

# **City of Palm Springs**

## **Code Requirements for Solar Photovoltaic (PV) Systems**

### **Single-Family Dwellings**

#### **PURPOSE**

The purpose of this information bulletin is to clarify requirements of the State Building Standards Codes (Title 24) that pertain to solar PV installations. This bulletin can serve as a reference guide for permit applicants and enforcing agencies to clarify how state code requirements are practically applied in the local jurisdiction. It is intended to minimize permitting uncertainty and differing interpretation regarding specific code requirements for solar PV installations.

The implementation of uniform standards to achieve the timely and cost-effective installation is consistent with the California Solar Rights Act that views solar installation as a matter of statewide concern and prohibits local jurisdictions from adopting unreasonable barriers to the installation of solar energy systems (CA Government Code Section 65850.5).

#### **PART I: BUILDING AND RESIDENTIAL CODE REQUIREMENTS**

##### **1. Definitions**

###### **1.1 Solar photovoltaic (PV) system:**

The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load (CEC Article 690.2)

###### **1.2 Solar photovoltaic module:**

A complete, environmentally protected unit consisting of solar cells, optics, and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight (CEC Article 690.2)

###### **1.3 Solar photovoltaic (PV) panel:**

A collection of modules mechanically fastened together, wired, and designed to provide a field-installable unit (CEC Article 690.2)

###### **1.4 Building integrated photovoltaic (BIPV) system:**

Photovoltaic cells, devices, modules, or modular materials that are integrated into the outer surface or structure of a building and serve as the outer protective surface of the building (CEC Article 690.2)

##### **2. Structural Requirements**

###### **2.1 PV systems positively anchored to the building:**

**2.1.1 Exemption from structural calculations:** The building official may waive the requirement for structural calculations for solar PV installations on top of existing roofs if the official can readily determine that the additional weight of the new solar PV system on the roof does not affect the structural integrity of the building.

Here are some parameters to consider under such prescriptive approach:

- ❖ Maximum distributed weight of the solar PV system in pounds per square feet
- ❖ Maximum perpendicular distance between the solar PV system and the roof below
- ❖ Maximum concentrated load imposed by the PV panel support onto the building's roof
- ❖ Anchoring requirements such as type of fasteners, minimum fastener size, minimum embedment, and minimum number of attachment points
- ❖ Any limitation on the type of building construction

**2.1.2 Structural calculations:** When structural calculations are required, calculations shall demonstrate

that the primary structure will support the additional vertical and lateral loads from the panels and related equipment. Calculations will not be required where it is shown that the dead load of the installed system does not exceed 5 pounds per square feet.

2.1.2.1 Roof dead Load: The weight of solar PV systems shall be considered in the design of the structure. (CBC Section 1606, CRC Section R301.4)

2.1.2.2 Roof live load: The building official may allow the live load to be reduced in the area covered by each solar PV panel when such area is inaccessible as determined by the enforcing agency and as discussed in Section 2.1.2.1 of this information bulletin. Roof surfaces not covered by solar PV panels shall be designed for the roof live load. (CBC Section 1607, CRC R301.6)

2.1.2.3 Wind design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist wind loads. The design wind speed for Palm Springs is 95mph V3. (CBC Section 1609, CRC R301.2.1)

2.1.2.4 Seismic design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist earthquake loads. (CRC 301.2.2)

2.1.2.5 For wood construction, supports shall be attached with fasteners of sufficient length and size to achieve minimum required embedment into solid wood taking into consideration the plywood and multiple layers of roofing that may exist, unless otherwise approved by the enforcing agency. (CRC Section R301.1.3)

2.1.2.6 Requirements for load combinations: The applicable load combinations in CBC 1605 may be applied to all loading conditions, including evaluating the effects of dead load to counteract wind uplift. (CRC Section R301.1.3)

2.2 Structural strength of PV panels: The structural strength of solar PV panels is not addressed in the code. UL 1703, Third Edition, published March 15, 2002, requires that solar PV panels are tested to withstand a superimposed load of 30lb/ft<sup>2</sup>. Therefore, all solar PV panels that are listed per UL 1703 are considered to meet this requirement.

When used as a building component and depending on the load values that the solar PV panels are subjected to, the department will require a test report from an agency recognized by the enforcing agency showing the strength of the solar PV panels.

2.3 Condition of existing roof: Solar PV systems shall not be installed on an existing roof that is deteriorated to the point where it is not adequate as a base (this interpretation is based on CRC R907)

2.4 Pre-manufactured support systems: Pre-manufactured support systems must support the PV system and allow the system to stay attached to the structure when exposed to wind or seismic activity. Compliance of the PV support system with appropriate building codes is accomplished through a design specified by a licensed engineer or architect or through research reports from approved sources as defined in CBC Section 1703.4.2. Additional requirements may be imposed by the enforcing agency. (CRC Section R301.1.3)

### **3. Fire Safety Provisions**

#### **3.1 Fire/roof classification of photovoltaic (PV) panels**

3.1.1 Solar PV panels installed on top of a building's roof structure: Rooftop mounted panels shall be tested listed and identified with fire classifications in accordance with UL 1703. The fire classification shall be B for Type VA structures and C for VB. (CRC Section R902.4)

##### **3.1.1.2 Solar PV panels used as roofing on an independent (stand-alone) structure:**

Solar PV panels/modules that are designed to be on the roof, and span to structural supports, and have a use or occupancy underneath, shall comply with the minimum fire/roof classification requirements for roof covering as required by CRC Section R902. An example of this type of installation is a carport structure having solar PV panels as the roof.

##### **3.1.1.3 Solar PV panels installed as a part of a building's roof structure:**

Solar PV panels installed as integrated roofing material shall comply with the minimum fire/roof classification requirements for roof covering as required by the current CRC Section R902.3. An example of this type of installation is PV modules integrated into the roofing shingles (BIPV systems).

### 3.1.2 Solar PV systems installed on grade:

Solar PV panels that are part of a stand-alone, ground-mounted solar PV panel structure, with no use and no potential use underneath are generally considered equipment and therefore the fire/roof classification requirements would not apply. (Based on the definition of a roof assembly in CRC Section R202)

### 3.2 Area, height, and story limitations:

Where there is a use between the solar PV panels and the roof/grade underneath, adding such solar PV structures may constitute additional floor area, story, and/or height. Solar PV panels supported by framing that has sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency, are generally considered equipment. (CRC Section 1.1.3, definition of a roof assembly in CRC Section R202)

### 3.3 Location from property line and adjacent buildings:

Solar PV panels and associated framing, with no use and no potential use between the panels and the grade underneath, are generally treated as equipment; when not considered equipment, they may be considered a structure and shall be located and protected based upon the code required fire separation distance to property lines and adjacent buildings. (CRC Section R302.1)

3.4 Roof access points: Where roof slopes exceed 2:12, panels may not be located within 3 feet of a roof ridge or 18 inches of a hip or valley. (CRC Section R331.4)

## 4. Roof drainage:

Roof-mounted solar PV systems shall not cause excessive sagging of the roof that results in water ponding. They shall also not block or impede drainage flows to roof drains and scuppers. (CRC Section R903.4)

## 5. Roof penetrations:

All roof penetrations shall be sealed using approved methods and products to prevent water leakage. Such methods include but not limited to caulking, roof jacks, and sheet metal flashing. (CRC Section R903.2)

## 6. Skylights:

Solar PV panels shall maintain a minimum clearance around the perimeter of skylights as not to interfere with the function of the skylight. The minimum clearance of any panel to the perimeter of a skylight shall be equal to the height of the skylight above the roof deck. (CRC Section R303)

## 7. Plumbing vent, mechanical equipment, and mechanical exhaust terminations:

Solar PV panels shall not obstruct or interfere with the function of plumbing vents or mechanical equipment. (CPC Sections 901.1 & 906, CMC Section 304). In order to not be considered an obstruction, panels shall be located a minimum distance of two pipe diameters above any vent or exhaust discharge. However, in no case shall any panel be located above any exhaust for a Type 1 commercial hood.

## PART II: ELECTRICAL CODE REQUIREMENTS

### 1. Product listing (certification):

The solar PV panel/module and other equipment used in the PV system shall be listed/certified by a nationally recognized listing/certification agency in accordance with the applicable standards.

### 2. Installation:

The installation of the solar PV system must conform to the requirements of the California Electrical Code (CEC).

### **3. Signage:**

Signage must conform to the requirements of the (CEC). Signage requirements and location of certain equipment for solar PV systems may be subject to additional provisions adopted by the enforcing agency that may include requirements from the State Fire Marshal Solar Photovoltaic Installation Guideline (

### **4. Service:**

Electrical service must be energized prior to obtaining a final inspection for Solar PV systems.

## **PART III: PLANNING REQUIREMENTS**

1. **Painting of Conduits:** Electrical conduits and rack systems must blend in with the color of the existing surrounding structure. (93.03.00{3} PSMC).

2. **Inclination of the Panel Array.** Panel arrays shall be mounted to follow the profile of the existing roof. (93.03.00{3} PSMC). The Planning Department allows inclinations that do not strictly follow the slope of the roof as long as the maximum height of the panels does not exceed eighteen (18) inches above the roof surface. Reverse slope or inclination is prohibited.

# City of Palm Springs

## Solar Permit Submittal Requirements

### Roof Mounted Systems under 10kw

#### 1. Approval Requirements

The following permits are required to install a solar PV system under 10KW:

- a) Solar PV Permit
- b) Panel Upgrade permit (if applicable)

Planning approval is required for solar PV installations of this size.

Fire Department approval is not required for solar PV installations of this size.

#### 2. Submittal Requirements

- a) Completed permit application form. This permit application form can be downloaded at [www.Palmspringsca.gov](http://www.Palmspringsca.gov) .
- b) Three sets of complete plans:

An electrical plan shall be submitted that includes the following:

- ❖ Locations of main service or utility disconnect.
- ❖ Identify amperage of the existing or proposed service main.
- ❖ Identify if the main is center loaded or if the main disconnect is located at the top of the panel.
- ❖ Total number of modules, number of modules per string, and the total number of strings
- ❖ Make and model of inverter(s) and/or combiner box if used
- ❖ One-line diagram of system
- ❖ Specify grounding/bonding, conductor type and size, conduit type and size, and number of conductors in each section of conduit
- ❖ If batteries are to be installed, include them in the diagram and show their locations and venting
- ❖ Equipment cut sheets including inverters, modules, AC and DC disconnects, combiners, and wind generators
- ❖ Labeling of equipment as required by CEC, Sections 690 and 705
- ❖ Site diagram showing the arrangement of panels on the roof or ground, north arrow, lot dimensions, and the distance from property lines to adjacent buildings/structures (existing and proposed)

- c) Demonstrate compliance with structural requirements.

Structural support information for roof-mounted systems including the following shall include:

- ❖ Weight of panels, support locations, and method of attachment
- ❖ Where an approved racking system is used, provide documentation showing manufacturer of the rack system, maximum allowable weight the system can support, attachment method to the roof or ground, and product evaluation information or structural design for the rack system
- ❖ Structural load calculations only when the dead load for the system exceeds 5 pounds per square feet

- d) Complete City of Palm Springs PV Electrical Information Worksheet

- e) A separate permit is required for panel upgrades.

### 3. Plan Review

Permit applications can be submitted to Palm Springs Building Department in person at 3200 E. Tahquitz Canyon Way, Palm Springs, CA 92263

### 4. Fees

Plan Review and Permit Fees are charged according to the Comprehensive Fee Schedule.

### 5. Inspections

Once all permits to construct the solar installation have been issued and the system has been installed, it must be inspected before final approval is granted for the solar system. Inspections are performed Monday through Thursday and must be scheduled no later than the proceeding day. Inspections are received over the phone by automated means. Provide your permit number, job address and contact phone number. An inspector will contact you the morning of your requested inspection to identify an am or pm approximation of time.

Permit holders must be prepared to show conformance with all technical requirements in the field at the time of inspection. The inspector will verify that the installation is in conformance with applicable code requirements and with the approved plans. The approved plans and permit card must be on site and a ladder must be provided for roof access at the time of the inspection.

Below are common points of inspection with which the applicant should be prepared to show compliance:

- ❖ Number of PV modules and model number matches plans, and specification sheets number matches plans and specification sheets
- ❖ Array conductors and components are installed in a neat and workman-like manner.
- ❖ PV array is properly grounded
- ❖ Electrical boxes are accessible and connections are suitable for environment
- ❖ Array is fastened and sealed according to attachment detail
- ❖ Conductor ratings and sizes match plans
- ❖ Appropriate signs are properly constructed, installed, and displayed, including:
  - Sign identifying PV power source system attributes at DC disconnect
  - Sign identifying AC point of connection
  - Sign identifying switch for alternative power system
- ❖ Equipment ratings are consistent with application and installed signs on the installation, including:
  - Inverter has a rating as high as max voltage on PV power source sign
  - DC-side overcurrent circuit protection devices (OCPDs) are DC rated at least as high as max voltage on sign
  - Switches and OCPDs are installed according to the manufacturer's specifications (i.e. many 600VDC switches require passing through the switch poles twice in a specific way)
  - Inverter is rated for the site AC voltage supplied and shown on the AC point of connection sign
  - OCPD connected to the AC output of the inverter is rated at least 125% of maximum current on sign, and is no larger than the maximum OCPD on the inverter listing label
  - Sum of the main OCPD and the inverter OCPD is rated for not more than 120% of the bus bar rating
- ❖ System is energized. When the work includes a panel upgrade, that work must be completed and energized prior to a PV Solar final inspection

# City of Palm Springs PV Electrical Information Worksheet

**Property Address:** \_\_\_\_\_

**PV System Information** (Note: Provide input data from manufacturer's cut sheets. PV module and inverter manufacturer's cut sheet must be attached.)

**Module:** (Mfr and model#) \_\_\_\_\_ Total Modules: \_\_\_\_\_ No. of Modules in Series \_\_\_\_\_ No. of Strings \_\_\_\_\_

Max Module Watts (Pmax): \_\_\_\_\_ Watts Max. Voltage (Vmp): \_\_\_\_\_ Volts Max Current (Imp): \_\_\_\_\_ Amps

Open Circuit Voltage (Voc) \_\_\_\_\_ Short Circuit Current (Isc) \_\_\_\_\_ Max DC System Voltage (Vdc) \_\_\_\_\_

Max Series Fuse (OCPD) \_\_\_\_\_ Total Circuit Length (array to inverter) \_\_\_\_\_ Conductor Resistance Factor (Ω/kft) \_\_\_\_\_

Temperature Correction Factor \_\_\_\_\_ Conduit Fill Factor \_\_\_\_\_

Inverter: (Mfr and model#) \_\_\_\_\_ Max Dc Input Volts \_\_\_\_\_ Continuous Power (W) \_\_\_\_\_ Max AC Output \_\_\_\_\_

Point of Connection: Main Service OCPD: \_\_\_\_\_ Amps Bus Bar Rating: \_\_\_\_\_

Location of Main OCPD: (Center or at top or bottom of Service panel) \_\_\_\_\_

**(Note: Center Fed Panels may not take advantage of the 120% rule)**

**PV Array Calculations and Verification of Conductor Sizes**

**Rated DE Power of System** = (Module wattage) x (# of models in array) =  X  =

**Rated MPP Voltage** = (Vmp) x (# modules in series) =  X  =

**Rated MPP Current** = (Imp) x (# panel circuits) =  X  =

**Max DC System Voltage** =  
 (Voc) x (# modules in series) x (Temp correction) =  X  X  =

**Wire Size from Modules to Inverters (DC):**

**Maximum PV Circuit Current:**

**Source Currents** (Isc) x (125%)  X  =

**Output Circuit:** (Source circuit current) x (# parallel circuits)  X  =

**Conductor Ampacity & Overcurrent Rating:**

**Source Circuits:** (Max Circuit Current) x (125%)  X  =

**Output Circuit:** (Max circuit Current) x (125%)  X  =

**Derated Ampacity** (Conditions of Use Factors)

**Source Circuits** =

(Continuous current / (temp correction) x (Conduit fill)  / (  X  ) =

**Voltage Drop(%)** =

(Imp) x (Ω/kft) x (Total circuit length /1000) / Array Vmp (  X  X  ) /  =

**Minimum Conductor Size** (using CEC Table 310.16)

**AWG (Copper)**

X  =

**Overcurrent Device Rating:** (Max Circuit current) x (125%)

**Conductor Size from Inverter to Service Panel (AC):**

**Total AC Output of PV System** (Cannot exceed 10KW for expedited review) =

(Inverter AC output) X (Nominal Voltage)       amps X  volts =  Watts.

**Maximum Circuit Current** =

Max inverter Output / Nominal AC Voltage       $\frac{\text{input}}{\text{input}} = \text{input}$  Amps

**Conductor Ampacity & Overcurrent Device Rating:**

Inverter Output = (max circuit current) X (125%)       X  =  Amps Rounded up

**Minimum Conductor Size** (using CED Table 310.16)       AWG (Copper)

**Overcurrent Device Rating:**

(maximum circuit current) X (125%)       X  =  Amps

**AC Point of Connection to main Service Panel**

**Maximum Allowable OCPD**

(bus bar rating) X (100% or 120%)       X  =  Amps

**Maximum PV OCPD:**

(Max allowable OCPD) – (Main OCPD)       --  =

**Maximum Size Inverter:**

(Max PV OCPD) X (0.8)       X  =

**Grounding Electrode Conductor:**

(CEC Sec 690.47(c) (2) and 250.166)      DC  AWG      AC  AWG

**This worksheet must accompany the permit application and construction plans for submittal and review.**

**Acknowledgement:** Contractor acknowledges that they are responsible for the accuracy of the information and calculations, and that the PV system design, equipment selection, and sizing of conductors, conduits, and overcurrent protection devices are in compliance with all current applicable State and local codes.

Contractor: \_\_\_\_\_

Date: \_\_\_\_\_