*PV TOOLKIT DOCUMENT #3*
*Expedited Permitting Process*

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

**Building and Safety Division**
**Effective Date January 1, 2021**

SCOPE: Use this plan ONLY for utility-interactive 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 structure. The photovoltaic system must interconnect to the load side of a single-phase AC service panel of nominal 120/240Vac with a bus bar rating of 225A or less. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers, trackers, more than two inverters or more than one DC combiner (non inverter-integrated) per inverter. 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 690.3.

MANUFACTURER'S SPECIFICATION SHEETS MUST BE PROVIDED for proposed inverter, modules, combiner/junction boxes and racking systems. Installation instructions for bonding and grounding equipment 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 identified and listed for the application (CEC 690.4[B]).

Job Address: _____ Permit #: _____

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 greater than or equal to -5° C, **$C_F$ = 1.12**

☐ If $T_L$ is between -6° and -10° C, **$C_F$ = 1.14**

Average ambient high temperature ($T_H$) ≤ 47° C

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

DC Information:

| |
|---|
| Module Manufacturer: _____ Model: _____ |
| 2) Module $V_{oc}$ (from module nameplate): ____Volts |
| 3) Module $I_{sc}$ (from module nameplate): ___Amps<br>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) |

## 5) DC Module Layout

| Identify each source circuit (string) for inverter 1 shown on the roof plan with a Tag (e.g. A,B,C,…) | Number of modules per source circuit for inverter 1 |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| Total number of source circuits for inverter 1: | |

## 6) Are DC/DC Converters used? ☐ Yes ☐ No If No, skip to Step 7. If Yes enter info below.

DC/DC Converter Model #: _____

Max DC Output Current: _____ Amps

Max # of DC/DC Converters in an Input Circuit: _____

DC/DC Converter Max DC Input Voltage: _____ Volts

Max DC Output Current: _____ Volts

DC/DC Converter Max DC Input Power: _____ Watts

## 7) Maximum System DC Voltage —

Only use for systems without DC/DC converters.

☐ A. Module $V_{OC}$ (STEP 2) = _____ x # modules in series (STEP 5) ____ x $C_F$ (STEP 1) _____ = _____ V

| Table 1. Maximum Number of PV Modules in Series Based on Module Rated $V_{OC}$ for 600 Vdc Rated Equipment (CEC 690.7) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Rated Module $V_{OC}$ (*1.12) (Volts) | 29.76 | 31.51 | 33.48 | 35.71 | 38.27 | 41.21 | 44.64 | 48.70 | 53.57 | 59.52 | 66.96 | 76.53 | 89.29 |
| Max. Rated Module $V_{OC}$ (*1.14) (Volts) | 29.24 | 30.96 | 32.89 | 35.09 | 37.59 | 40.49 | 43.86 | 47.85 | 52.63 | 58.48 | 65.79 | 75.19 | 87.72 |
| Max # of Modules for 600 Vdc | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 |

Only use for DC/DC converters. The value calculated below must be less than DC/DC converter max DC input voltage (STEP 6).

☐ B. Module $V_{OC}$ (STEP 2) = _____ x # of modules per converter (STEP 6) _____ x $C_F$ (STEP 1) = _____ = _____ V

| Table 2. Largest Module $V_{OC}$ for Single-Module DC/DC Converter Configurations (with 80 V AFCI Cap) (CEC 690.7 and 690.11) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Rated Module $V_{OC}$ (*1.12) (Volts) | 30.4 | 33.0 | 35.7 | 38.4 | 41.1 | 43.8 | 46.4 | 49.1 | 51.8 | 54.5 | 57.1 | 59.8 | 62.5 | 65.2 | 67.9 | 70.5 |
| Max. Rated Module $V_{OC}$ (*1.14) (Volts) | 29.8 | 32.5 | 35.1 | 37.7 | 40.4 | 43.0 | 45.6 | 48.2 | 50.9 | 53.5 | 56.1 | 58.8 | 61.4 | 64.0 | 66.7 | 69.3 |
| DC/DC Converter Max DC Input (Step #6) (Volts) | 34 | 37 | 40 | 43 | 46 | 49 | 52 | 55 | 58 | 61 | 64 | 67 | 70 | 73 | 76 | 79 |

## 8) Maximum System DC Voltage from DC/DC Converters to Inverter — Only required if Yes in Step 6

Maximum System DC Voltage = _____ Volts

## 9) Sizing Source Circuit Conductors

Source Circuit Conductor Size = Min. #10 AWG copper conductor, 90° C wet (USE-2, PV Wire, XHHW-2, THWN-2, RHW-2) ☐ ☐

For up to 8 conductors in roof-mounted conduit exposed to sunlight at least ½" from the roof covering (CEC 310)

Note: For over 8 conductors in the conduit or mounting height of lower than ½" from the roof, use Comprehensive Plan.

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 ISC (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, Comprehensive Standard Plan)

Grounded or Ungrounded 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 14) | 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 | 6 | 6 | 6 |

13) Point of Connection to Utility – Inverter(s) must be connected to either load or supply side of the 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 CEC 705.12(B)(2)(3)(d)):

[Combined Inverter output OCPD size + Main OCPD Size] ≤ [bus bar size x (120%)]

| Table 4. Maximum Combined Supply OCPDs Based on Bus Bar Rating (Amps) per CEC 705.12(D)(2) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bus Bar Rating | 100 | 125 | 125 | 200 | 200 | 200 | 225 | 225 | 225 |
| Main OCPD | 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. Otherwise, use Comprehensive Standard Plan.

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): _____

14) Rapid Shutdown2

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: _____

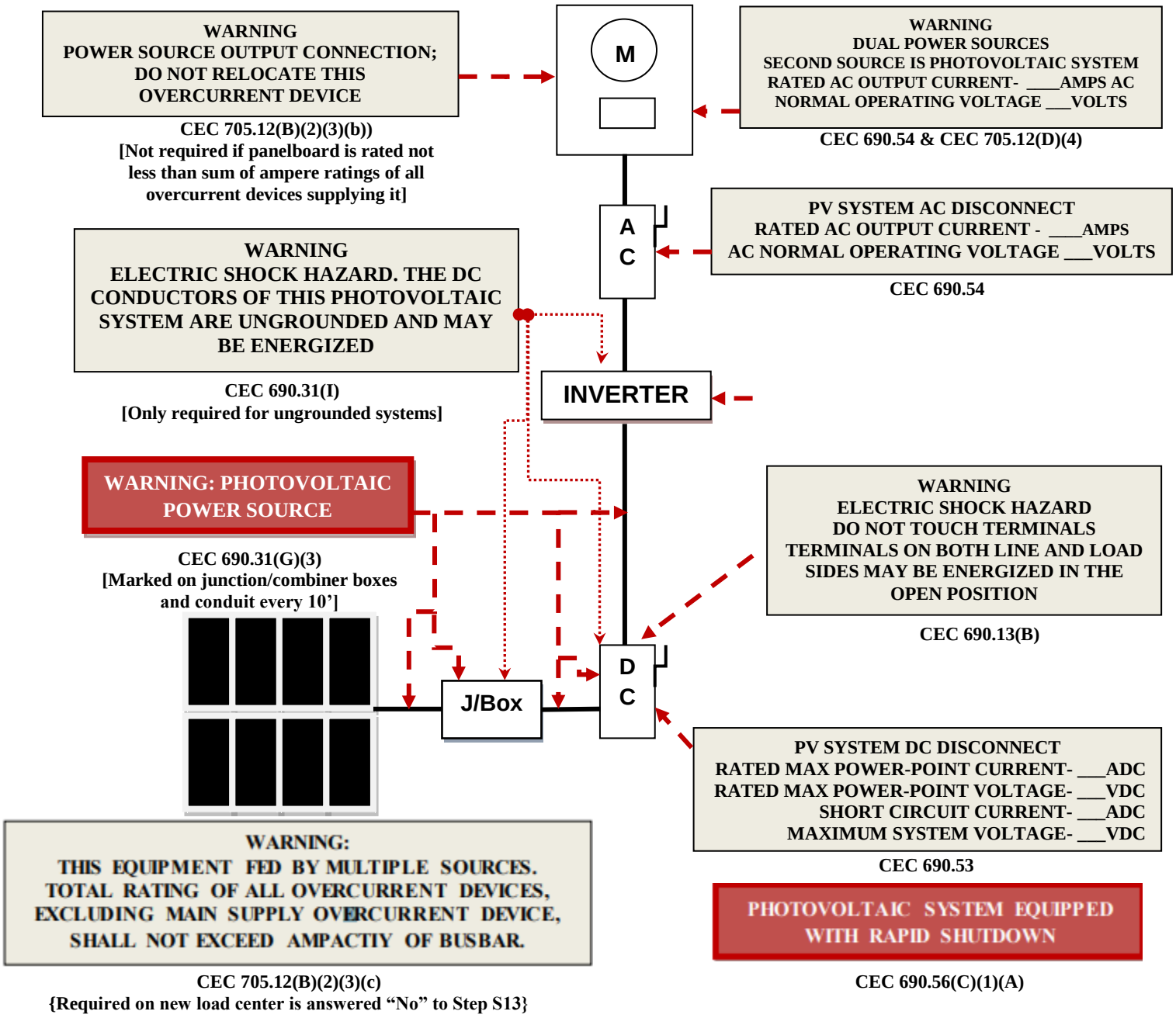
15) Grounding and Bonding of Modules and Racking System (<u>select one</u>):

- ☐ 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 CRC Section R324 require the following labels or markings be installed at these components of the photovoltaic system:




**Informational note: ANSI Z535.4 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.**

**CEC 705.12 requires a permanent plaque or directory denoting all electric power sources on or in the premises.**

# Solar PV Standard Plan – Simplified
# Central/String Inverter System for One- and Two-Family Dwellings

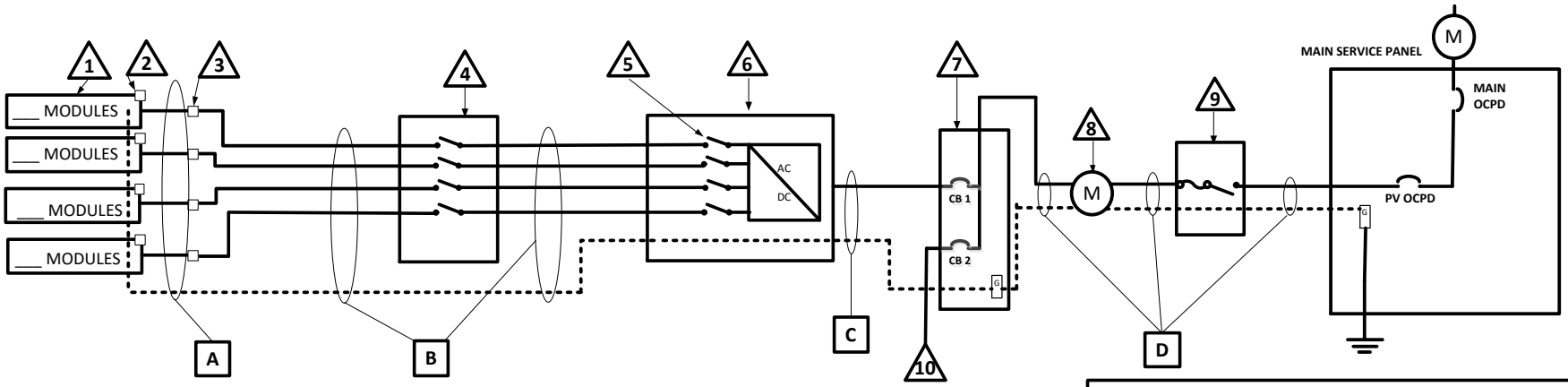
| TAG | DESCRIPTION |
|---|---|
| 1 | SOLAR PV MODULE / STRING |
| 2 | DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED) |
| 3 | SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO |
| 4 | SEPARATE DC DISCONNECT INSTALLED?: YES / NO |
| 5 | INTERNAL INVERTER DC DISCONNECT: YES / NO |
| 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 2) |

* Consult with your local AHJ and /or Utility

## SINGLE-LINE DIAGRAM #1 – NO STRINGS COMBINED PRIOR TO INVERTER

**CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:** ☐ **GROUNDED (INCLUDE GEC)** ☐ **UNGROUNDED**

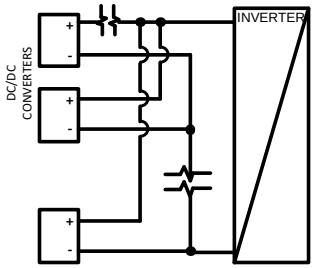
**FOR UNGROUNDED SYSTEMS:**
- **DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT**
- **UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.**



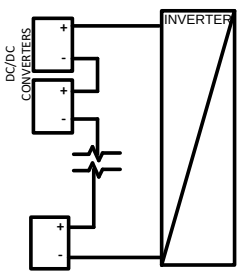

| CONDUCTOR/CONDUIT SCHEDULE | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A | USE-2 □ OR PV-WIRE □ | | | | |
| | EGC/GEC: | | | | |
| B | | | | | |
| | EGC/GEC: | | | | |
| C | | | | | |
| | EGC/GEC: | | | | |
| D | | | | | |
| | EGC/GEC: | | | | |

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

IF DC/DC CONVERTERS ARE USED, CHECK THE BOX BELOW THE CORRESPONDING CONFIGURATION




☐ PARALLEL DC/DC CONVERTERS ON ONE SOURCE CIRCUIT (FIXED UNIT VOLTAGE DC/DC CONVERTERS)




☐ DC/DC CONVERTERS ARE ALL RUN IN SERIES (FIXED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

# Solar PV Standard Plan – Simplified
# Central/String Inverter System for One- and Two-Family Dwellings

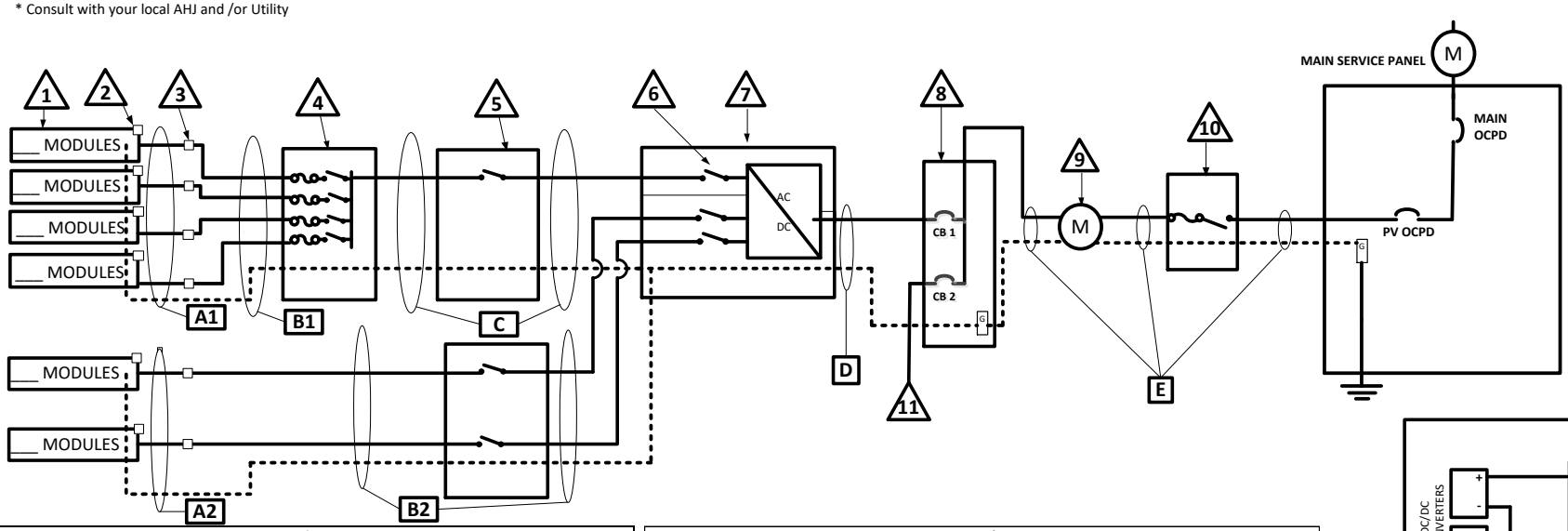
| △TAG | DESCRIPTION |
|---|---|
| 1 | SOLAR PV MODULE / STRING |
| 2 | DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED) |
| 3 | SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO |
| 4 | COMBINER BOX (STEPS 11 & 12 REQUIRED) |
| 5 | SEPARATE DC DISCONNECT INSTALLED?: YES / NO |
| 6 | INTERNAL INVERTER DC DISCONNECT: YES / NO |
| 7 | CENTRAL INVERTER |
| 8 | LOAD CENTER INSTALLED?: YES / NO |
| 9 | PV PRODUCTION METER INSTALLED?: YES / NO |
| 10 | *SEPARATE AC DISCONNECT INSTALLED?: YES / NO |
| 11 | CONNECT TO INVERTER #2 (USE LINE DIAGRAM 4) |

* Consult with your local AHJ and /or Utility

## SINGLE-LINE DIAGRAM #2 – COMBINING STRINGS PRIOR TO INVERTER

**CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:** ☐ **GROUNDED (INCLUDE GEC)** ☐ **UNGROUNDED**

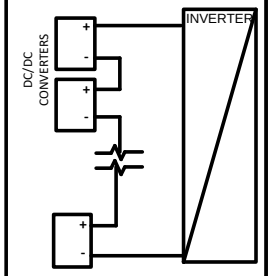
**FOR UNGROUNDED SYSTEMS:**
- **DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT**
- **UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.**




| COMBINER CONDUCTOR/CONDUIT SCHEDULE | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A1 | USE-2 □ OR PV-WIRE □ | | | | |
| | EGC/GEC: | | | | |
| B1 | | | | | |
| | EGC/GEC: | | | | |
| C | | | | | |
| | EGC/GEC: | | | | |
| D | | | | | |
| | EGC/GEC: | | | | |
| E | | | | | |
| | EGC/GEC: | | | | |

| NON-COMBINED STRINGS CONDUCTOR/CONDUIT SCHEDULE (IF APPLICABLE) | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A2 | USE-2 □ OR PV-WIRE □ | | | | |
| | EGC/GEC: | | | | |
| B2 | | | | | |
| | EGC/GEC: | | | | |

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE




IF DC/DC CONVERTERS ARE USED, THEY ARE RUN IN SERIES (FIXED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

## Supplemental Calculation Sheets for Inverter #2 (Only include if second inverter is used)

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)

Module Manufacturer: _____ Model: _____

S2) Module $V_{oc}$ (from module nameplate): _____Volts

S3) Module $I_{sc}$ (from module nameplate): _____Amps

S4) Module DC output power under standard test conditions (STC) = _____ Watts (STC)

S5) DC Module Layout

| Identify each source circuit (string) for inverter 1 shown on the roof plan with a Tag (e.g. A,B,C,…) | Number of modules per source circuit for inverter 1 | Identify, by tag, which source circuits on the roof are to be paralleled (if none, put N/A) |
|---|---|---|
| | | Combiner 1: |
| | | |
| | | |
| | | Combiner 2: |
| | | |
| | | |
| Total number of source circuits for inverter 1: | | |

S6) Are DC/DC Converters used? Yes ☐ No ☐ If No, skip to Step S7. If Yes, enter info below.

DC/DC Converter Model #: _____

Max DC Output Current: _____ Amps

Max # of DC/DC Converters in an Input Circuit: _____

DC/DC Converter Max DC Input Voltage: _____ Volts

Max DC Output Current: _____ Volts

DC/DC Converter Max DC Input Power: _____ Watts

7) Maximum System DC Voltage —

Only use for systems without DC/DC converters.

☐ A. Module $V_{OC}$ (STEP 2) = _____x # modules in series (STEP 5) ____x $C_F$ (STEP 1) _____ = _____V

| Table 1. Maximum Number of PV Modules in Series Based on Module Rated $V_{OC}$ for 600 Vdc Rated Equipment (CEC 690.7) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Rated Module $V_{OC}$ (*1.12) (Volts) | 29.76 | 31.51 | 33.48 | 35.71 | 38.27 | 41.21 | 44.64 | 48.70 | 53.57 | 59.52 | 66.96 | 76.53 | 89.29 |
| Max. Rated Module $V_{OC}$ (*1.14) (Volts) | 29.24 | 30.96 | 32.89 | 35.09 | 37.59 | 40.49 | 43.86 | 47.85 | 52.63 | 58.48 | 65.79 | 75.19 | 87.72 |
| Max # of Modules for 600 Vdc | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 |

Only use for DC/DC converters. The value calculated below must be less than DC/DC converter max DC input voltage (STEP 6).

☐ B. Module $V_{OC}$ (STEP 2) = _____x # of modules per converter (STEP 6) _____x $C_F$ (STEP 1) =_____ = _____V

| Table 2. Largest Module $V_{OC}$ for Single-Module DC/DC Converter Configurations (with 80 V AFCI Cap) (CEC 690.7 and 690.11) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Rated Module $V_{OC}$ (*1.12) (Volts) | 30.4 | 33.0 | 35.7 | 38.4 | 41.1 | 43.8 | 46.4 | 49.1 | 51.8 | 54.5 | 57.1 | 59.8 | 62.5 | 65.2 | 67.9 | 70.5 |
| Max. Rated Module $V_{OC}$ (*1.14) (Volts) | 29.8 | 32.5 | 35.1 | 37.7 | 40.4 | 43.0 | 45.6 | 48.2 | 50.9 | 53.5 | 56.1 | 58.8 | 61.4 | 64.0 | 66.7 | 69.3 |
| DC/DC Converter Max DC Input (Step #6) (Volts) | 34 | 37 | 40 | 43 | 46 | 49 | 52 | 55 | 58 | 61 | 64 | 67 | 70 | 73 | 76 | 79 |

8) Maximum System DC Voltage from DC/DC Converters to Inverter — Only required if Yes in Step 6

Maximum System DC Voltage = _____ Volts

9) Sizing Source Circuit Conductors

Source Circuit Conductor Size = Min. #10 AWG copper conductor, 90° C wet (USE-2, PV Wire, XHHW-2, THWN-2, RHW-2)

For up to 8 conductors in roof-mounted conduit exposed to sunlight at least ½" from the roof covering (CEC 310)

Note: For over 8 conductors in the conduit or mounting height of lower than ½" from the roof, use Comprehensive Plan.

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 ISC (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, Comprehensive Standard Plan)

Grounded or Ungrounded System? ☐ Grounded ☐ Ungrounded

AC Information:

S15) 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 14) | 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 | 6 | 6 | 6 |

## Load Center Calculations
## (Omit if a load center will not be installed for PV OCPDs)

S20) Load Center Output:

Calculate the sum of the maximum AC outputs from each inverter.

Inverter #1 Max Continuous AC Output Current Rating [STEP S14] _____ × 1.25 = _____ Amps

Inverter #2 Max Continuous AC Output Current Rating [STEP S14] _____ × 1.25 = _____ Amps

Total inverter currents connected to load center (sum of above) = _____ Amps

Conductor Size: _____AWG

Overcurrent Protection Device: _____Amps

Load center bus bar rating: _____Amps

Can the load center accept more than two breakers? Yes No

If Yes, the sum of 125% of the inverter output circuit currents and the rating of the overcurrent device protecting the busbar shall not exceed 120% of the ampacity of the busbar.

If No, the sum of the ampere rating of the two PV overcurrent devices shall not exceed the rating of the busbar.

# Solar PV Standard Plan – Simplified
# Central/String Inverter System for One- and Two-Family Dwellings

| △TAG | DESCRIPTION |
|---|---|
| 1 | SOLAR PV MODULE / STRING |
| 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 | *SEPARATE AC DISCONNECT INSTALLED?: YES / NO |
| 8 | TO LOAD CENTER ON LINE DIAGRAM 1 |

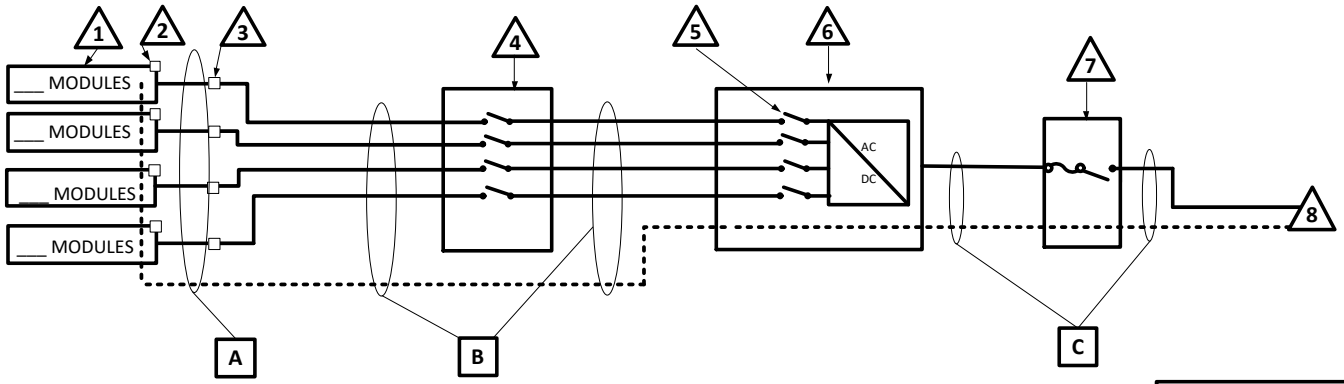
* Consult with your local AHJ and /or Utility

## SINGLE-LINE DIAGRAM #3 – ADDITIONAL INVERTER FOR DIAGRAM #1

### INVERTER # 2

**CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:** ☐ **GROUNDED (INCLUDE GEC)** ☐ **UNGROUNDED**

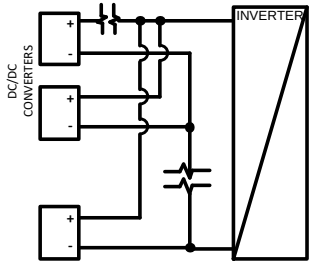
**FOR UNGROUNDED SYSTEMS:**
**- DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT**
**- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.**



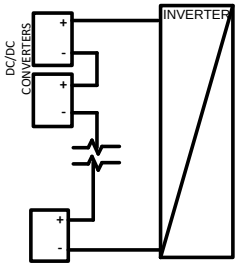

| CONDUCTOR/CONDUIT SCHEDULE | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A | USE-2 □ OR PV-WIRE □ | | | | |
| | EGC/GEC: | | | | |
| B | | | | | |
| | EGC/GEC: | | | | |
| C | | | | | |
| | EGC/GEC: | | | | |

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

IF DC/DC CONVERTERS ARE USED, CHECK THE BOX BELOW THE CORRESPONDING CONFIGURATION




☐ PARALLEL DC/DC CONVERTERS ON ONE SOURCE CIRCUIT (FIXED UNIT VOLTAGE DC/DC CONVERTERS)




☐ DC/DC CONVERTERS ARE ALL RUN IN SERIES (FIXED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

# Solar PV Standard Plan – Simplified
# Central/String Inverter System for One- and Two-Family Dwellings

| TAG | DESCRIPTION |
|---|---|
| 1 | SOLAR PV MODULE / STRING |
| 2 | DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED) |
| 3 | SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO |
| 4 | COMBINER BOX (STEPS 11 & 12 REQUIRED) |
| 5 | SEPARATE DC DISCONNECT INSTALLED?: YES / NO |
| 6 | INTERNAL INVERTER DC DISCONNECT: YES / NO |
| 7 | CENTRAL INVERTER |
| 8 | *SEPARATE AC DISCONNECT INSTALLED?: YES / NO |
| 9 | TO LOAD CENTER ON LINE DIAGRAM 3 |

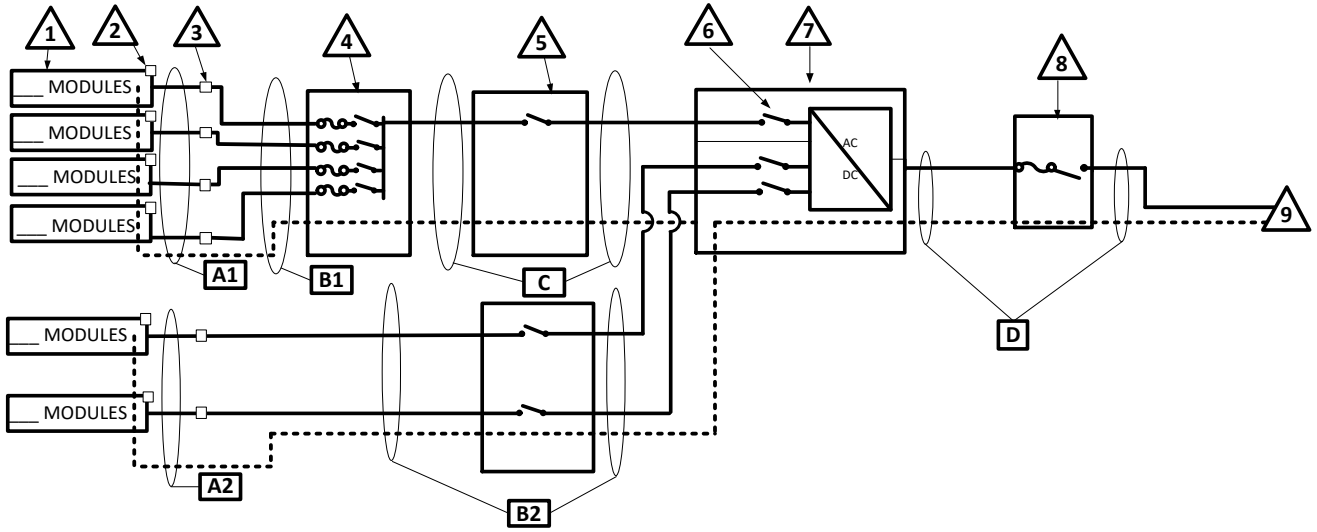
* Consult with your local AHJ and /or Utility

## SINGLE-LINE DIAGRAM #4 – ADDITIONAL INVERTER FOR DIAGRAM #2

### INVERTER # 2

**CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:** ☐ **GROUNDED (INCLUDE GEC)** ☐ **UNGROUNDED**

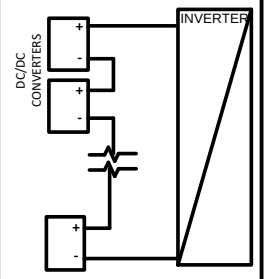
**FOR UNGROUNDED SYSTEMS:**
- **DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT**
- **UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.**




| COMBINER CONDUCTOR/CONDUIT SCHEDULE | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A1 | USE-2 ☐ OR PV-WIRE ☐ | | | | |
| | EGC/GEC: | | | | |
| B1 | | | | | |
| | EGC/GEC: | | | | |
| C | | | | | |
| | EGC/GEC: | | | | |
| D | | | | | |
| | EGC/GEC: | | | | |

| NON-COMBINED STRINGS CONDUCTOR/CONDUIT SCHEDULE (IF APPLICABLE) | | | | | |
|---|---|---|---|---|---|
| ☐ TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE |
| A2 | USE-2 ☐ OR PV-WIRE ☐ | | | | |
| | EGC/GEC: | | | | |
| B2 | | | | | |
| | EGC/GEC: | | | | |

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE




IF DC/DC CONVERTERS ARE USED, THEY ARE RUN IN SERIES (FIXED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

# SOLAR PV STANDARD PLAN

**Roof Layout Diagram for One- and Two-Family Dwellings**

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