

RESIDENTIAL PHOTOVOLTAIC SUBMITTAL REQUIREMENTS

Chapter 1 Section 105.1 of the California Building Code requires any person engaged in the construction, alteration, expansion, repair, demolition or change of occupancy of a building/structure or its components (electrical, plumbing, mechanical systems) shall obtain appropriate permits. The following is provided in an effort to expedite the process of obtaining permits for the installation of Solar Photovoltaic Systems.

SUBMITTAL REQUIREMENTS

Plans are required for permits to install Photovoltaic Systems in compliance with the California Electrical Code as well as the California Building Code when structural review is required.

Provide 2-sets of plans which include the following documents:

1. **Site Plan:** Provide the site address, property owner's name and address, all property lines and setbacks dimensioned, and location of all existing and proposed structures. Site plans shall be drawn to a suitable scale and sufficient clarity. (*aerial or overhead photos are not acceptable*) For PV systems installed on the existing building's roof structure, the site plan may also serve as a roof plan if the footprint of the building, roof layout, roofing material, and the location of the arrays and all equipment are clearly shown. For ground mounted PV systems, show property lines and setback dimensions to the supporting structure. (*See attached Sample Site Plan*)
2. **Electrical Plan:** Provide an electrical one-line diagram showing the number of photovoltaic panels, number of strings, with voltage and kilowatt output, all disconnects, all combiners, all inverters with input and output ratings, the size of the main electrical panel bussing in amperes, the size of the main service disconnect, the size of the PV circuit breaker in amperes, size and type of all raceways and the size and type of all conductors.
Provide manufacturer's "cut" sheets for all modules and inverters that clearly specify all electrical information.
 - DC Roof Top Disconnects: There shall be a separate emergency DC disconnect on the roof to disconnect solar panels from DC wiring running through and on the building to the inverter. This disconnect must be permanently labeled in reflective, fade-resistant material that states: "Emergency DC Disconnect." This provides a safety mechanism for firefighting ensuring power has been disabled as close to the source as possible. Disconnects, provided in a NEMA 3R box, shall be installed as close to the array as possible to eliminate any substantial length of energized wiring that cannot be shut down. (FMC section 10-50605.11.1)
 - *Exception: Conductors in rigid or electrical metallic tubing (EMT)*
 - All micro-inverter systems will require a rooftop AC disconnect.
 - Electrical Load Calculations for the dwelling electrical panel is required when de-rating the main service breaker.

3. Structural Plans (if applicable see below):

- **Ground Mounted Structures:** Complete plans shall be required for all structures for ground mounted arrays, trellises, and patio covers. Provide the attachment of the panels to the roof for all roof mounted modules. If using pre-manufactured racking systems, provide the manufacturer's installation specifications.
- **Existing Roof Structures:** If the existing roofing material is tile or there is more than one layer of composition shingles, alterations may be required to the existing roof structure to support the additional loads imposed from the module system. Structural plans shall be provided that are of sufficient detail and scope to demonstrate the required load path to ground. (Roof framing plan, cross-sections, structural calculations and details as necessary). Structural design may require a licensed Architect or Engineer to prepare plans and calculations and properly certify in conformance with section 5537(b) of the California Business and Professions Code. (*see Building Industry Bulletin at the end of this document for structural analysis requirements*)

PERMIT REQUIREMENTS

1. A Solar Photovoltaic Permit shall be required for the installation of all PV systems. Permit fees are calculated per the revised fee schedule adopted January 3, 2012 as follows:
 - First 10 solar panels: \$114.47
 - Each additional 10 panels over 10: \$ 87.22
 - Standard Electrical fee: \$ 81.76
 - Residential Solar Plan Check fee: \$ 80.35*(may be subject to additional fees for complex structural review)*
2. An additional Electrical Permit may be required for additional electrical modifications to the existing electrical system. (example: service panel change/upgrade, etc.) Fees shall be calculated as itemized in the revised fee schedule for "stand-alone" electrical permits.
3. An additional Building Permit may be required if structural modifications to the existing roof structure are required to provide adequate support for the solar panels. (to be determined during plan check)
4. A separate Building Permit is required for installations on new structures such as trellises, patio covers, carports, ground mounted structures, etc. to support the PV System.

INSPECTIONS

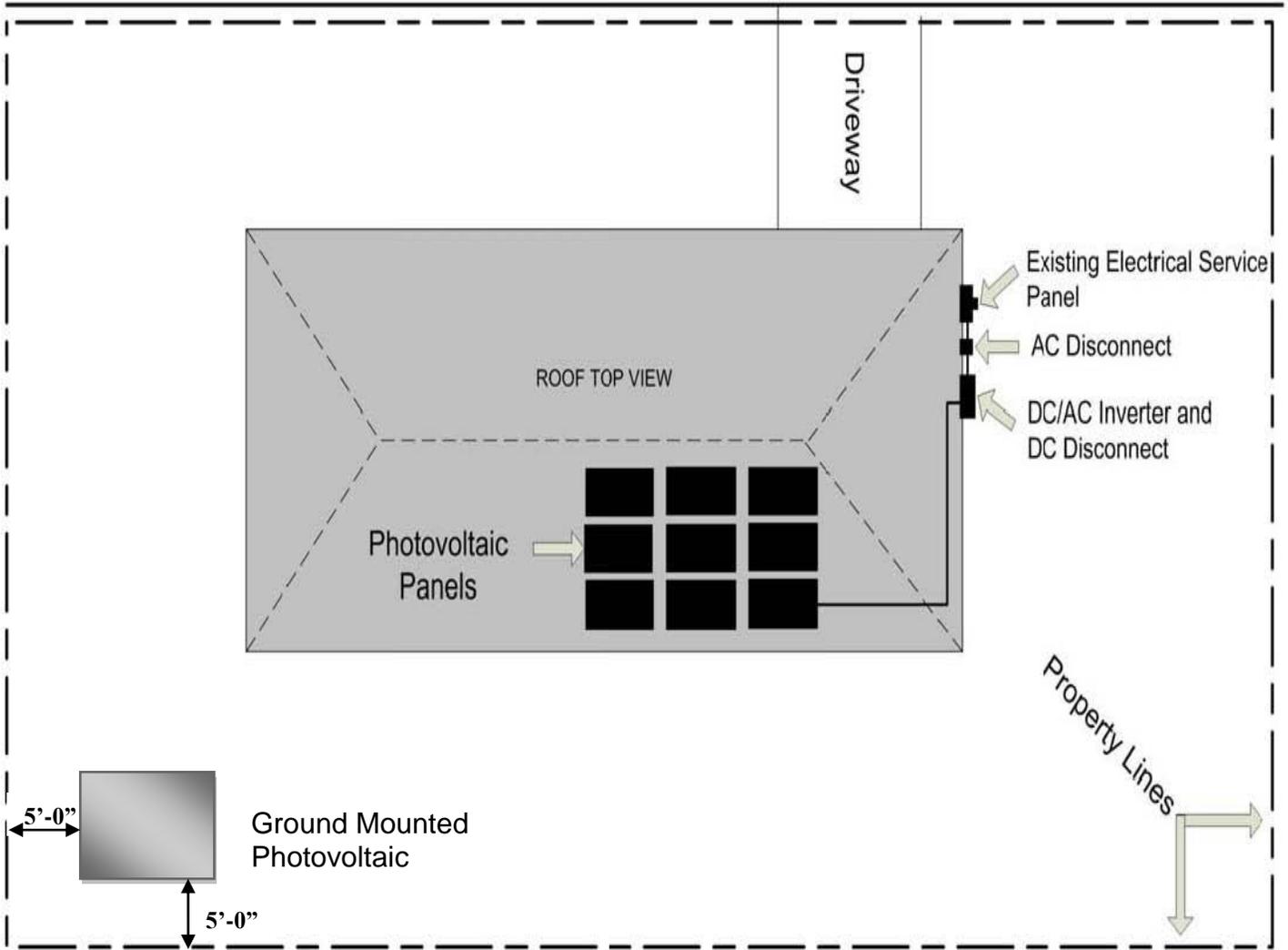
Required inspections may include:

- Electrical Underground
- Electrical Rough
- Electrical Final
- Structural-Foundation
- Structural-Rough Framing
- Structural-Final

WARNING LABELS

As required by Article 690 of the California Electrical Code, signage or labels shall be posted at all equipment locations which state the following information:

<p>“WARNING”</p> <p>ELECTRIC SHOCK HAZARD. THE DIRECT CURRENT CIRCUIT CONDUCTORS OF THIS PHOTOVOLTAIC POWER SYSTEM ARE UNGROUNDED BUT MAY BE ENERGERIZED WITH RESPECT TO GROUND DUE TO LEAKAGE PATHS AND/OR GROUND FAULTS.</p>	<p>“WARNING:”</p> <p><u>ELECTRIC SHOCK HAZARD</u></p> <p>DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGERIZED IN THE OPEN POSITION.</p>																								
<p>PHOTOVOLTAIC</p> <p>AC – DISCONNECT</p>	<p>PHOTOVOLTAIC</p> <p>“DC – DISCONNECT</p>	<p>CAUTION:</p> <p>SOLAR CIRCUIT</p>																							
<p>“WARNING”</p> <p><u>BIPOLAR PHOTOVOLTAIC ARRAY</u></p> <p>DISCONNECTION OF NEUTRAL OR GROUNDED CONDUCTORS MAY RESULT IN OVERVOLTAGE ON ARRAY OR INVERTER.</p>	<p>CAUTION:</p> <p>SOLAR ELECTRIC SYSTEM</p>	<p>“WARNING”</p> <p>DUAL POWER SUPPLY</p>																							
<p>AC</p> <p>PHOTOVOLTAIC DISCONNECT</p> <table border="0"><tbody><tr><td>Open-circuit Voltage</td><td>XXXX Vdc</td></tr><tr><td>Operating Voltage</td><td>XXXX Vdc</td></tr><tr><td>Maximum System Voltage</td><td>XXXX Vdc</td></tr><tr><td>Operating Current</td><td>XXXX Amps</td></tr><tr><td>Short Circuit Current</td><td>XXXX Amps</td></tr><tr><td>Maximum Power</td><td>XXXX Watts</td></tr></tbody></table>	Open-circuit Voltage	XXXX Vdc	Operating Voltage	XXXX Vdc	Maximum System Voltage	XXXX Vdc	Operating Current	XXXX Amps	Short Circuit Current	XXXX Amps	Maximum Power	XXXX Watts	<p>DC</p> <p>PHOTOVOLTAIC DISCONNECT</p> <table border="0"><tbody><tr><td>Open-circuit Voltage</td><td>XXXX Vdc</td></tr><tr><td>Operating Voltage</td><td>XXXX Vdc</td></tr><tr><td>Maximum System Voltage</td><td>XXXX Vdc</td></tr><tr><td>Operating Current</td><td>XXXX Amps</td></tr><tr><td>Short Circuit Current</td><td>XXXX Amps</td></tr><tr><td>Maximum Power</td><td>XXXX Watts</td></tr></tbody></table>	Open-circuit Voltage	XXXX Vdc	Operating Voltage	XXXX Vdc	Maximum System Voltage	XXXX Vdc	Operating Current	XXXX Amps	Short Circuit Current	XXXX Amps	Maximum Power	XXXX Watts
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SAMPLE SITE PLAN (additional plans are also required)

BUILDING AND SAFETY SERVICES DIVISION
2600 FRESNO STREET • THIRD FLOOR • ROOM 3043
FRESNO, CALIFORNIA 93721-3604
(559) 621-8082 • FAX (559) 498-4357
www.fresno.gov

JENNIFER K. CLARK
DEPARTMENT DIRECTOR

BUILDING INDUSTRY BULLETIN

EFFECTIVE DATE: *October 18, 2012*

REVISED: *August 12, 2015*

TO: *ARCHITECTS, ENGINEERS, SOLAR CONTRACTORS, and ASSOCIATIONS*

SUBJECT: STRUCTURAL DESIGN REQUIREMENTS FOR ROOFTOP SOLAR
PHOTOVOLTAIC SYSTEMS ON EXISTING STRUCTURES

BULLETIN NUMBER: **12-01**

FROM:



Brian T. Leong, C.B.O.
Building Official/Building and Safety Services Manager

BACKGROUND:

The purpose of this bulletin is to clarify the requirements of the California Building Code and to establish uniform standards related to the structural support of Solar Photovoltaic Systems on existing roof structures.

As indicated in Chapter 16 of the California Building Code, “all structures and parts thereof shall be designed and constructed to support safely the load combinations defined in the code without exceeding the appropriate strength limits for the materials of construction.” Upon review and consideration of various standards established by the Division of the State Architect, the Office of the State Fire Marshall, the Governor’s Office of Planning and Research, and other jurisdictions in the State, the City of Fresno shall establish the following policy for verification of the structural integrity of solar photovoltaic systems on existing structures.

POLICY:

1. In an effort to streamline the permitting process for roof mounted solar PV systems, structural calculations are not required if all of the following conditions are met:
 - Lightweight roof covering such as Composition with a maximum of 1-layer of roofing material.
 - Weight of the solar panels does not exceed four pounds per square foot (4 psf).
 - The maximum concentrated load imposed by the support device onto the roof structure is a maximum of 60 pounds.
 - For wood construction, the maximum spacing for the support devices shall be 48" on center, and shall be anchored to solid roof rafters or to solid blocking with the appropriate connection as recommended by the manufacturer.
 - The clear space between the roof and solar panels does not exceed 12 inches.

2. Structural Calculations: When structural calculations are required, calculations shall demonstrate that the structure will support the additional vertical and lateral loads from the solar panels and related equipment.
 - 2.1 Roof Dead Load: The weight of the solar PV system shall be considered in the design of the structure along with all other applicable dead load requirements of the Code.

 - 2.2 Roof Live Load: Live Load shall be considered in accordance with section 1607.12 of the California Building Code and section 4.2.1 of ASCE7-10. Live loads may be reduced in the area covered by the solar panels when such area is inaccessible as determined by the enforcing agency. (*clear space between the roof and solar panels is 12 inches or less*)
 - Live loads may be reduced to a minimum of twelve pounds per square foot (12 psf) in areas considered inaccessible. Roof surfaces not covered by solar panels shall be designed for the full live load requirements as set forth in Table 1607.1 of the California Building Code.
 - When the clear space between the roof and solar panels is in excess of 12 inches, live load requirements per Table 4.1 of ASCE7-10 shall be used.
 - 300 lbs. concentrated roof live load per CBC Table 1607.1 for commercial structures and CRC Table 301.6 for residential structures shall be considered.

 - 2.3 Pre-fabricated Roof Trusses: Combined Stress analysis for pre-engineered trusses shall be provided for the new loads imposed on existing trusses.

 - 2.4 Wind Design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist applied wind loads.

 - 2.5 Seismic Design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist earthquake loads.

3. For solar panels that are mounted on open grid framing, design the structural framing and components for:
 - 1) 10 psf uniform roof live load with no solar panel dead load
 - 2) 300 lbs. concentrated load with solar panel dead load