



Building and Safety Division • Public Information

County of Ventura • Resource Management Agency
Main Office • 800 South Victoria Avenue, Ventura, CA 93009 • (805) 654-2771
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B&S STD E-18 Solar Photovoltaic (PV) Systems Revised: January, 2017

The following document outlines the requirements for the issuance of building and electrical permits for solar photovoltaic systems. Plans shall accurately represent the work being installed and shall comply with 2016 VCBC, CEC, CRC, CBC, CFC.

- I. Approvals from Other Agencies:
 - a. Obtain a Zone Clearance from Planning for Ground-Mounted PV arrays.
 - b. Obtain Setback Certification from Environmental Health for Ground-Mounted PV arrays located on properties with an onsite waste water treatment system.
- II. Expedited Electrical Permits (available over-the-counter) are required for:
 - a. Roof-mounted PV arrays weighing **less** than six (6) lbs/sq.ft. and located on roofs with a **single** layer of roof covering material (no existing recovers) and 12 kW or less.
 - b. Ground-mounted PV arrays **less** than six (6) feet above grade and 12 kW or less.
- III. Electrical Permits (including plan review) are required for all **non-residential** PV systems, **stand-alone** and **hybrid** PV systems, energy storage systems, and all residential PV systems **greater than 12.0 kw**.
- IV. Electrical **and** Building Permits (including structural plan review) are required for:
 - a. All **non-residential** PV systems.
 - b. Ballasted roof-mounted PV arrays.
 - c. Roof-mounted PV arrays weighing **more** than six (6) lbs/sq.ft.
 - d. Ground-mounted PV arrays **more** than six (6) feet in height above grade.
 - e. Roof-mounted PV arrays installed on carports, gazebos, patio covers, barns and similar structures.
- V. Plan Submittal Requirements:
 - a. Completed permit application form, available for download at:
<http://www.vcrma.org/buildingsafety/info-handouts.html>
 - b. All applicable clearances from other agencies.
 - c. Complete structural drawings with load calculations prepared by a licensed civil or structural engineer with a wet stamp and signature when required (See section IV above).
 - d. Three (3) sets of plans (minimum size 11"X17") that include the following information:
 - i. Project address and the name of the owner in the title block.
 - ii. Wet stamp and signature and/or contractor's license number and signature of the person authorized to design the system. VCBC 107.
 - iii. **Site plan** showing the arrangement of the array on the roof or ground, north arrow, lot dimensions with the distance from property lines to adjacent buildings/structures. Include the location of the Main Service Panel, PV disconnects, inverter, other power production sources, load transfer equipment conduit locations and all distribution panelboards on the premises.
 - iv. Plans for ground-mounted PV arrays shall include the following:
 - **Foundation Plan** with width and depth of footings, spacing of posts and distance between rails.
 - Structural calculations prepared by licensed civil or structural engineer with wet stamp and signature (arrays over 6 feet in height).
 - Elevation drawing identifying the minimum and maximum height of the array.
 - Identify mounting system manufacturer and model number, maximum allowable weight the system can support. Detail the attachment method of posts, rails, and modules. Provide the product evaluation or structural design for the mounting system.
 - A clear, brush-free area of 10 feet shall be required for ground-mounted PV arrays. CRC R331.5.



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- Where PV source and output circuits operating at maximum system voltages greater than 30 volts are installed in readily accessible locations, circuit conductors shall be guarded or installed in a raceway. CEC 690.31 (A). All ground-mounted PV arrays shall comply.
- v. A **Roof plan** showing building orientation, PV array layout and the following information:
 - Location of roof access points, access pathways from eave to ridge, and required fire setbacks at ridge per CRC Section R331 (See Figures 1-4 below)
 - Type of roof covering, minimum fire classification, and the number of layers. (single layer only).
 - PV module fire classification per UL1703/CSFM 14-011; shall meet or exceed the minimum required fire classification of existing roof covering. Certificate of Compliance with UL 2703 required for PV system.
 - Raceways shall be located as close as possible to the ridge, hip, or valley and run as directly as possible to an outside wall so-as-to minimize the amount of conduit on the roof. Conduit shall be fastened to the structure.
 - Stand-off locations, flashing and method of attachment.
 - Roof framing plan and details for any work necessary to strengthen the existing roof structure. Site-specific structural drawings and calculations shall be prepared by a licensed civil or structural engineer.
 - Identify mounting system manufacturer and model number, maximum allowable weight the system can support, attachment method to the roof and the product evaluation or structural design for the mounting system.
- vi. Complete **Electrical single-line diagram** of the system:
 - Provide total number of modules, number of modules per string, and the total number of strings. (include calculations per CEC 690.7 and 690.8)
 - Identify micro inverters, DC to DC converters (optimizers), rapid shutdown devices, combiner boxes with rooftop DC disconnects when required by 690.15(C)
 - Overcurrent protection of DC source and output circuits (more than two parallel source circuits) per 690.9
 - Detail grounding/bonding, conductor type and size, conduit type and size and number of conductors in each section of conduit. (include ampacity adjustments as needed per CEC 310.15)
 - Main Service Panel (Rating of Bus and MCB), ratings of subpanels, feeder conductors, over current protection devices.
 - Location and rating of DC and AC disconnects. (shall be listed for PV CEC 690.17 and lockable per CEC 110.25)
 - Batteries are to be installed, include them in the diagram and show their location, venting, length of feeders and disconnecting means.
 - Identify Point of Connection with the utility power supply, all other on-site power sources and demonstrate compliance with CEC 705.12.
 - PV systems utilizing a **Supply-Side Connection** per CEC 705.12(A) and 230.82(6) shall either:
 - Provide field evaluation report from recognized third-party organization for altered service-panels modified to accept the supply-side connection per CEC 90.7 and 110.3(A)&(B), or
 - Replace the main service-panel with one that is listed to accept a supply-side connection without field alteration.
- vii. **Equipment cut sheets** including inverters, modules, DC to DC converters (optimizers), AC and DC disconnects, combiners, mounting system, and rapid shutdown equipment. **All equipment shall be listed and identified for use with PV.** CEC 690.17.
- viii. **Certificate of Compliance to Standard UL 2703** for PV system consisting of the racking system AND the modules as an assembly. The

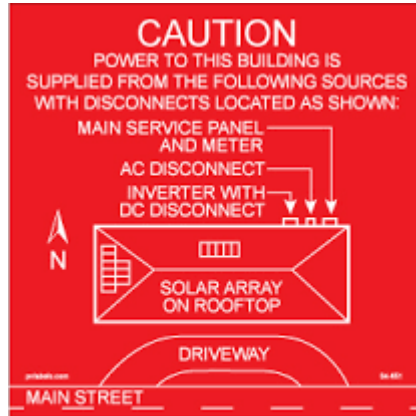


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certificate shall identify the racking system with the module type for the proposed roof pitch and shall meet or exceed minimum fire classification for the roof covering. CRC R902.4 and CBC 1505.9

- ix. **Warning label schedule** identifying locations as required by CEC 690 and 705. Include building power source directory per CEC 705.10. (See below) All labels must comply with CEC 110.21.



4" X 4"

Informational note: ANSI Z535.4 provides guidelines for the design of safety signs and labels for application to products. A phenolic plaque with contrasting colors between the text and background would meet the intent of the code for permanency. No type size is specified, but 20 point (3/8") should be considered minimum.

Figure 1: Cross Gable Roof

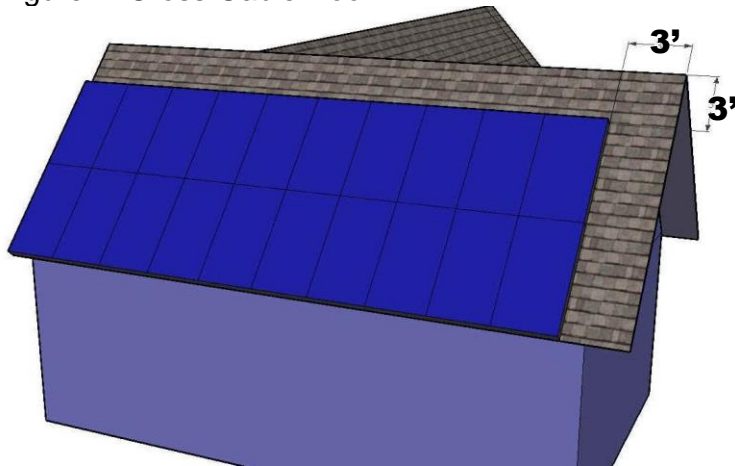
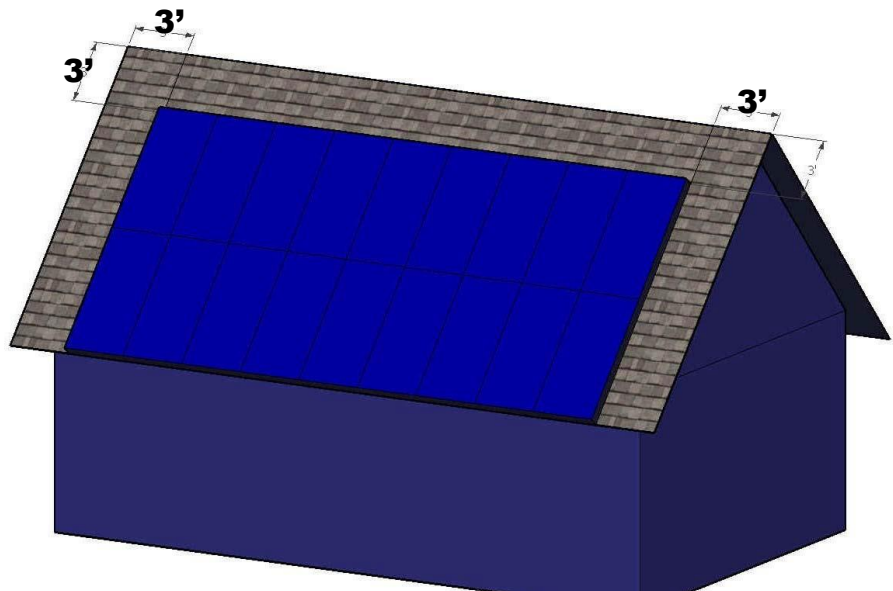


Figure 2: Full Gable





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Figure 3: Cross Gable with Valley

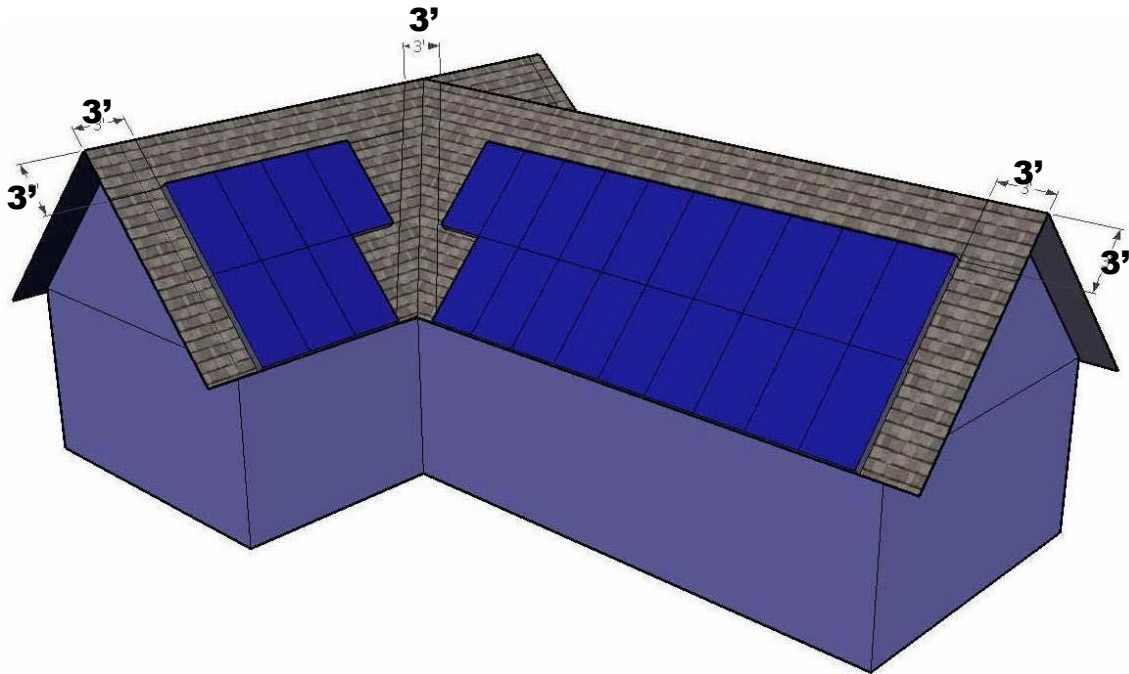
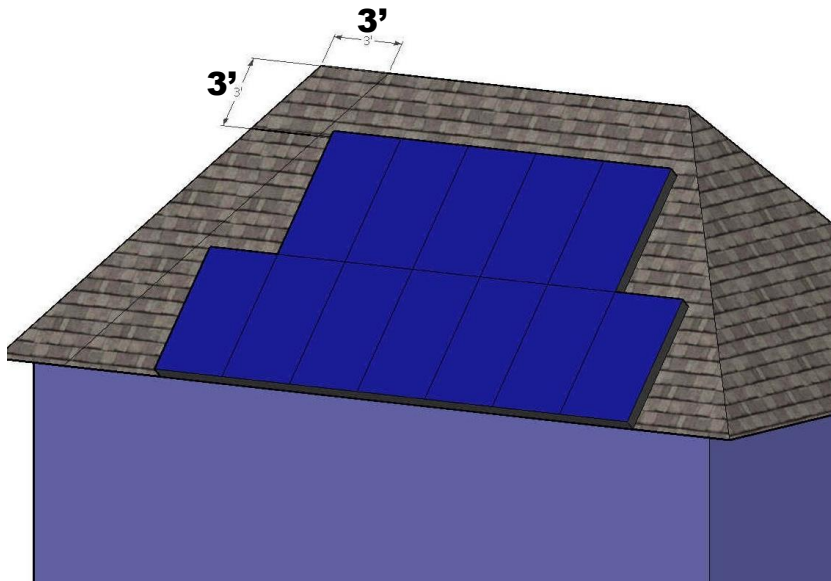


Figure 4: Full Hip Roof





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Residential Solar Photovoltaic System Worksheet

All code sections refer to 2016 CA Electrical Code

This worksheet shall be completed by a qualified person representing the contractor **after** the installation is completed and **before** requesting final inspection. Provide this completed worksheet to the inspector at final inspection.

1. System Type: Roof mounted Ground mounted
2. Inverter Type: Grounded Ungrounded (complies with section 690.35)
 - Central with DC to DC converters A/C modules or micro inverters
 - Central **without** DC to DC converters (complete sections 2 & 3 below). Identify rapid shutdown equipment in compliance with section 690.12 on the line below:

➤ _____
3. Calculate the maximum DC system voltage in compliance with section 690.7:

Max number of modules per string _____ X Voc X ambient temperature correction factor ^(a)
1.14 = _____ VDC. (a) 2016 CEC Table 690.7

Note: This formula is intended to provide a close approximation of the maximum DC voltage generated by a PV system at a given location with the lowest expected ambient temperature condition. This result will always be slightly higher than when using the module manufacturer supplied temperature coefficient. **Max DC voltage shall not exceed 600 for one- and two-family dwellings.**

4. Calculate the minimum ampacity for conductors used in DC source and output circuits in compliance with section 690.8:

Module Isc _____ X Number of parallel source circuits _____ X 1.56 = _____
Minimum ampacity of conductors used for DC source and output circuits after adjustments required by section 310.15.

5. Contractor's representative shall certify PV system is installed per approved plan prior to final approval by Building and Safety.
 - Racking manufacturer and model: _____
 - Module manufacturer and model: _____
 - Inverter manufacturer and model: _____
 - Racking system and modules conform to UL 2703 for bonding and have a minimum Class A fire classification: YES NO

I have verified the system and equipment identified above is installed per the approved plan. YES NO

Contractor Name: _____

Print Name: _____

Signature: _____

Project Address: _____

Permit Number: _____