



# CITY OF SEBASTOPOL

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BUILDING DEPARTMENT INFORMATIONAL HANDOUT

Handout  
Revised 3-2-16

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## INSTALLATION GUIDELINES for SOLAR PHOTOVOLTAIC SYSTEMS

Any PV system on new structures should be included in the overall valuation of the project and do not require separate permits but do need to comply with installation criteria in this policy and all local requirements. New PV installations on existing structures should comply with these installation criteria. Any system larger than 10 kW, any PV system incorporating battery storage or alternate energy source will require submittal for review by the Building Department. Residential structures are considered single and two-family dwellings and townhomes.

Residential roof mounted PV systems of up to 5 kW may be submitted for permit on an approved Standardized Permit Submittal Residential Photovoltaic Systems form.

Permit fees for residential systems are \$250.00, commercial systems are \$1500.00.

The access pathway requirements in section 2.2 are **mandatory** guidelines for design. They are based on minimum operational requirements for fire personnel safety. If reduced clearances are necessary for system operations or site constraints please contact the Fire Department for prior approval.

### **1.0 PHOTO VOLTAIC DESIGN AND REVIEW**

Solar photovoltaic power systems shall be installed in accordance with the California Building Code, Residential Code, California Fire Code and California Electric Code. All PV applications shall be reviewed at application for completeness. Every attempt will be made to review and approve projects that are residential PV systems of 5 kW or less "over-the-counter".

Larger PV systems (>5kW) may be required to be submitted for plan review.

All PV system plans shall be reviewed for:

1. Electrical wiring and configuration, including system disconnects.
2. Signage
3. Placement of equipment and modules with associated access and pathways.
4. Equipment type, listing, testing agency approvals, etc

### **1.1 SUBMITTAL REQUIREMENTS**

1. General information: Name of applicant, address of project, name of licensed contractor, size of system being installed. 3 complete sets of plans must be signed by the responsible party
2. Roof plan, drawn to scale, with the following information: North arrow; direction to street frontage; location of service lateral conductors, main electric meter and panel, DC disconnect, inverter, AC disconnect; roof slope, materials of roof covering, roof dimensions, location of array(s) and dimension of array(s); all skylights, roof ventilation openings, or other mechanical equipment on the roof; access location;

clearances around arrays for pathways and access; approximate location of conduit and where it turns to go down to electrical service panel.

3. Single line diagram of electrical equipment clearly showing: Size of main panel, sub panels, PV system equipment including: make, model and size of units, disconnects, associated electrical devices, the size, conduit size and type, and wire size and type.
4. Mounting information: Specify and detail mounting of modules to roof or other assembly.
5. Show actual proposed labels as required by code and policy. Note where to be located with approx. dimension of the label.
6. Plans must include a statement that the installation will comply with all applicable codes, the California Electrical Code specifically Article 690.

## **2.0 INSTALLATION CRITERIA**

### **2.1 PHOTOVOLTAIC DISCONNECT REQUIREMENTS**

1. A mechanism shall be provided to allow safe installation or servicing of portions of the PV array or the entire array. The system must be “disabled” to allow safe access to the photovoltaic system.
2. The photovoltaic disconnecting means shall be installed in a readily accessible location either on the outside of the building or structure or inside nearest the point of entrance of the system conductors.
3. Additional disconnect requirements for protection of emergency personnel:
  - a. Where it is *practical* a separate emergency disconnect on the roof to disconnect solar panels shall be provided for each array.
  - b. A main separate emergency disconnect shall be installed to disconnect from interior and exterior wiring running to inverter.
  - c. Each disconnect for an array portion shall state the maximum possible KW of power generated by that portion of the array.
  - d. All disconnects shall be accessible to fire department and located together when possible.
  - e. All electrical panel shut-offs shall be designed to shut off all power (Solar and Domestic) after the panel.

### **2.2 ACCESS REQUIREMENTS AND ARRAY CONFIGURATIONS**

1. Requirements relating to ridge, hip, and valleys do not apply to roof slopes of two units vertical in twelve units horizontal (2:12) or less
2. Residential structures shall be designed so that each array is no greater than 150 feet (45 720mm) by 150 feet (47 720mm) in either axis.
3. The Fire Official may allow panels/modules to be located up to the ridge when an alternative ventilation method acceptable to the Fire Official has been provided or where the Fire Official has been provided or where the Fire Official has determined vertical ventilation techniques will not be employed.

**Smoke Ventilation** Panels/modules shall be located no higher than 3 feet (914mm) below the ridge in order to allow for fire department smoke ventilation operations.

**Roof Access Points** Roof access points shall be defined as an area that does not place ground ladders over openings such as windows or doors, and are located at strong points of the building construction in locations where the access point does not conflict with overhead obstructions such as tree limbs, wires, or signs.

Roof access, pathways, and spacing requirements shall be provided in order to ensure access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation operations, and to provide emergency egress from the roof.

All arrays shall be mounted per the listing installation instructions of the system. Pathways should be established in the design of the solar installation and clearly indicated on the plans. Any modifications to access pathways require approval of the Fire Official. Arrays should be located in a manner that provides access pathways for the following conditions:

1) **Residential Buildings with hip roof layouts.**

Modules should be located in a manner that provides one three-foot clear access pathway from the eave to the ridge on each roof slope where modules are located. The access pathway should be located at a structurally strong location on the building (such as a bearing wall).

2) **Residential Buildings with a single ridge (Gable Roof).** Modules shall be located in a manner that provides two three-foot (3') wide access pathways from the eave to the ridge on each roof slope where arrays are located.

3) **Hips and Valleys:** Modules should be located no closer than 18 inches to a hip or valley if modules are to be placed on both sides of a hip or valley. If the modules are to be located on only one side of a hip or valley that is of equal length then the modules may be placed directly adjacent to the hip or valley. Designation of ridge, hip, and valley does not apply to roofs with 2 in 12 or less pitch. Arrays should be located no higher than three feet (3') below the ridge.

4) **Commercial Buildings and Residential Housing comprised of (3) or more units**  
**Exception:** When the jurisdiction determines that the roof configuration is similar to residential (such as in the case of townhouses, condominiums or single family dwellings) the residential requirements may be applied.

**ACCESS:** There should be a minimum four (4) foot wide clear perimeter around the edges of the roof.

Pathways should be established in the design of solar installation. Pathways must meet the following requirements:

- a. Shall be over structural members.
- b. Centerline axis pathways shall be provided in both axis of the roof. Centerline axis pathways shall run on structural members or over the next closest structural member nearest to the centerline of the roof.
- c. Shall be straight line not less than 4 feet clear to skylights and/or ventilation hatches.
- d. Shall be straight line not less than 4 feet clear to roof standpipes.
- e. Shall provide not less than 4 feet clear around roof access hatch with at least one not less than 4 feet clear pathway to parapet or roof edge.

**Locations of DC conductors.** Conduit, wiring systems, and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways, between

arrays. DC wiring shall be run in metallic conduit or raceways when located within enclosed spaces in a building. Inside a building or structure PV conductors should be routed along building structural members.

**Beneath Roofs.** Wiring methods shall not be installed within 10 inches of the roof decking for sheathing except where directly below the roof surface covered to the roof penetration point to support a minimum 10 inches below the roof decking.

**Flexible Wiring Methods.** Where flexible metal conduit (FMC) smaller than trade size ¾ or type MC cable smaller than 1 inch diameter containing PV power conductors is installed across ceiling or floor joists, the raceway or cable shall be protected by substantial guard strips that are at least as high as the raceway or cable. When run exposed, other than within 6 feet of their connection to equipment, these wiring methods shall closely follow the building surface or be protected from physical damage by an approved system.

**4. Marking and Labeling Methods and Locations.** The labels or markings shall be visible after installation. Photovoltaic power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings or floors. Spacing between labels or markings, shall not be more than 10 feet within 1 foot (305 mm) of all turns or bends and with 1 foot (305mm) above and below all penetrations of roof/ceiling assemblies and all walls and/or barriers. Labels required by this section shall be suitable for the environment where they are installed.

#### 5) **NON-HABITABLE STRUCTURES**

Non-habitable structures are not subject to the requirements in this section. Examples of non-habitable structures include, but are not limited to parking shade structures, solar trellises, etc.

### **2.3 SIGNAGE REQUIREMENTS FOR PV SYSTEMS**

Permanently affixed labels shall have a red background with white lettering. Printed material shall be resistant to fading per UL 969. Use UL 969 as standard to weather rating (UL listing of markings is not required).

1. **Exterior/Interior Conduit signage:** The label shall state, "CAUTION: SOLAR SYSTEM CIRCUIT"

**CAUTION: SOLAR SYSTEM CIRCUIT**

- a. Required shut off marking is required on all interior and exterior DC conduit, raceways, enclosures, cable assemblies, and junction boxes to alert the fire service to avoid cutting them.
- b. Marking shall be placed every 10 feet, at turns and above and/or below penetrations and at all DC combiner and junction boxes.
- c. Vertical conduits shall be provided with a minimum of one label to be affixed 66" above clear standing surface.
- d. Exterior/Interior Conduit signage shall be:
  - i. Red background with white lettering.

- ii. Reflective, weather resistant printed material shall be resistant to fading per UL 969.
  - iii. Letters shall be “Arial” font or similar, non- bold, a minimum of 3/8” height lettering, and in all capital letters.
2. **Exterior/interior of Electrical Panel signage:** Exterior/Interior of Electrical Panel signage: Signs are required on all interior and exterior overcurrent devices (electrical panels, etc.)
- a. A permanent placard with fade resistant material per UL 969 shall be installed on exterior and interior of main electrical panel stating: “CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED”.

**CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED**

- b. Exterior/Interior overcurrent device signage shall be:
  - i. Red background with white lettering.
  - ii. Of durable non fading weather resistant material attached or adhered to panel or directly adjacent to the panel.
  - iii. Letters shall be “Arial” font or similar, non- bold, a minimum of 3/8” height lettering, and be all capital letters.
  - iv. Where all terminals of the disconnecting means may be energized in the open position, a warning sign shall be posted mounted on or adjacent to the disconnecting means.

**WARNING  
ELECTRICAL SHOCK HAZARD.  
DO NOT TOUCH TERMINALS. TERMINALS  
ON BOTH THE LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION.**

- c. Direct Current Photovoltaic Power Source labeled as follows at an accessible location at the disconnecting means:
  - i. Operating Current
  - ii. Operating Voltage
  - iii. Maximum System Voltage
  - iv. Short-circuit current

3. **Roof top signage:** All roof top disconnects to be easily identified by a vertical indicator at least 60” in height.

4. **Microinverter Systems:** Require a label on the exterior of the Main Electrical Service panel stating:

**“Microinverter System Solar Disconnect located inside panel is PV System Disconnect”**

**Ground mounted photovoltaic arrays.** Ground mounted photovoltaic arrays shall comply with all applicable provisions of the California Codes. Setback requirements do not apply to ground mounted, freestanding photovoltaic arrays. A clear brush area of 10 feet (3048 mm) is required for ground mounted photovoltaic arrays.

### **3.0 PROTECTION OF EMERGENCY RESPONDERS**

The following conditions shall be verified and apply to all roof and ground mount Solar PV systems:

1. All sharp edges and fastener tips shall be covered or crimped over as to not provide a sharp edge where emergency responders or any other individual accessing the roof top may be injured.
2. All roof surface mounted conduits, pipes, braces, etc crossing the pathways are to be clearly identified by a red/white reflective tape or other fire department approved identifying material. Any item higher than 18" must have steps up and down on either side.

#### **4.0 FEES**

The residential roof mounted solar system fee is **\$75.00** collected at the time of permit issuance.

Commercial systems fees are based on the size of the system. Systems 30 kilowatts or less are **\$500** minimum fee. Systems over 30kW are based on a plan review/inspection hourly rate.

#### **APPLICABLE CODES**

Note: this is partial list of the applicable codes

##### **2013 California Building Code**

Chapter 1 Administration  
Chapter 15 Roof Assemblies  
Chapter 16 Structural Design  
Chapter 23 Wood

##### **2013 California Residential Code**

Chapter 1 Administration Division II  
Chapter 3 Building/Planning  
Chapter 8 Roof Assemblies  
Part VIII Electrical

##### **2013 California Fire Code**

Chapter 1 Administration  
Section 605 Electrical Equipment, Wiring and Hazards  
Section 605.11 Solar Photovoltaic Power Systems  
Section 608 Stationary Storage Battery Systems

##### **2013 California Electrical Code**

Article 89 California General Code Provisions  
Article 90 Introduction  
Article 100 Definitions  
Article 110 Requirements for Electrical Installations  
Article 200 Use and Identification of Grounded Conductors  
Article 210 Branch Circuits  
Article 240 Overcurrent Protection  
Article 250 Grounding and Bonding

Article 300	Wiring Methods
Article 310	Conductors for General Wiring
Article 338	Service-Entrance Cable Types SE and USE
Article 408	Switchboards and Panel boards
Article 445	Generators
Article 480	Storage Batteries
Article 490	Equipment over 600 Volts, Nominal
Article 690	Solar Photovoltaic Systems
Article 692	Fuel Cell Systems
Article 705	Interconnected Electric Power Production Sources
Article 720	Circuits and Equipment Operating at Less Than 50 Volts