



# County of Riverside

## Building and Safety Department

### Photovoltaic Permitting Guidelines

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**The information provided in this document is general and is intended only as a guide. Each project is unique and additional requirements may apply.**

#### **PLANS AND PERMITS**

In order to minimize installation problems, plans must be provided that show compliance with all applicable codes. Because of the inherent complexities and potential hazards associated with photovoltaic systems, a California Registered Electrical Engineer or a California Licensed Electrical (C-10) or Solar (C-46) Contractor is required to prepare and sign the plans. In order to expedite the plan review and approval process, it is recommended that the plans include all of the information discussed in this informational handout.

#### **Site Plan**

Provide a fully dimensioned site plan showing property lines, all structures, and the location of the main electrical service, all photovoltaic inverters and disconnects, etc.

#### **Roof Plan**

Provide a roof plan showing the location of the photovoltaic panels and any required walkways to roof mounted equipment (including any roof mounted heating and air conditioning equipment, plumbing vents, sky lights, etc.). Roof plans should also identify the size and spacing of the existing roof framing members and the slope of the roof plus any required roof framing alterations needed.

#### **Attachment Details**

Provide details to show how the photovoltaic panels will be secured to the roof.

#### **Engineering Calculations**

Engineering calculations may be required on some photovoltaic systems to show that the existing roof is strong enough to support the added weight of the system.

#### **Electrical Single Line Diagram**

Provide a complete electrical single line diagram showing all electrical equipment, conductor size and type, conduit sizes, over current protection location and ratings, grounding electrode type and location, point of interconnection to existing service panel (i.e. back fed breaker), etc.

#### **Product Specifications and Literature**

Provide specifications on the inverters, solar panels, disconnect boxes and solar panel anchorage system to be used.

#### **Signage Specifications**

Provide a legend showing locations and wording of all required signs or placards at various photovoltaic system components.

#### **STREAMLINING THE PLAN REVIEW PROCESS**

The following information represents many of the most common plan review correction comments and should be helpful in assisting you to prepare a set of plans that are able to be quickly reviewed and approved. Well drawn plans that provide complete and thorough information will be helpful in minimizing installation errors and inspection problems. Please be aware, commercial photovoltaic system applications may be subject to a Fire Department review.

## **TYPICAL GENERAL PLAN CHECK COMMENTS**

1. The font size used on the plans submitted is too small to be legible and/or the line quality is too light to be reproduced or archived in our database. All plans and specifications or reports must be legible and reproducible on a standard copy machine (**Not** a color copier). Minimum recommended font size is equal to or larger than #12 Times New Roman. In order to comply with our legibility and reproduction standards, it may be necessary to provide plans on a larger size paper (18" X 24" or larger).
2. Please provide a note stating that the working clearances around the existing electrical equipment as well as the new electrical equipment will be maintained in accordance with CEC 110.26.
3. Identify any existing mechanical equipment on the roof plan and provide a minimum working clearance of 36" around the entire unit as well as a minimum 24" wide clear access way from the roof scuttle or roof access point. (CEC 110.26 and CMC 904.10)
4. Note on the plans that the photovoltaic inverter will be listed as UL 1741 compliant. (CEC 690.4D).
5. Plans are to be signed by a California Registered Electrical Engineer or a California Licensed Electrical (C-10) or Solar (C-46) Contractor, with their related California registration or license number. (B & P Code 5537.2, 5537.4 and 6737.4)
6. Please provide an electrical single line diagram showing all equipment as well as conductor sizes for all grounding, bonding and current carrying conductors. Show type of grounding electrode(s) used and location(s).
7. The electrical single line diagram must be clear as to the point of interconnection to the service. In order for us to evaluate the design, much more information is needed. Please identify the back fed breaker size on the plans. Show all electrical service gear and amperage rating of bus bars and main breaker size.
8. Please note that adequate spacing must be maintained between any plumbing sewer vents extending through the roof and the underside of the photovoltaic panels (6" minimum recommended).
9. Identify the location of the Inverter on the site plan.
10. The 2010 California Residential Code (CRC) requires that Smoke alarms and Carbon Monoxide alarms are retrofitted into the existing dwelling. The required Smoke alarms and Carbon Monoxide detectors shall be located as required per sections R314 & R315 within the 2010 California Residential Code (CRC). Please provide a note on the plans to document these requirements. (CRC R314, R315)

## **TYPICAL WIRING METHOD PLAN CHECK COMMENTS**

11. Identify that all exposed photovoltaic system conductors on the roof will be USE-2 or Photovoltaic (PV) type wire. Identify wire size for all conductors. (CEC 690.31B, 338.10 B 4 b, Table 310.16, Table 310.17)
12. Identify that all photovoltaic system conductors will be 90 degree C rated. (CEC 690.31B, Table 310.16, Table 310.17)

13. Where DC conductors are run inside the building (or attic), they shall be contained in a metal raceway. (CEC 690.31 E)
14. Identify that all exterior conduit, fittings, and boxes shall be rain-tight and approved for use in wet locations. (CEC 314.15).
15. \*Line side taps into the bus bars or conductors on the supply side (i.e. between the service entrance conductors and the main over current device downstream of the meter) are NOT ALLOWED by the County of Riverside at this time. All incoming current from the photovoltaic system must be back fed through a circuit breaker on the load side of the service main breaker. (CEC 690.64 and Utility Dept. policy)
16. \*Supply side taps into the existing buss bars will NOT BE ALLOWED by Riverside County at this time.
17. \*Supply side taps into feeder conductors (Feeder Conductor Taps) will NOT BE ALLOWED by Riverside County at this time.  
  
\* **NOTE:** Line side and supply side taps are not recommended per the current electrical purveyors. Alterations to Listed and labeled equipment are not permitted in Riverside County. Listed or labeled equipment shall be installed and used in accordance with the instructions and specifications included within the listed and labeled equipment (CEC 110.3 B).
18. Provide a note stating that any conductors exposed to sunlight shall be listed as sunlight resistant. (CEC 300.6 C1, 310.8 D)
19. Ground mounted system wiring over 150 volts shall not be accessible, except to qualified personnel. Provide protective fencing, screening or raceways for all wiring over 150 volts. (CEC 690.7 D)
20. All photovoltaic output circuits operating above 30 volts shall be installed in readily accessible locations and in electrical raceways. (CEC 690.31 A)

### **Typical Signage, Markings, and Label Plan Check Comments**

21. Signage information on plan is inadequate, please refer to the County attached handout for additional information. As an aid in streamlining your plan preparation, you may simply attach a copy of the County of Riverside "Photovoltaic Signage Requirements" handout to your plans.
22. Provide a label or marking in a visible location near the ground-fault indicator stating:  
***"WARNING – ELECTRIC SHOCK HAZARD - IF A GROUND FAULT IS INDICATED, THE NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED"***. (CEC 690.5 C)
23. The photovoltaic system disconnecting means shall be permanently marked to identify it as the ***"PHOTOVOLTAIC DISCONNECT FOR UTILITY OPERATIONS"***. (CEC 690.14 C 2 and NEM 6.3)
24. A warning sign shall be mounted on or adjacent to the disconnecting means and shall state ***"WARNING – ELECTRIC SHOCK HAZARD - DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE"***

**OPEN POSITION.”** (CEC 690.17)

25. A warning sign shall be mounted on all serviceable panels or boxes and shall state **“WARNING – ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.”** (CEC 690.17)
26. A label or marking shall be provided at the photovoltaic power source (typically at the inverter) indicating the following (CEC 690.53):
- Rated maximum power-point current**
  - Rated maximum power-point voltage**
  - Maximum system voltage**
  - Short circuit current**
  - Maximum rated output current of the charge controller (if installed)- (only applicable to battery systems)**
27. At the point of interconnection between the photovoltaic power and the Utility power (typically at the back-fed photovoltaic breaker at the service) a sign or marking shall be provided to identify the **RATED AC OUTPUT CURRENT AND THE NOMINAL OPERATING AC VOLTAGE.** (CEC 690.54)
28. A sign shall be provided at the main electrical service stating; **“THIS SERVICE ALSO SERVED BY A PHOTOVOLTAIC SYSTEM”** (CEC 705.10) ...OR ...
29. A **DIRECTORY** providing the location of the service disconnecting means and the photovoltaic system DC disconnecting means shall be provided if the two disconnects are NOT at the same location (typically within 10 feet of each other and within sight of each other – with no fences or other barriers between). (CEC 690.56 B)
30. Identify the signage or labeling specifications. The following standards are recommended:
- Red background with white lettering
  - 3/8" letter height
  - All capital letters
  - Arial or similar font
  - Weather resistant material (i.e. engraved plastic)

### **TYPICAL GROUNDING AND BONDING PLAN CHECK COMMENTS**

31. Indicate that all metallic raceways and equipment shall be bonded and electrically continuous. (CEC 250.90, 250.96).
32. Indicate that the photovoltaic arrays shall be provided with DC ground-fault protection. (CEC690.5).
33. The DC grounding electrode conductor shall be sized according to CEC 250.166. (CEC 690.47B)
34. The DC grounding electrode shall be bonded to the AC grounding electrode and the conductor shall be no smaller than the largest grounding electrode conductor, either AC or DC. (CEC690.47 C 7)
35. The AC grounding electrode conductor shall be sized according to NEC 250.66. (And Table 310.15 B 6 for dwellings) (CEC 690.47 )

36. Indicate in the notes that grounding bushings are required around pre-punched concentric knockouts on the DC side of the system. (CEC 250.97)
37. The grounding electrode conductor must be protected from physical damage between the grounding electrode and the panel (or inverter) if smaller than #6 copper wire. (CEC250.64B)
38. Indicate that the grounding electrode conductor will be continuous, except for splices or joints at bus bars within listed equipment. (CEC 250.64 C)
39. Identify the existing grounding electrode type (i.e. driven rod, ufer, water pipe, or combination of some or all of the previously mentioned). In existing electrical systems that use only a water piping grounding electrode system, an additional grounding electrode (i.e. driven rod) shall be provided. (CEC 250.50)

### **TYPICAL OVERCURRENT PROTECTION AND DISCONNECT COMMENTS**

40. The sum of the ampere ratings of the main service breaker supplying power to the bus bar from the Utility and the ampere rating of the back-fed breaker supplying power to the bus bar from the photovoltaic source shall not exceed 120 percent of the rating of the bus bar or conductor. (CEC690.64 B )
41. In systems with panel boards connected in series, the rating of the first over current device directly connected to the output of a utility-interactive inverter shall be used in the 120 percent calculation for all bus bars and conductors. (CEC 690.64 B 2), (CEC 705.12 D 2)
42. Provide a DC disconnect at the inverter. (CEC 690.15)
43. Where the main service breaker is downsized, the following shall be provided:
  - a. **Load calculations.** Please provide the electrical load calculations to show that the downsizing of the main breaker will remain adequate for the loads at the main panel.
  - b. **Panel Schedule.** Provide a panel schedule of the existing electrical panel indicating all circuit breaker sizes and designations.
  - c. **Placard.** A permanently affixed metal placard shall be riveted in placed for clear visibility inside the electrical panel that states: "The main service breaker has been down sized to \_\_\_\_\_AMPS. No up-sizing is permitted.
44. Provide a note stating that the back fed PV breaker(s) at the main panel will be installed at the opposite end of the bus bar from the main breaker and that a permanent warning label with the following marking will be provided adjacent to the PV breaker(s): "**WARNING – PHOTOVOLTAIC CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE.**" (CEC 690.64 B 7) [Note: this requirement is only applicable when the sum of the over current devices feeding the panel board exceeds 100% of the bus rating.]

### **TYPICAL UTILITY DEPARTMENT AND AC DISCONNECT REQUIREMENTS**

45. Identify the location of the Utility Disconnect in relation to the main service panel.

46. Indicate that a photovoltaic meter socket will be provided within 10" to 72" (center to center of meters) from the existing service meter and that it will be installed between 36" to 75" above the floor or grade level. Note that the photovoltaic meter will be provided and installed by Riverside Public Utilities when they are the service provider.

### **TYPICAL STRUCTURAL PLAN CHECK COMMENTS**

47. Due to the additional dead load from the photovoltaic panels and related wiring and roof mounted equipment, the capacity of the existing roof framing to support the added dead load is in question. During the plan review, engineering analysis of the existing roof framing to support the added loads may be required. (CBC 3403.2 & 3403.2.3.2)

48. Where photovoltaic panels are mounted on existing patio covers, a California Registered Professional Engineer must review and report on the existing lateral load carrying structural elements. The Engineer's report is to show that the demand-capacity ratio of the lateral load-carrying structural elements is not exceeded by more than 10%. (CBC 3403.4 Exception)

49. Provide an engineering analysis, which is stamped and signed by a California Registered Engineer, for the photovoltaic panel roof attachment method... OR ... provide the manufacturer's product cut sheets with a California Registered Engineer's stamp and signature on the cut sheets.

50. Provide additional information concerning the roof framing. Provide the rafter size, rafter spacing, rafter span (identify any purlin) and roof slope in the areas supporting the solar panels. Some roof framing members on older homes may NOT be designed to carry the additional load of the solar panels.

51. Provide method of attachment of the solar panels to the roof framing. Provide listings and/or product approval information.

52. Ground mount systems will require an engineered design prepared by a California licensed architect or civil engineer.

53. Due to the use of the ballast hold-down system, the Engineer of Record will be required to provide Structural Observation and a report stating that the ballast is installed in full compliance with the design and the approved plans. Provide note on plans concerning Structural Observation requirements. (CBC 1702.1, 1710)

54. Per the California State Fire Marshall, the roof mount solar panel layout shall reflect the minimum 3'-0" setback from the roof edge and ridge lines as well as 1'-6" from hips and valleys on residential applications. Commercial roof mount solar panel layouts will require a minimum 6'-0" set back from all perimeter edges.