

Building and Safety Division
Policy and Procedure No. A093015

Effective Date January 1, 2023



CITY of CALABASAS

Expedited Permitting Process
Residential Roof-Top Mounted Solar Installations

Form 5 – Solar PV Standard Plan – Simplified Central/String Inverter Systems

SCOPE: Use this plan ONLY for electrical review of utility central/string inverter systems not exceeding a system AC inverter output rating of 10kW on the roof of a one- or two-family dwelling or accessory building. The specific structural and fire requirements are covered in other parts of the California Solar Permitting Guidebook. This covers photovoltaic system interconnected to the load side of a single-phase AC service panel of nominal 120/240Vac with a bus bar rating of 225A or less. Plan also applies to supply side connections (between the meter and the service disconnects), where permitted by the local utility. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers, trackers, more than two inverters, or strings combined. Systems must be in compliance with current California Building Standards Codes and local amendments of the authority having jurisdiction (AHJ). Other Articles of the California Electrical Code (CEC) shall apply as specified in 690.4. For systems beyond this scope or the criteria in this plan, consult the AHJ for details regarding comprehensive process.

MANUFACTURER'S SPECIFICATION SHEETS MUST BE PROVIDED for proposed inverters, modules, combiner/junction boxes, racking systems, and rapid shutdown system or equipment. Installation instructions for bonding and grounding equipment and rapid shutdown systems shall be provided, and local AHJs may require additional details. Listed and labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling (CEC 110.3). Equipment intended for use with PV system shall be listed for the PV application (CEC 690.4[B]).

Job Site Address: _____ Email: _____

Contractor/Engineer Name: _____ License # and Class: _____

Signature: _____ Date: _____ Phone Number: _____

Total # of Inverters installed: _____ (If more than one inverter, complete and attach the "Supplemental Calculation Sheets" and the "Load Center Calculations" if a new load center is to be used.)

Inverter 1 AC Output Power Rating: _____ Watts

Inverter 2 AC Output Power Rating (if applicable): _____ Watts

Combined Inverter Output Power Rating: _____ ≤ 10,000 Watts

Ambient Temperature Adjustment Factors: select the box for the expected lowest ambient temperature (T_L) with the corresponding Ambient Temperature Correction Factor (C_F):

1) If T_L is between 4°C and 0°C, $C_F = 1.10$ Average

ambient high temperature (T_H) ≤ 37° C

Note: For a lower T_L or a higher T_H , this plan is not applicable.

For raceways/cables exposed to direct sunlight or installed within 7/8" of the roof, apply an additional 33 °C (60 °F) and update correction per CEC310.15(B)(2).

DC Information:

Module Manufacturer: _____ Model: _____

2) Module V_{OC} (from module nameplate): _____ Volts

3) Module I_{SC} (from module nameplate): _____ Amps

Is Module I_{SC} less than 13 Amps? Yes No (If No, this plan is not applicable.)

4) Module DC output power under standard test conditions (STC) = _____ Watts (STC)

10) Inverter DC Disconnect

Does the inverter have an integrated DC disconnect? Yes No If Yes, skip to Step 11.
 If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)

11) Inverter Information

Manufacturer: _____ Model: _____
 Max. Continuous AC Output Current Rating: _____ Amps
 Max. Short Circuit Current Per Input: _____ Amps
 Does PV Module I_{sc} (Step 3) exceed value above? Yes No (If No, this plan is not applicable.)
 Integrated DC Arc-Fault Circuit Protection? Yes No (If No is selected, this plan is not applicable.)
 Grounded or Underground System? Grounded Ungrounded

AC Information:

12) Sizing Inverter Output Circuit Conductors and OCPD

Inverter Output OCPD rating = _____ Amps (Table 3)
 Inverter Output Circuit Conductor Size = _____ AWG (Table 3)

| Table 3. Minimum Inverter Output OCPD and Circuit Conductor Size | | | | | | | | | |
|--|----|----|----|----|----|----|----|----|----|
| Inverter Continuous Output Current Rating (Amps) (Step 11) | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 48 |
| Minimum OCPD Size (Amps) | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 60 |
| Minimum Conductor Size (AWG, 75°C, Copper) | 14 | 12 | 10 | 10 | 8 | 8 | 8 | 6 | 6 |

13) Point of Connection to Utility – Inverter(s) must be connected to either load or supply side of service disconnecting means. Only one of the sub-sections below and either Single Line Diagram #1 or Single Line Diagram #2 should be filled out.

Only use this section for connections on the load side of the service disconnecting means.

Is the PV OCPD positioned at the opposite end from input feeder location or main OCPD location?

Yes No

Load side connections (Per 705.12(B)(3)(2)):

(Combined inverter output OCPD size + Main OCPD size) ≤ [bus bar size × (120%)]

| Table 4. Maximum Combined Supply OCPDs Based on Bus Bar Rating (Amps) per CEC 705.12(B)(3)(2) | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Bus Bar Rating (Amps) | 100 | 125 | 125 | 200 | 200 | 200 | 225 | 225 | 225 |
| Main OCPD (Amps) | 100 | 100 | 125 | 150 | 175 | 200 | 175 | 200 | 225 |
| Max Combined PV System OCPD(s) at 120% of Bus Bar Rating | 20 | 50 | 25 | 60* | 60* | 40 | 60* | 60* | 45 |

*This value has been lowered to 60 A from the calculated value to reflect 10 kW AC size maximum.

Reduction of the main breaker is not permitted with this plan. Interconnection to center-fed panelboards may be permitted per Informational Bulletin.¹

Only use this section for connections on the supply side of the service disconnecting means (between the utility meter and the service disconnecting means). Select one:

Utility- and AHJ-approved meter socket adapter.

Adapter name/model: _____

Service equipment listed for the purpose of PV interconnection.

Description / model number(s): _____

¹ See Page 8, Part 1 of California Solar Permitting Guidebook for guidance. See CA BSC’s Information Bulletin 16-03.

14) Rapid Shutdown

The rapid shutdown initiation device shall be labeled according to CEC 690.56(C), and its location shall be shown on the site plan drawing. The rapid shutdown initiation device may be the inverter output or input circuits' disconnecting means, the service main disconnect, or a separate device as approved by the AHJ. The disconnecting means shall be identified for the purpose, suitable for their environment, and listed as a disconnecting means. A single rapid shutdown initiation device shall operate all disconnecting means necessary to control conductors in compliance with CEC 690.12.

Note: Check with the AHJ regarding approval where field verification of reduction of voltage within the time required by CEC 690.12 is performed.

Rapid shutdown shall be provided as required by CEC 690.12 with one of the following methods (Select one):

- The inverter(s) is within 10 feet of the array, and the location of the inverter is such that uncontrolled PV system conductors are no greater than 5 feet of length within the building. A remotely-controlled AC disconnecting means is required immediately adjacent to or as close as practicable to the inverters, and located within 10 feet of the array.
- The inverter(s) is within 10 feet of the array, and the location of the inverter is such that uncontrolled PV system conductors are no greater than 5 feet of length within the building. Reduction of the voltage for the inverter output within the time required by CEC 690.12 shall be verified in the field, or the inverter output is listed to UL 1741 with rapid shutdown capability.
- Remotely-controlled DC disconnecting means are located within 10 feet of the PV array and DC input of the inverter(s), and the locations of the disconnecting means are such that uncontrolled PV system conductors are no greater than 5 feet of length within the building. Reduction of the voltage for the inverter output within the time required by CEC 690.12 shall be verified in the field, or the inverter output is listed to UL 1741 with rapid shutdown capability.
- Remotely-controlled DC disconnecting means is located within 10 feet of the array at the DC input of inverter(s) connected to a module level DC-DC converter circuit where the DC-DC converter circuit meets the requirements for controlled conductors when disconnected from the inverter. Reduction of the voltage for the DC-DC converter output and the inverter output within the time required by CEC 690.12 shall be verified in the field, or the DC-DC converter output and the inverter output are listed to UL 1741 with rapid shutdown capability.
- A UL 1741-listed and identified inverter(s) with input and output rapid shutdown capability supplying module level DC-DC converter circuit where the DC-DC converter circuit meets the requirements for controlled conductors when disconnected from the inverter.
- A UL 1741-listed rapid shutdown system:
 - Manufacturer: _____
 - Testing Agency Name: _____
 - System Model Number: _____
 - System Components: _____

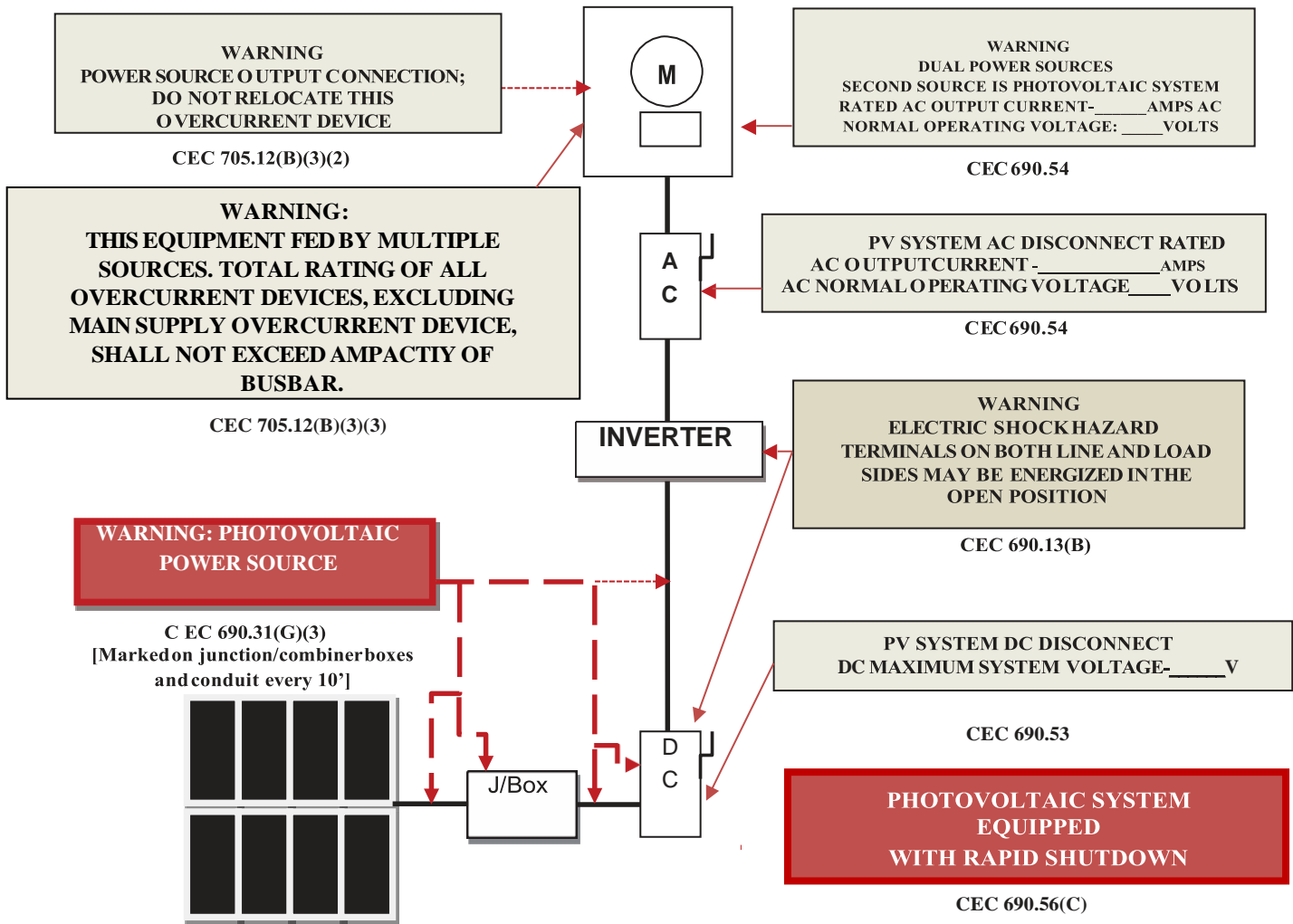
15) Grounding and Bonding of Modules and Racking System (select one):

- Racking system listed to UL 2703 using modules identified in the listing.
- Other method subject to AHJ approval
- _____

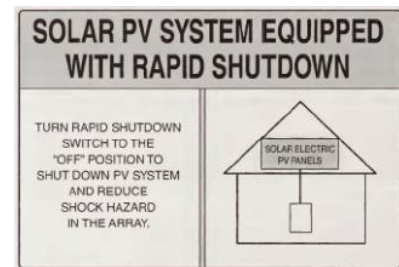
Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

Markings

CEC Articles 690 and 705 and CA Residential Code Section R324 require the following labels or markings be installed at these components of the photovoltaic system:



NOTE: CEC 705.10 requires a permanent plaque or directory denoting all electric power sources on or in the premises.



Informational note: ANSI Z535.4-2011 provides guidelines for the design of safety signs and labels for application to products. A phenolic plaque with contrasting colors between the text and background would meet the intent of the code for permanency. No type size is specified, but 20 point (3/8") should be considered the minimum. Labels required by this section shall be suitable for the environment where they are installed.

CEC 705.10 requires a permanent plaque or directory denoting all electric power sources on or in the premises or rapid fire shutdown equipment.

Solar PV Standard Plan — Supply-Side Central/String Inverter Systems for One- and Two-Family Dwellings

| TAG | DESCRIPTION | SINGLE-LINE DIAGRAM #2 – SUPPLY SIDE CONNECTION | | | | | | | |
|---|--|--|--|--|--|----------------|----------------------|--------------------|--------------|
| 1 | SOLAR PV MODULE / STRING | <p style="text-align: center;">CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED: <input type="checkbox"/> GROUNDED (INCLUDE GEC) <input type="checkbox"/> UNGROUNDED</p> <p style="text-align: center;">REFER TO STEP 14 FOR RAPID SHUTDOWN DETAILS</p> <p style="text-align: center;">FOR UNGROUNDED SYSTEMS: - DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT - UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.</p> | | | | | | | |
| 2 | DC/DC CONVERTERS INSTALLED?: YES / NO (IF YES, STEPS 6 & 8 REQUIRED) | | | | | | | | |
| 3 | SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO | | | | | | | | |
| 4 | SEPARATE DC DISCONNECT INSTALLED?: YES / NO | | | | | | | | |
| 5 | INTERNAL INVERTER DC DISCONNECT: YES / NO | | | | | | | | |
| 6 | CENTRAL INVERTER | | | | | | | | |
| 7 | LOAD CENTER INSTALLED?: YES / NO | | | | | | | | |
| 8 | PV PRODUCTION METER INSTALLED?: YES / NO | | | | | | | | |
| 9 | *SEPARATE AC DISCONNECT INSTALLED?: YES / NO | | | | | | | | |
| 10 | CONNECT TO INVERTER #2 (USE LINE DIAGRAM 3) | | | | | | | | |
| * Consult with your local AHJ and /or Utility | | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="text-align: center;">Inverter Make: _____ Inverter Model: _____</p> </div> <div style="width: 50%; text-align: right;"> <p>MAIN SERVICE PANEL BUSBAR RATING: _____ (M)</p> <p>PV OCPD RATING: _____</p> <p>MAIN OCPD RATING: _____</p> </div> </div> <p style="text-align: center;">ENTER N/A WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE</p> | | | | | | | |
| CONDUCTOR/CONDUIT SCHEDULE | | | | | | | | | |
| <input type="checkbox"/> TAG | DESCRIPTION AND CONDUCTOR TYPE | | | | | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A | USE-2 <input type="checkbox"/> OR PV-WIRE <input type="checkbox"/> EGC/GEC: | | | | | | | | |
| B | EGC/GEC: | | | | | | | | |
| C | EGC/GEC: | | | | | | | | |
| D | EGC/GEC: | | | | | | | | |
| | EGC/GEC: | | | | | | | | |

Select one interconnection method:

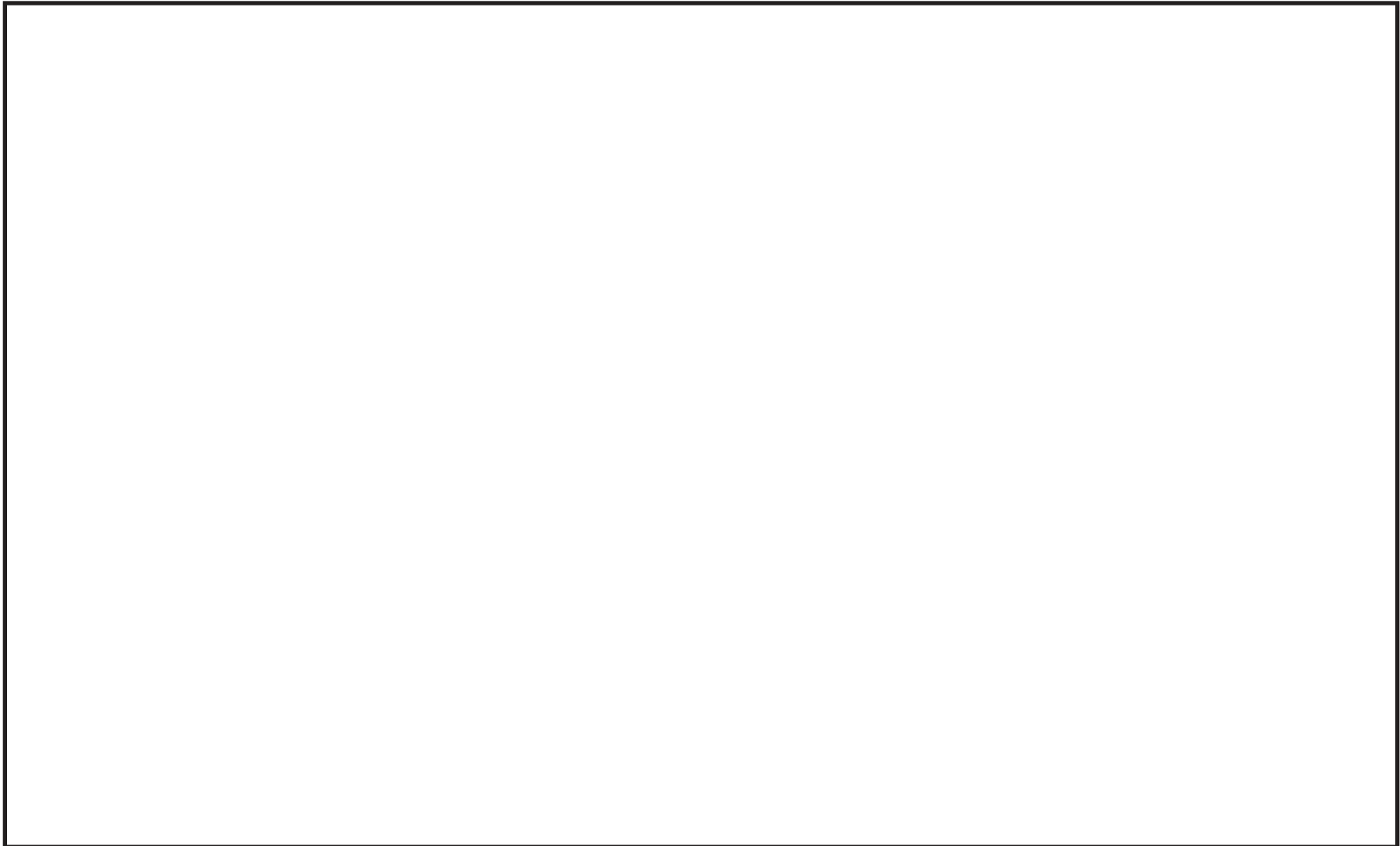
Utility- and AHJ-approved meter socket adapter.
Adapter name/model: _____

Service equipment listed for purpose of PV interconnection.
Description / model number: _____

SOLAR PV STANDARD PLAN — SIMPLIFIED

Single-Inverter Systems for One- and Two-Family Dwellings ROOF

LAYOUT PLAN



Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points.