the module power rating; "ZZ" can be B3A, B4A, E3A, E4A, H3A, H4A; and "aa" can be blank, (TF), ME or ME (TF)
Panasonic	Panasonic modules with 35 and 40 mm frames BHNxxxYYzzA Where "xxx" refers to the module power rating; "YY" can be either KA, 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 or G
Peimar	Peimar modules with 40 mm frames SGxxxYzz Where "xxx" is the module power rating; "Y" can be M or P; and "zz" can be blank, (BF), or (FB)
Phono Solar	Phono Solar modules with 35, 40 and 45 mm frames PSxxxY-ZZ/A Where xxx refers to the module power rating; "Y" can be M or P; "ZZ" can be 20 or 24; and "A" can be F, T or U
Prism Solar	Prism Solar frameless modules BiYY-xxxBSTC Where "YY" can be 48, 60, 60S, 72 or 72S; and "xxx" is the module power rating
REC Solar	REC modules with 30, 38 and 45 mm frames RECxxxYYZZ Where "xxx" is the module power rating; "YY" can be AA, M, NP, PE, PE72, TP, TP2, TP2M, TP2SM, or TP2S; and "ZZ" can be blank, Black, BLK, BLK2, SLV, or 72
Renesola	ReneSola modules with 35, 40 and 50 mm frames JCxxxY-ZZ Where "xxx" refers to the module power rating; "Y" can be F, M or S; and "ZZ" can be Ab, Ab-b, Abh, Abh-b, Abv, Abv-b, Bb, Bb-b, Bbh, Bbh-b, Bbv, Bbv-b, Db, or Db-b
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 35 and 40 mm frames RSMyy-6-xxxZZ Where "yy" can be 60 or 72; "xxx" is the module power rating; and "ZZ" can be M or P Frameless modules RSMyy-6-xxxZZ Where "yy" can be 60 or 72; "xxx" is the module power rating; and "ZZ" can be MDG or PDG
S-Energy	S-Energy modules with 40 frames SNxxxY-ZZ Where "xxx" is the module power rating; "Y" can be M or P; and "ZZ" can be 10, or 15
Seraphim Energy Group	Seraphim modules with 35 and 40 mm frames SEG-6YY-xxxZZ Where "YY" can be MA, MB, PA, or PB; "xxx" is the module power rating; and "ZZ" can be BB, BW, WB or WW
Seraphim USA	Seraphim modules with 40 and 50 mm frames SRP-xxx-6YY Where "xxx" is the module power rating; and "YY" can be MA, MB, PA, PB, QA-XX-XX, and QB-XX-XX
Sharp	Sharp modules with 35 and 40 mm frames NUYYxxx Where "YY" can be SA or SC; and "xxx" is the module power rating
Silfab	Silfab Modules with 38 mm frames SYY-Z-xxx Where "YY" can be SA or LA; SG or LG; "Z" can be M, P, or X; and "xxx" is the module power rating
Solaria	Solaria modules with 40 mm frames PowerXT xxxY-ZZ Where "xxx" is the module power rating; "Y" can be R or C; and "ZZ" can be AC, BD, BX, BY, PD, PX, PZ, WX or WZ
Solarcity	Solarcity modules with 40 mm frames SCxxxYY Where "xxx" is the module power rating; and "YY" can be blank, B1 or B2
SolarTech	SolarTech modules with 42 mm frames STU-xxxYY Where "xxx" is the module power rating; and "YY" can be PERC or HJT
SolarWorld AG / Industries GmbH	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 Where "xxx" is the module power rating
SolarWorld Americas Inc.	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 Where "xxx" is the module power rating
Stion	Stion Thin film modules with 35 mm frames S O-xxx or STO-xxxA Thin film frameless modules STL-xxx or STL-xxxA Where "xxx" is the module power rating
SunEdison	SunEdison Modules with 35, 40 and 50 mm frames SE-YxxxZABCDE Where "Y" can be B, F, H, P, R, or Z; "xxx" refers to the module power rating; "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

MODULE COMPATIBILITY

Suniva	Suniva modules with 35, 38, 40, 46 and 50 mm frames OPTxxx-AA-B-YYY-Z MVXxxx-AA-B-YYY-Z Where "xxx" is the module power rating; "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) 40 and 46 mm frames SPR-Zb-xxx-YY Where "Z" is either A, E, P or X; "b" can be blank, 17, 18, 19, 20, 21, or 22; "xxx" is the module power rating and "YY" can be blank, BLK, COM, C-AC, D-AC, E-AC, G-AC, BLK-C-AC, or BLK-D-AC
Sunpreme	Sunpreme frameless modules GXB-xxxYY Where "xxx" is the module power rating; and "YY" can be blank or SL
Sunspark	Sunspark modules with 40 mm frames SYY-xxZ Where "YY" can be MX or ST; "xxx" is the module power rating; and "Z" can be P or W
Suntech	Vd, Vem, Wdb, Wde, and Wd series modules with 35, 40 and 50 mm frames
Talesun	Talesun modules with 35 and 40 frames TP6yyZxxx-A Where "yy" can be 60, 72, H60 or H72; "Z" can be M, or P; "xxx" is the module power rating; and "A" can be blank, B, or T
Trina	Trina Modules with 30, 35, 40 and 46mm frames TSM-xxxYYZZ Where "xxx" is the module power rating; "YY" can be DD05, DD06, DE14, DE15, DEG15, PA05, PC05, PD05, PD06, PA14, PC14, PD14, PE14, or PE15; and "ZZ" can be blank, .05, .08, .10, .18, .08D, .18D, 0.82, .002, .00S, 05S, 08S, A, A.05, A.08, A.10, A.18, 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), or M 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
Vikram	Vikram solar modules with 40 mm frames Syy.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
Winaico	Winaico modules with 35 and 40 mm frames Wsy-xxxz6 Where "y" can be either P or T; "xxx" is the module power rating; and "z" can be either M or P
Yingli	Panda, YGE and YGE-U series modules with 35, 40 and 50 mm frames



Tech Brief

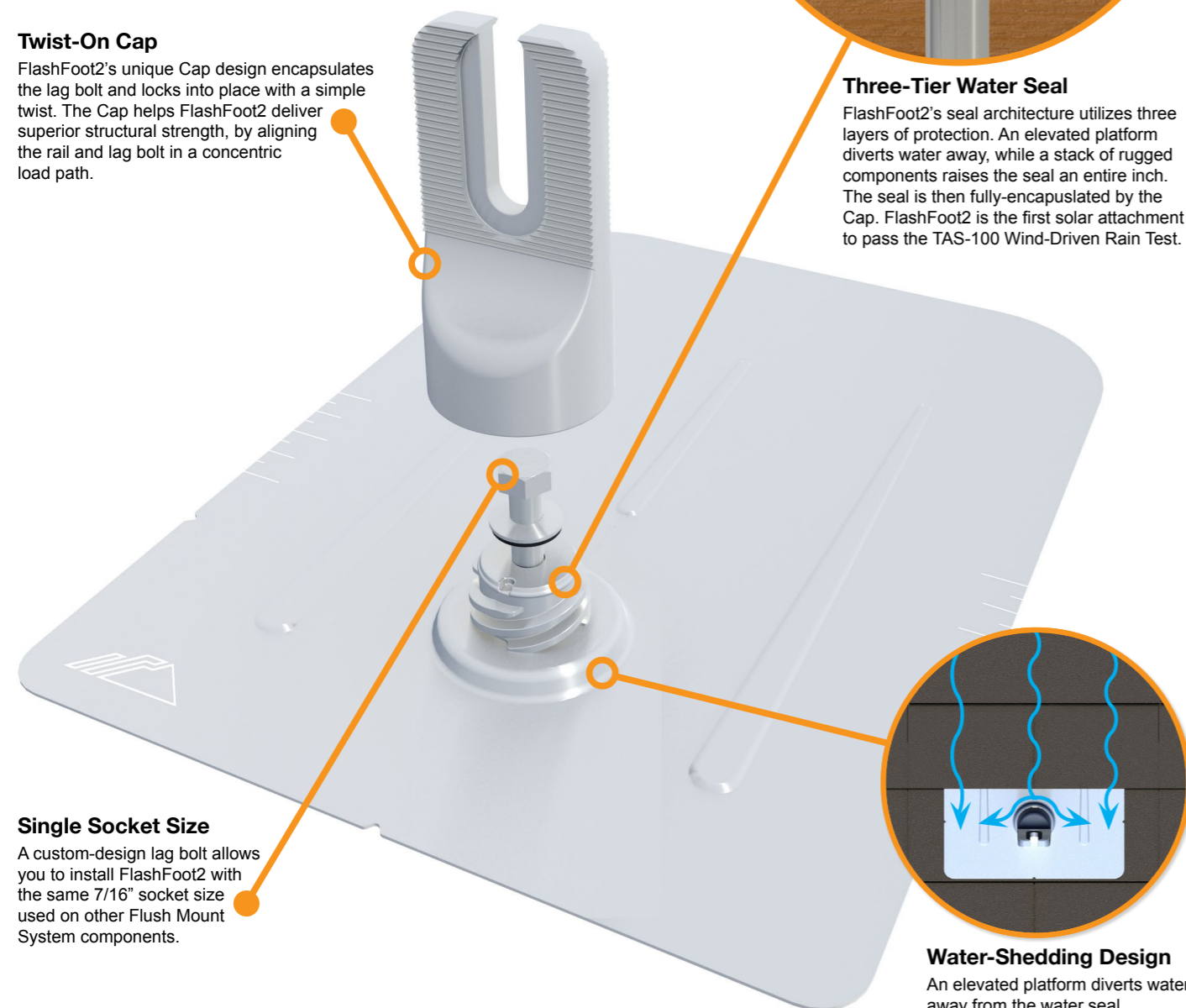
FlashFoot2

The Strongest Attachment in Solar

IronRidge FlashFoot2 raises the bar in solar roof protection. The unique water seal design is both elevated and encapsulated, delivering redundant layers of protection against water intrusion. In addition, the twist-on Cap perfectly aligns the rail attachment with the lag bolt to maximize mechanical strength.

Twist-On Cap

FlashFoot2's unique Cap design encapsulates the lag bolt and locks into place with a simple twist. The Cap helps FlashFoot2 deliver superior structural strength, by aligning the rail and lag bolt in a concentric load path.



Three-Tier Water Seal

FlashFoot2's seal architecture utilizes three layers of protection. An elevated platform diverts water away, while a stack of rugged components raises the seal an entire inch. The seal is then fully-encapsulated by the Cap. FlashFoot2 is the first solar attachment to pass the TAS-100 Wind-Driven Rain Test.

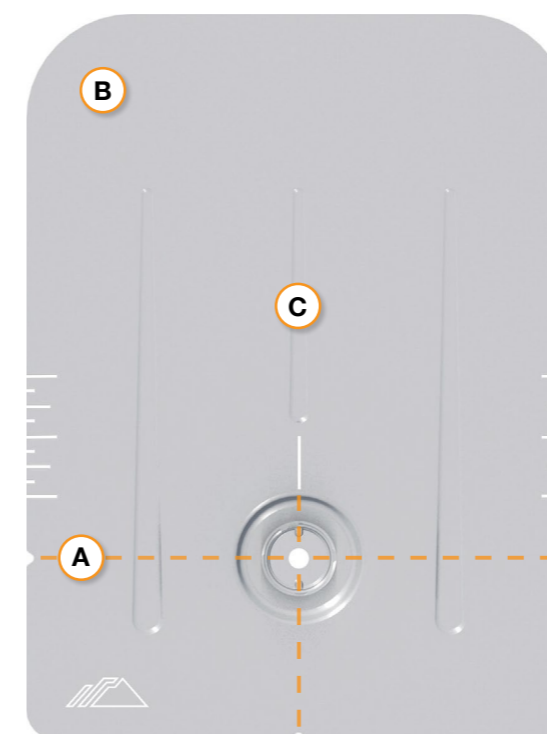
Single Socket Size

A custom-design lag bolt allows you to install FlashFoot2 with the same 7/16" socket size used on other Flush Mount System components.

Water-Shedding Design

An elevated platform diverts water away from the water seal.

Installation Features



A Alignment Markers

Quickly align the flashing with chalk lines to find pilot hole

B Rounded Corners

Makes it easier to handle and insert under the roof shingles.

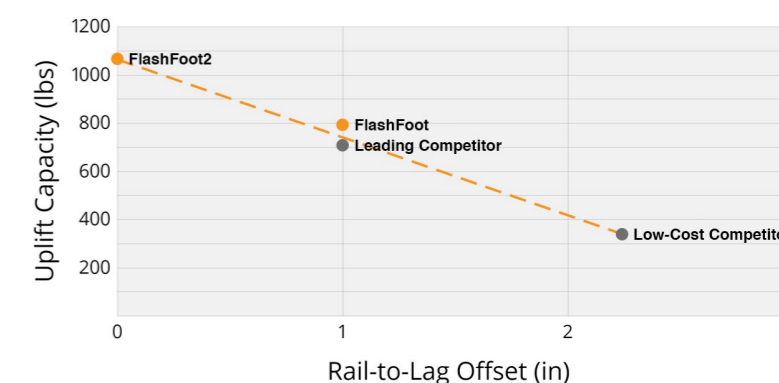
C Reinforcement Ribs

Help to stiffen the flashing and prevent any bending or crinkling during installation.

Benefits of Concentric Loading

Traditional solar attachments have a horizontal offset between the rail and lag bolt, which introduces leverage on the lag bolt and decreases uplift capacity.

FlashFoot2 is the only product to align the rail and lag bolt. This concentric loading design results in a stronger attachment for the system.



Testing & Certification

Structural Certification

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

Water Seal Ratings

Water Sealing Tested to UL 441 Section 27 "Rain Test" and TAS 100-95 "Wind Driven Rain Test" by Intertek. Ratings applicable for composition shingle roofs having slopes between 2:12 and 12:12.

UL 2703

Conforms to UL 2703 Mechanical and Bonding Requirements. See Flush Mount Install Manual for full ratings.

THE BOSS.6 AND .12

BATTERY ONLY STORAGE SYSTEMS



EXPAND YOUR ENERGY STORAGE— MORE POWER PER HOUR

SimpliPhi Power's BOSS.6 and BOSS.12 carbon-steel enclosures are weather-resistant battery bank housing and wiring solutions with built-in shelving. The BOSS consolidates a PHI battery bank paired with any SimpliPhi-compatible Balance of System equipment and can provide additional battery capacity to a SimpliPhi ExprESS or AccESS fully integrated unit. They include terminal blocks for electrical wiring in parallel, busbar-to-terminal block battery cabling, and terminal block to inverter cabling when ordered. The BOSS.6 and BOSS.12 have been UL 9540 Certified when used with our AccESS 12K with Sol-Ark.



NEMA 3R-rated, weather-resistant carbon steel enclosures are easily installed and assembled.



Corrosion-resistant fan prevents PHI batteries from reaching maximum 120°F charging temperature.



Energized with cobalt-free, safe and non-toxic PHI batteries that outperform alternative solutions.



**CERTIFIED
TO UL9540**



BOSS.6

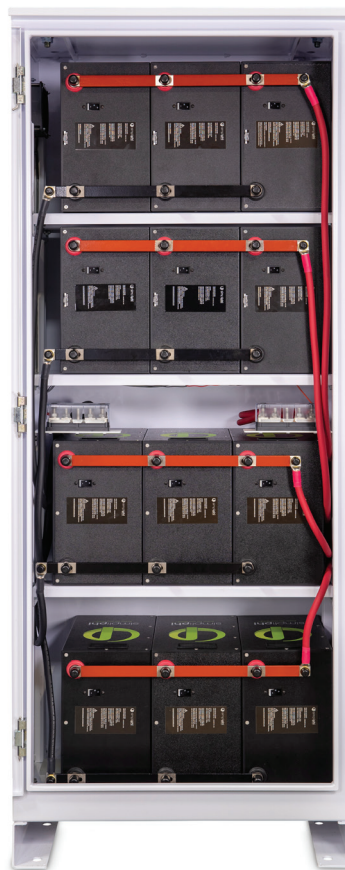
Dimensions	36" W x 36" H (40" w/feet) x 16" D / 91.4 cm W x 91.4 cm H (101.6 cm w/feet) x 40.64 cm D
Weight	180 lbs (81.64 kg.) w/o batteries
Enclosure Rating	NEMA 3R Outdoor Rated
Mounting	Free-standing or Pad-mounted
Knockouts	3 x Trade Size 1 Knockouts per side (6 total)
Built-In DC Connections	2 x 5-point Terminal Busbars, 3/8" lugs, 650 ADC
Charging Temperature	32°F to 120°F (0°C to 49°C)
Maximum Contained Battery Quantity	Six (6) AmpliPHI or PHI 3.8, 3.5 or 3.4 batteries (each battery measuring 13.5" W x 15.5" H w/terminals x 8" D)
Enclosure Warranty Period	2 years

BOSS.12

Dimensions	29.5" W x 76" H (w/feet) x 20" D / 75 cm W x 193 cm H (w/feet) x 51 cm D
Weight	428 lbs (194.138 kg.) w/o batteries
Enclosure Rating	NEMA 3R Outdoor Rated
Mounting	Free-standing or Pad-mounted
Built-In DC Connections	2 x 5-point Terminal Busbars, 3/8" lugs, 650 ADC
Charging Temperature	32°F to 120°F (0°C to 49°C)
Maximum Contained Battery Quantity	Twelve (12) AmpliPHI or PHI 3.8, 3.5 or 3.4 batteries (each battery measuring 13.5" W x 15.5" H w/terminals x 8" D)
Enclosure Warranty Period	2 years



**CERTIFIED
TO UL9540**



AmpliPHI 3.8™ BATTERY



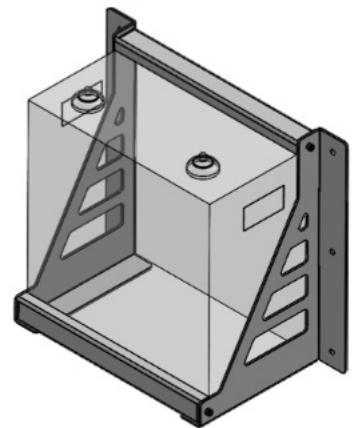
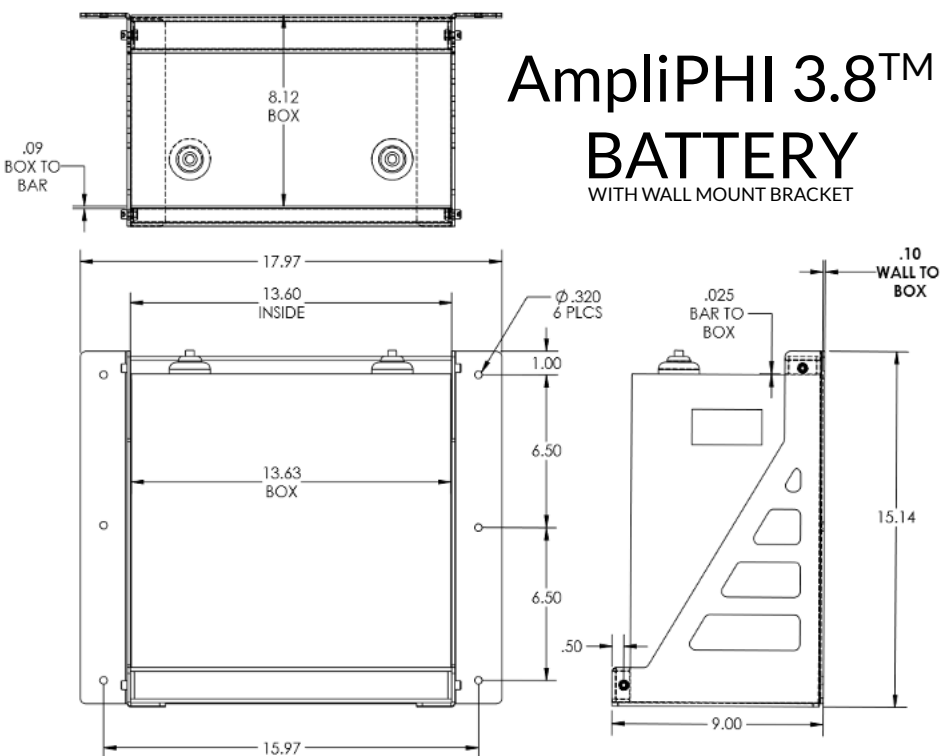
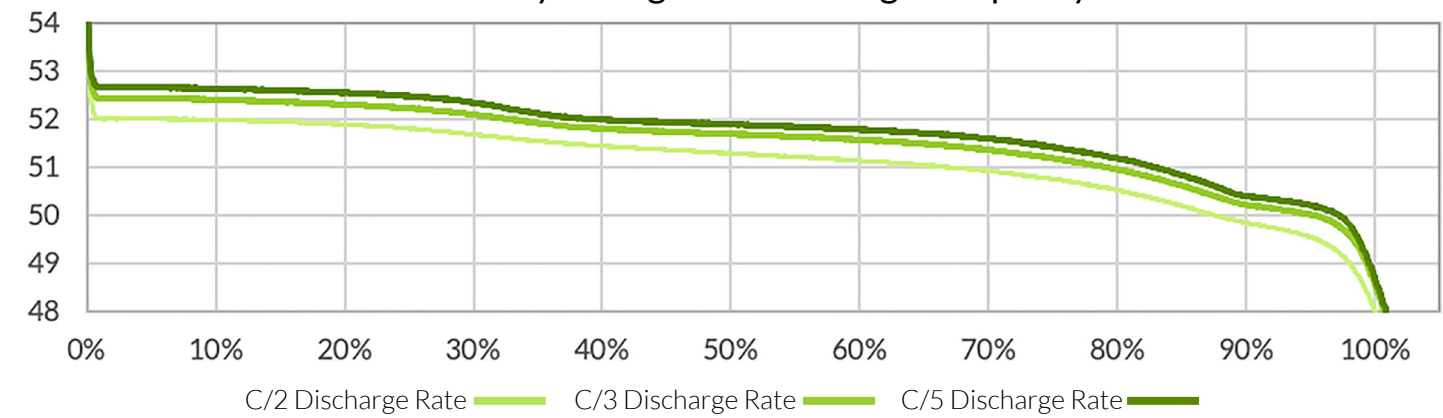
SimpliPhi Power's AmpliPHI 3.8™ Battery utilizes the safest Lithium Ion chemistry available, Lithium Ferro Phosphate (LFP). No cobalt or explosive hazards that put customers at risk. By eliminating cobalt, the risk of thermal runaway, fire propagation, operating temperature constraints, and toxic coolants are reduced. The AmpliPHI features a Battery Management System (BMS) with closed loop communications pre-configured with Sol-Ark inverters that reports SOC and other critical real-time data, optimizing the value of storage and functionality within balance-of-system equipment. Combined with our proven overcurrent protection (OCPD) and accessible 100 Amp DC breaker On/Off switch, installation time is reduced and safety is increased during set-up for residential and commercial systems, on and off-grid. Designed to scale up to 40 batteries, the AmpliPHI will offer pre-configured communications with other inverter manufacturers, to be announced soon.

AmpliPHI 3.8 kWh Module	AmpliPHI 48V
SKU	AmpliPHI-3.8-48
DC Voltages - Nominal	51.2 VDC
Amp-Hours	75 Ah
Rated kWh Capacity	3.8 kWh DC @ 100% DOD 3.04 kWh DC @ 80% DOD
Maximum Quantity Per System	40 (154.8kWh)
MAX Discharge Rate (10 minutes)	100 Amps DC (5.1 kW DC)
MAX Continuous Discharge Rate	37.5 Amps DC (1.9 kW DC)
MAX Continuous Charge Rate	37.5 Amps DC (1.9 kW DC)
DC Voltage Range ¹	48 VDC to 56 VDC
Depth of Discharge ¹	up to 100%
Charging Temperature ¹	32° to 120° F (0° to 49° C)
Operating Temperature ¹	-4° to 140° F (-20° to 60° C)
Storage Temperature	6 months: 14° to 77° F (-10° to 25° C) 3 months: -4° to 113° F (-20° to 45° C)
Self-Discharge Rate	< 1% per month
Cycle Life	10,000+ cycles (@ 80% DOD)
Memory Effect	None
Warranty	10 Years
Weight	86 lbs. (39.0 kg)
Dimensions (W x H x D)	13.5 x 14 x 8 in. (15.5" H w/terminals) / 0.88 ft ³ (34.3 x 35.6 x 20.3 cm / 0.025 m ³)
Model Number	AMPLIPHI 3.8 48v

1. Max operating ranges. Refer to Installation Manual for recommended conditions.
• All specifications listed are typical/nominal and subject to change without notice.
• UN 3480, Lithium ion batteries, 9, II
• UL, CE, UN/DOT and RoHS compliant components - UL Compliant
• Designed and manufactured in California, USA



48V Battery Voltage VS. Discharged Capacity



Terminals	3/8 IN	10 MM
Battery Cables	6 AWG MINIMUM	

Refer to the Integration Guide section of SimpliPhi's [Product Documentation](#) web page for wiring instructions, inverter and/or charge controller specific settings. Must be followed to maintain PHI Warranty.

