

# Ballasted Photovoltaic System on Flat-Roof, Low-Rise Building

To obtain a building permit for a ballasted photovoltaic system installed on flat-roof, low-rise building, you must submit plans for review by the Building Division. The checklist below outlines the content of documents required for the plan review process. This checklist is only a general guide; the Building Division may require additional information or supporting documents based upon the specific project and installation. Contact Building Division staff at 408-535-3555 if you have questions about your plan submittal.

## REFERENCES

- 2019 California Building Code (CBC)
- 2019 California Existing Building Code (CEBC)
- 2019 California Electrical Code (CEC)

## GENERAL INSTRUCTIONS FOR PLANS

- The plans must be prepared by a registered engineer.
- Submit 4 sets of all plans; minimum legible sheet size: 11" X 17"
- Put plans, as applicable to your project, in the order shown below.
- Plans may be combined on the same sheet for simpler projects if clarity is maintained.

<b>BUILDING PLANS</b>	<b>ELECTRICAL PLANS</b>
<ul style="list-style-type: none"> <li>▪ Title Sheet with project information - see B2 and B4</li> <li>▪ Roof Plan - see B3</li> <li>▪ Roof Framing Information - see B4</li> <li>▪ Site Plan with Electrical Components and Equipment</li> <li>▪ Floor Plan - see B9</li> <li>▪ Ballasted PV System Plan - see B8</li> <li>▪ 1/4"-Scale Drawing of Large Equipment Areas</li> </ul>	<ul style="list-style-type: none"> <li>▪ Title Sheet with Electrical Scope of Work - see E1</li> <li>▪ Electrical work as it relates to Site Plan - see E2</li> <li>▪ Electrical work as it relates to Roof Plan - see E3</li> <li>▪ Single Line Diagram - see E4</li> <li>▪ Electrical requirements on the 1/4"-Scale Drawing of Large Equipment Areas - see E5</li> <li>▪ Manufacturer Specification Sheets - see E1</li> </ul>

## INFORMATION TO INCLUDE ON THE PLANS

<b>BUILDING PLANS</b>	
B1.	Photovoltaic system design construction documentation (all plan sheets) must be designed, signed, sealed, and dated by the responsible registered design professional in charge. CBC §107.1 & Business and Professions Code 5536.1 & 5537
B2.	Cover or title sheet must show: CBC §107.2.1
	a. All applicable codes and local ordinances.
	b. Building roof area and building height.
	c. Occupancy group per CBC Chapter 3.
	d. Type of construction per CBC Chapter 6.
	e. The existence and/or requirement of automatic fire sprinkler system.
B3.	Roof plan must show:
	a. Dimensioned locations of all arrays, modules, and supporting equipment.
	b. Location of parapet walls, if any.
	c. Location of interior roof transitions or boundaries (e.g., stepped roof plane), if any.
	d. Location of all roof features and structures (equipment, vents, screens, skylights, etc.) with dimensions.
	e. All access and pathways, with dimensions, that comply with CBC §3111.2.
	f. Placement of the placard per San Jose PCN#30. <a href="https://www.sanjoseca.gov/Home/ShowDocument?id=54885">https://www.sanjoseca.gov/Home/ShowDocument?id=54885</a>
	g. Coordination with Fire Prevention Bureau on fire code requirements. <a href="https://www.sanjoseca.gov/Home/ShowDocument?id=9235">https://www.sanjoseca.gov/Home/ShowDocument?id=9235</a>

<b>B4. Existing building compliance verification:</b>	
a.	Provide roof framing information:
i.	Plan that depicts existing roof framing layout, member size, spacing, and grade/material specification.
ii.	Roof assembly detail including insulation and finishing material.
iii.	If any built up roof structure exists, indicate location and construction information (i.e. crickets).
b.	Show overlay of PV arrays and modules on the existing roof framing plan
c.	Demonstrate adequacy of gravity elements. Any existing gravity-carrying structural member/element must be strengthened, supplemented, replaced, or repaired when gravity load increased more than 5%. Provide justification calculations to comply with CEBC § 503.3. Roof live load where PV system occurs, must be in accordance with CBC §1607.13.5. Calculation to include consideration for deflection and ponding per CBC §1604.3.6 and 1611.
d.	Demonstrate adequacy of the existing lateral load resisting system. Lateral load carrying structural elements may remain unaltered when demand-capacity ratio with the alteration considered is no greater than 10% compared to its demand-capacity ratio of the existing building. Provide lateral load analysis, both seismic and wind, to justify compliance with CEBC § 503.4.
e.	On plan cover sheet, the registered engineer in charge must provide a summary of analyses in a statement that includes:
i.	Seismic design data (CBC §1603.1.5)
ii.	Wind design data (CBC §1603.1.4)
iii.	Roof live load (CBC §1603.1.2, §1607.13.5)
iv.	Dead load of PV panel system (panel + rack), psf (CBC §1603.1.8.1)
v.	Whether or not the existing building requires any alteration to accommodate new added PV system.
<b>B5. Include manufacturer specifications and listing on the plan:</b>	
a.	Show specifications for PV modules or panels and rack system; include installation instructions (CBC §1510.7).
b.	Show the listing documentation to demonstrate compliance with ANSI/UL 1703 “Flat-Plate Photovoltaic Modules and Panels” for fire classification (Class A, B or C) based on building type of construction, per CBC Table 1505.9. Example of approval document could be Certificate of Compliance issued by UL. (CBC §1505.9, §1510.7)
<b>B6. Seismic and wind designs for the ballasted photovoltaic system:</b>	
a.	Provide seismic design.*
b.	Provide wind design.*
* See also San José PCN#30 at <a href="https://www.sanjoseca.gov/Home/ShowDocument?id=54885">https://www.sanjoseca.gov/Home/ShowDocument?id=54885</a> . Note: All tests must be performed by an approved testing agency. The test report must be validated by a recognized agency such as ICC-ES, iAS, LARR, etc. If peer review is conducted by owner, the peer reviewer must be qualified and meet requirements described in PV2-2012.	
<b>B7. Friction test report</b>	
a.	When friction test report is provided, the tests must conform to ASTM G115 and conducted by an approved testing agency. CBC §104.11.2
<b>B8. Ballasted PV System plan must include, at minimum, the following information:</b>	
a.	Indicate the dead load, psf, of the PV system, including modules and racks
b.	Method (specify applied references and code sections) used for both seismic and wind design.
c.	Minimum separation distances for all conditions.
d.	Roof finish material and friction coefficient used in calculations.
e.	Depict enlarged plan for each array, which consists a series of modules.
f.	Depict ballast block layout that show quantity and weight of blocks
g.	If additional positive anchorage or attachment is required, affix anchorage device manufacture specifications and its fasteners. Clearly identify exact locations as occur and provide installation details including existing roof assembly.
h.	Placard and boundary markings per PRN #30: <a href="https://www.sanjoseca.gov/Home/ShowDocument?id=54885">https://www.sanjoseca.gov/Home/ShowDocument?id=54885</a>
<b>B9. Energy storage system:</b>	
a.	If proposing energy storage system equipment (e.g., batteries), show location on floor plan. State weight and dimensions of batteries and/or cabinets. Provide structural support for equipment. <a href="http://www.sanjoseca.gov/documentcenter/view/5049">http://www.sanjoseca.gov/documentcenter/view/5049</a>
b.	Coordinate with <a href="#">Fire Prevention Bureau</a> for Hazardous Material review.

**ELECTRICAL PLANS**

<b>E1. Scope and Specifications:</b>	
a.	Cover Sheet must include Electrical Scope of Work
b.	Include manufacturer specification sheets for equipment used for the PV system in the electrical plan set.
<b>E2. Site Plan must show the following equipment and related features:</b>	
a.	Conduit runs with conductor call outs, inverters, disconnects, panel boards, distribution equipment, and structures such as carports.
b.	Equipment installed in areas that are subject to physical damage must show the protection on the plans.
c.	All working clearances must be maintained; compliance must be shown on the plans.
<b>E3. Roof Plan must show the following equipment and related features:</b>	
a.	All arrays, conduit runs with conductor call outs, inverters, disconnects, panel boards, and distribution equipment.
a.	Minimum setbacks and aisle ways to maintain fire fighter access.
b.	Equipment installed in areas that are subject to physical damage must show the protection on the plans.
c.	All working clearances must be maintained; compliance must be shown on the plans.
d.	Method for compliance with the rapid shut down requirements as stated in 690.12.
<b>E4. Provide a Single Line Diagram that shows the complete PV system, including:</b>	
a.	PV source circuits, PV output circuits, Inverter output circuits and Power Production Source Conductors.
b.	All calculations for circuits, including adjustment factors
c.	Locations to which circuits travel; both inside and outside the building must be identified; for example, the height of the raceway on the roof must be shown.
<b>E5. Provide a 1/4"-scale drawing for Large Equipment Areas and Electrical Rooms:</b>	
a.	Show how the minimum requirements of CEC §110.26 are met
<b>E6. Only for projects where new electrical service is installed:</b>	
a.	Provide a PG&E Available Fault Current (AFC) Letter
b.	Identify the new services Short Circuit Current Rating (SCCR) on the plans of installed equipment.
c.	Show AFC/SCCR at each piece of equipment shown on the one-line.
<b>E7. Only for projects using a <u>supply</u> side connection for the Power Production Source Conductors (PPSCs). The following must be met and installed in accordance with CEC §705.12(A):</b>	
a.	Raceway for PPSCs must terminate in the same vertical section of the service ahead of the Main Disconnect. PPSCs must not be run with Load Side conductors.
b.	The Line Side connection of new PPSCs at the electrical service must either:
i.	Have a letter from the manufacturer stating that the connection does Not Void the Listing; OR
ii.	Equipment must be evaluated by a City of San José-approved third party.
c.	PPSCs must be run in Ridged or IMC conduit and installed in accordance with section CEC 250.90 & 250.92 to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.
d.	Ampacity of PPSCs must be equal to or greater than the rating of the Overcurrent Protection Device at the disconnecting means.
e.	The disconnect for PPSCs must be suitable for use "As Service Equipment." Disconnecting means and O.C.P.D. are to be installed no further than 10' from the point of the line side connection. CEC 705.31.
f.	A Grounded Conductor (neutral) and a Ground Electrode Conductor must be run with the ungrounded conductors to the disconnecting means. No main bonding jumper is permitted at this disconnect.
<b>E8. Only for projects using a <u>load</u> side connection for the Power Production Source Conductors (PPSCs). The following items must be met and installed in accordance with CEC §705.12(B).</b>	
a.	Breakers used for the point of connection must be on the opposite end of the buss bar when the total ampacity of both the PV breaker and the breaker feeding the panel or service exceeds 100% of the buss bar rating. All downstream breakers must be suitable for back feed. Both breakers cannot exceed 120% of the buss bar rating.
b.	When the inverter output circuit connection is made on a feeder between its breaker and the panel it feeds:
i.	The feeder ampacity cannot be less than the feeder overcurrent device and the rating of the inverter output overcurrent device (both breakers cannot exceed 100% of the feeders current carrying capacity).
ii.	An overcurrent device on the load side of the inverter output overcurrent device must be installed and rated not greater than the ampacity of the feeder.

E9. Equipment grounding and bonding must comply with CEC 690.43 and meet the following requirements:	
	a. An equipment grounding conductor between a PV array and other equipment is required.
	b. Exposed non-current-carrying metal parts of PV module frames, electrical equipment, and conductor enclosures must be grounded.
	c. Devices listed and identified for grounding the metallic frames of PV modules or other equipment must be permitted to bond the exposed metal surfaces or other equipment to mounting structures.
E10. Rapid Shutdown for PV Systems on buildings must:	
	a. Comply with CEC 690.12 and be labeled in accordance with 690.56 (B) and(C).
	b. Methods used to show compliance must be identified on the plans.
E11. Integrated Battery Backup Systems that are installed with PV systems:	
	a. Must meet the requirements of CEC 690.71.
E12. Seismic requirements	
	a. Electrical connections to ballasted arrays must be installed with flexibility to allow for seismic movement; provide a detail showing this connection.
	b. The PV Designer must contact CSJ structural reviewer for any other code restrictions that may be affected for electrical equipment that is installed within the ballasted areas.