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COUNTY OF RIVERSIDE BUILDING AND SAFETY DEPARTMENT

PHOTOVOLTAIC PERMITTING GUIDELINES

PLANS AND PERMITS

In order to minimize installation problems, plans must be provided that show compliance with all applicable codes. In order to expedite the plan review and approval process, it is recommended that the plans include all of the information discussed in this handout. The following information is general and is intended only as a guide. Each project is unique and additional requirements may apply.

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 without interfering with any existing venting systems.

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.

General:

1. Each sheet of the plans is to be signed by a California Licensed Electrical Engineer or a California Licensed Electrical (C-10), or Solar (C-46) (Residential only) with related registration or license number. (B & P Code 5537.2, 5537.4 and 6737.4)
2. Unless the plans qualify for a non-structural signage per the solar conditions requirements (Residential only), a California licensed Civil Engineer or California Licensed Architect shall sign the plans and supporting documentation for the plans. (B & P Code 5537.2, 5537.4 and 6737.4)

NOTE: A California licensed Civil Engineer or California Licensed Architect may stamp & sign all pages (Electrical & Structural) of the PV solar plans.

3. Identify the location of all existing and proposed electrical equipment on the site plan. Include the electrical service size, location, any load centers or sub-panels, disconnects, performance meters, and inverters. **R106.1.1**
4. Ground mounted PV systems and systems installed on patios or similar structures that are accessory to residential property do not qualify for expedited plan review and approval. A standard plan review process is necessary in order to verify compliance with Codes. **RMC 16.22.030**

Typical Electrical Comments

5. The electrical single line diagram **is unclear as to the point of interconnection** to the service. In order for us to evaluate the design, more information is needed. Please identify the back-fed breaker location and size on the plans. Show all electrical service equipment and associated amperes rating of bus bars and main breaker size. **R106.1.1**
6. **On the single line diagram** identify all source circuits, conductors, wire type, sizing, conduit where applicable, j-box or combiner, fuses, inverter(s), disconnects, load centers or sub panels, sizes, performance meter, back-fed breaker, and electrical service equipment. **R106.1.1**
7. Identify that all exposed photovoltaic system conductors will be **USE-2** or listed and labeled as **Photovoltaic (PV) type wire**. Identify wire size for all conductors. **CEC 690.31(B)**
8. Signage information on plan is inadequate. Please refer to the signage information below contained in the guideline handout for additional information.
9. Grounding and bonding of PV systems shall comply with **CEC 690.41 – 690.50**. Correctly identify and size the required **Grounding Electrode Conductor(s) (GEC)**, as it may not be spliced, and all **EQUIPMENT GROUNDING CONDUCTORS (EGC)**.

10. The DC Grounding Electrode Conductor shall be sized per **CEC 250.166** and installed in accordance with **CEC 250.64. CEC 690.47(B)**
11. The PV DC grounding electrode system shall connect to the AC grounding electrode system in accordance with either **CEC 690.47(C) 1, 2, OR 3**. Show the path of the GEC system(s) clearly on the single line diagram.
12. Identify the existing AC grounding electrode system (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 shall be provided. **CEC 250.50**.
13. The array equipment shall be grounded; conductors smaller than 6 AWG shall be protected. **CEC 690.41, 690.46, 250.120(C)**
14. 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. Provide supporting calculations accordingly. **CEC 705.12 (D) 2**
15. In systems with panel boards connected in series, the rating of the first overcurrent 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 705.12 (D) 2**
16. **Main Service breaker may only be downsized when supporting electrical load calculations are provided:**
17. 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 (**CEC220**).
 - 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 place for clear visibility inside the electrical panel that states: "The main service breaker has been downsized to _____AMPS. No up-sizing is permitted."
18. Show and note that the back-fed PV breaker at the main service 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 – INVERTER OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE."**
CEC 705.12 (D) 7

NOTE: This requirement is only applicable when the sum of the overcurrent devices feeding the panel board exceeds 100% of the bus bar rating.

LINE SIDE TAPS

1. *Typically, 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)
2. *Typically, supply side taps into the existing bus bars will NOT BE ALLOWED by Riverside County at this time.
3. *Typically, 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. Alternations 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)**

4. *** Where a line side tap per items 1, 2, or 3 above are proposed:

- a. A full PV solar electrical plan stamped and signed by an electrical engineer shall be submitted to the applicable utility purveyor for review *prior* to the County submittal.
- b. Should the utility company approve the plan, the approved utility electrical plan along with the structural plans and all typical PV solar plan submittal requirements shall be submitted to the Building Department for review.
- c. The applicant/contractor obtaining the PV solar permit shall supply evidence of being a "Qualified person" per art. 690.4(E), California Electrical Code definitions, which requires a completion certificate of training class NFPA 70E-2009.

Typical Signage, Markings, and Label Plan Check Comments

1. 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.
2. Provide a label or marking in a visible location near the ground-fault indicator stating:
"WARNING – ELECTRIC SHOCK HAZARD – IF A GROUND VAULT IS INDICATED, THE NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED".
CEC 690.5 (C)
3. 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
4. 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 THE LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION."
CEC 690.17
5. 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

6. A label or marking shall be provided at the photovoltaic power source (typically at the inverter) indicating the following (CEC 690.53):
 - a. **Rated maximum power-point current**
 - b. **Rated maximum power-point voltage**
 - c. **Maximum system voltage**
 - d. **Short circuit current**
 - e. **Maximum rated output current of the charge controller (if installed) – (only applicable to battery systems)**

7. 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

8. A sign shall be provided at the main electrical service stating, **"THIS SERVICE ALSO SERVED BY A PHOTOVOLTAIC SYSTEM"** CEC 705.10 ...OR...

9. 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 sign of each other – with no fences or other barriers between). **CEC 690.56 (B)**

10. Identify the signage or labeling specifications. The following standards are recommended:
 - a. Red background with white lettering
 - b. 3/8" letter height
 - c. All capital letters
 - d. Arial or similar font
 - e. Weather resistant material (i.e. engraved plastic)

11. 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 place for clear visibility inside the electrical panel that states: "The main service breaker has been downsized to _____AMPS. No up-sizing is permitted."

12. 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 overcurrent devices feeding the panel board exceeds 100% of the bus rating.]

Typical Utility Department and AC Disconnect Requirements

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

14. 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 the utility purvey when they are the service provider.

Typical Structural Plan Check Comments

1. Provide an engineering analysis for wind and uplift, which is stamped and signed by a California Licensed Engineer, for the photovoltaic panel roof attachment method. . . **OR** . . . provide the racking system manufacturer's product **Engineering Certification** with an active California Licensed Engineer's stamp and signature. **R301.1.3**
2. **Provide additional information concerning the roof framing.** Show rafter sizes, rafter spacing, rafter spans (identify any purlins) and roof slope in the areas supporting the solar panels. Some roof framing members on older homes or accessory structures may NOT be designed to carry the additional load of the solar panels and supporting racking system. Supporting structural calculations and a design by a California Licensed Engineer may be required. **R301.1.3**
3. Show the method of attachment, spacing, anchor type, and depth of penetration of the solar panel racking system fastener(s) to the existing roof framing. Provide a typical section framing detail with dimensions and the product cut sheets and installation, typical. **R106.1.1**
4. **Criteria of solar projects that qualify for approval without supporting structural engineering design and calculations from a California Licensed Design Professional:**
 - a. Proposed racking system **California Engineering Certification** has been provided; AND
 - b. The weight of the new solar array is **less than 4 lbs. per square ft.** including the solar modules and racking system with related equipment; AND
 - c. The racking system standoff and supports are spaced **no more than 4 ft. on center;** AND
 - d. The roof anchors are an industry standard 5/16 inch bolt with a minimum 2 ½" penetration into the existing roof framing members or equivalent; AND
 - e. The solar array is installed on the rooftop of an existing dwelling or garage. No patios or similar structures are permitted; AND
 - f. This does not conflict from the racking manufacturer's installation specifications; AND
 - g. The existing roof framing members below the proposed solar array are in good service, materially sound, and **not considered substandard.**
5. 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**
6. 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%. **CBC3403.4 Exception**
7. 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.
8. Ground mount systems will require an engineered design prepared by a California licensed architect or civil engineer.
9. 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**

FIRE ACCESS/LIFE SAFETY

1. Roof access, pathways and spacing of the array shall be provided in accordance with **R331.4**
2. Residential structures shall be designed so that each photovoltaic array shall be no larger than 150 feet by 150 feet in either direction. **R331.4**
3. Residential buildings with hip roofs shall have the panels located in such a manner that provides a 3-foot wide clear access pathway from the eave to the ridge on each roof slope where the panels are located. The access pathway shall be located at a structurally strong location on the building being capable of supporting the live load of fire fighters accessing the roof. **(Not required on roofs with a slope of 2:12 or less.) R331.4.2.1**
4. Residential buildings with a single ridge shall have the panels located in such a manner that provides two 3-foot wide clear access pathways from the eave to the ridge on each roof slope where the panels are located. **(Not required on roofs with a slope of 2:12 or less.) R331.4.2.2.**
5. Residential buildings with roof hips and valleys shall have the panels located no closer than 18-inches to a hip or a valley where panels are placed on both sides of a hip or valley. Where panels are placed on only one side of a hip or valley that is of equal length, the panels shall be permitted to be placed directly adjacent to the hip or valley. **(Not required on roofs with a slope of 2:12 or less.) R331.4.2.3**
6. Residential buildings shall have the panels located no higher than 3-feet below the ridge. **R331.4.2.4**

SOLAR INSTALLATIONS & UNPERMITTED BUILDINGS, ADDITIONS, STRUCTURES & POOLS

Where solar installations are proposed, the equipment and supply shall be *only* to construction that has received an approved final inspection from the Building Department.

* Where equipment is proposed on unpermitted or expired structure, the structure in question must have building plans and all construction without permit (CWP) documentation submitted to the Building Department (and other applicable departments) for review and approval. Once the required permit(s) are obtained the required approved inspections through final will be obtained prior to the solar plan issuance.

* Where solar installations will supply power to unpermitted accessory structures, the accessory structures shall be required to move through the same process as above, OR remove all power and wire/conduit feed from the unpermitted structure and mark as "Not a part, permit required" on the site plan. Please be aware that depending on life safety concerns, Code Enforcement *may* be notified.

* Where a swimming pool has not received a final inspection, the swimming pool will be required to receive the required approved inspections through final, prior to solar permit issuance. Due to potential health risks a stagnant pool would pose, the swimming pool must be permitted and operational.