Central/String Inverter Systems for One and Two Family Dwellings

SCOPE: Use this plan ONLY for electrical review of utility-interactive central/string inverter systems not exceeding a combined system AC inverter output of 10kW on the roof of a single or duplex family dwelling or accessory building. The specific structural and fire requirements are covered under a separate permit. The photovoltaic system must interconnect to the load side of a single-phase AC service panel of 240Vac or less with a busbar rating of 225A or less. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers, trackers, ac modules, 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 all applicable Los Angeles Codes. Other Articles of the California Electrical Code (CEC) shall apply as specified in 690.3.

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 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” starting on page 8 & “Load Center Calculations” on page 13 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

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

1) □ If $T_L$ is greater than or equal to -5°C, $C_T = 1.12$
□ If $T_L$ is between -6°C and -10°C, $C_T = 1.14$

Average ambient high temperature ($T_{NH}$) ≤ 47°C
Note: For a lower $T_L$ or a higher $T_{NH}$, 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
   Is Module $I_{SC}$ below 9.6 Amps? □ Yes □ No (If No, this plan is not applicable.)
4) Module DC output power under standard test conditions (STC) = ________ Watts (STC)
Central/String Inverter Systems for One and Two Family Dwellings

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,...)

<table>
<thead>
<tr>
<th>Number of modules per source circuit for inverter 1</th>
<th>Identify, by tag, which source circuits on the roof are to be paralleled (if none, put N/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combiner 1:</td>
<td></td>
</tr>
<tr>
<td>Combiner 2:</td>
<td></td>
</tr>
</tbody>
</table>

Total number of source circuits:

6) Are DC/DC Converters used? □ Yes □ No
   DC/DC Converter Model #:________________________
   Max DC Output Current: ________________________ Amps
   Max # of DC/DC Converters in an Input Circuit: __________

   If No, skip to Step 7. If Yes enter info below.
   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
   Use for systems without DC/DC converters.
   A. Module $V_{dc}$ (STEP 2) ______ x # of modules in series (STEP 5) ______ x $C_f$ (STEP 1) ______ = _____ V

   Use for systems with DC/DC converters. The value calculated below must be less than DC/DC converter max DC input voltage (STEP 6).
   B. Module $V_{dc}$ (STEP 2) ______ x # of modules per converter (STEP 6) ______ x $C_f$ (STEP 1) ______ = _____ V

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 1/2" from the roof covering. (CEC 310)
   Note: For over 8 conductors in the conduit or mounting height of lower than 1/2" from the roof, this plan is not applicable.
Central/String Inverter Systems for One and Two Family Dwellings

10) Are PV source circuits combined prior to the inverter?  □ Yes  □ No
   If No, use Single Line Diagram 1 and proceed to Step 12.
   If Yes, use Single Line Diagram 2 and proceed to Step 11 after this step.

11) Sizing PV Output Circuit Conductors — If strings are combined (answered “Yes” in Step 10), Output Circuit Conductor Size = Min. #6 AWG copper conductor.
   If strings are combined (answered “Yes” in Step 10), Output Circuit Conductor Size = Min. #6 AWG copper conductor.
   If “Yes,” the DC output of the combiner shall have a load break disconnecting means located in the combiner or within 1.8m (6ft) of the combiner (CEC 690.15(C)).

12) Inverter DC Disconnect
   Does the inverter have an integrated DC disconnect?  □ Yes  □ No
   If “Yes,” the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)
   If Yes, proceed to step 13.
   If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)

13) Inverter Information
   Manufacturer:
   Model:
   Max. Continuous AC Output Current Rating:  Amps
   Integrated DC Arc-Fault Circuit Protection?  □ Yes  □ No
   Grounded or Ungrounded System?  □ Grounded  □ Ungrounded

AC Information:

14) 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
<table>
<thead>
<tr>
<th>Inverter Continuous Output Current Rating (Amps) (Step 13)</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
<th>36</th>
<th>40</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum OCPD Size (Amps)</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Minimum Conductor Size (AWG, 75° C, Copper)</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

15) Point of Connection to Utility
   Note: Only load side connections are permitted with this plan.
   Is the PV OCPD positioned at the opposite end from input feeder location or main OCPD location?
   □ Yes, use Table 4, row 3 and circle the Max Combined PV System OCPD(s) at 120% based on the bus bar rating and main OCPD values.
   □ No, use Table 4, row 4 and circle the Max Combined PV System OCPD(s) at 100% based on the bus bar rating and main OCPD values.

   Per 705.12(D)(2)(3): The value circled in Table 4 should be equal to or greater than the OCPD value selected from Table 3 (for a single inverter) or the OCPD value from Step S18 (for two inverters).

   Table 4. Maximum Combined Supply OCPDs Based on Bus Bar Rating (Amps) per CEC 705.12(D)(2)(3)(b)
<table>
<thead>
<tr>
<th>Bus Bar Rating</th>
<th>100</th>
<th>125</th>
<th>125</th>
<th>200</th>
<th>200</th>
<th>200</th>
<th>225</th>
<th>225</th>
<th>225</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main OCPD</td>
<td>100</td>
<td>125</td>
<td>125</td>
<td>150</td>
<td>175</td>
<td>200</td>
<td>175</td>
<td>200</td>
<td>225</td>
</tr>
<tr>
<td>Max Combined PV System OCPD(s) at 120% of Bus Bar Rating</td>
<td>20</td>
<td>50</td>
<td>50</td>
<td>60*</td>
<td>60*</td>
<td>40</td>
<td>60*</td>
<td>60*</td>
<td>45</td>
</tr>
<tr>
<td>Max Combined PV System OCPD(s) at 100% Bus Bar Rating</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>50</td>
<td>25</td>
<td>0</td>
</tr>
</tbody>
</table>

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

   Reduction of the main breaker and/or interconnection to center-fed panelboards are not permitted with this plan.
16) 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: _________________________________________________________

17) 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
CA Electrical Code (CEC) Articles 690 and 705 and CA Residential Code (CRC) Section R331 require the following labels or markings be installed at these components of the photovoltaic system:

**WARNING**

**INVERTER OUTPUT CONNECTION; DO NOT RELOCATE THIS OVERCURRENT DEVICE**

CEC 705.12(D)(2)(3)(b)
[Not required if panelboard is rated not less than sum of ampere ratings of all overcurrent devices supplying it]

**WARNING**

**ELECTRIC SHOCK HAZARD. THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED**

CEC 690.35(F)
[Only required for ungrounded systems]

**WARNING**

**PHOTOVOLTAIC POWER SOURCE**

CEC 690.31(G)(3)
[Marked on junction/combiner boxes and conduit every 10']

**WARNING**

**THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR.**

CEC 705.12(D)(2)(3)(c)
[Required on new load center if answered “No” to Step S21]

**WARNING**

**DUAL POWER SOURCES**

SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
RATED AC OUTPUT CURRENT- ___AMPS
NORMAL OPERATING VOLTAGE ___VOLTS

CEC 690.54 & CEC 705.12(D)(3)

**PV SYSTEM AC DISCONNECT**

RATED AC OUTPUT CURRENT - ___AMPS
AC NORMAL OPERATING VOLTAGE ___VOLTS

CEC 690.54

**WARNING**

**ELECTRIC SHOCK HAZARD**

IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

CEC 690.5(C)
[Normally already present on listed inverters]

**WARNING**

**ELECTRIC SHOCK HAZARD**

DO NOT TOUCH TERMINALS TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

CEC 690.17(E)

**PV SYSTEM DC DISCONNECT**

RATED MAX POWER-POINT CURRENT- ___ADC
RATED MAX POWER-POINT VOLTAGE- ___VDC
MAXIMUM CIRCUIT CURRENT- ___ADC
MAXIMUM SYSTEM VOLTAGE- ___VDC

CEC 690.53

**PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

CEC 690.56(C)
[Required at location approved by AHJ]

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 and the rapid shutdown initiation device.
Solar PV Standard Plan – Simplified
Central/String Inverter System for One- and Two-Family Dwellings

**DESCRIPTION**

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION AND CONDUCTOR TYPE</th>
<th>CONDUCTOR SIZE</th>
<th>NUMBER OF CONDUCTORS</th>
<th>CONDUIT/CABLE TYPE</th>
<th>CONDUIT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>USE-2 □ OR PV-WIRE □</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Enter "N/A" where suitable for when not using conduit or cable as permitted by code.

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

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

- **REFER TO STEP 16 FOR RAPID SHUTDOWN DETAILS**

- **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.

**USE-2** OR **PV-WIRE**

*Consult with your local AHJ and/or Utility*
Solar PV Standard Plan – Simplified

Central/String Inverter System for One and Two Family Dwellings

SOLAR PV STANDARD PLAN - SIMPLIFIED

Central/String Inverter Systems for One and Two Family Dwellings

Solar PV Central Standard Plan
V 1.0 -11/2016  2014 NEC
**DC Information:**

| Module Manufacturer: __________________________ | Model: __________________________ |

**S2) Module $V_{DC}$ (from module nameplate): ____ Volts**

**S3) Module $I_{SC}$ (from module nameplate): ____ Amps**

- **Is Module $I_{SC}$ below 9.6 Amps?**  
  - ☐ Yes  
  - ☐ No (If No, this plan is not applicable.)

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

**S5) DC Module Layout**

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

**S6) Are DC/DC Converters used?**  
- ☐ Yes  
- ☐ No  

<table>
<thead>
<tr>
<th>DC/DC Converter Model #: __________________________</th>
<th>DC/DC Converter Max DC Input Voltage: ____ Volts Max DC Output Current: _________ Volts DC/DC Converter Max DC Input Power: _____ Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC/DC Converter Model #: __________________________</td>
<td>Max DC Output Current: _________ Amps</td>
</tr>
<tr>
<td>Max # of DC/DC Converters in an Input Circuit: _________</td>
<td>Max # of DC/DC Converters in an Input Circuit: _________</td>
</tr>
</tbody>
</table>
SOLAR PV STANDARD PLAN - SIMPLIFIED

Central/String Inverter Systems for One and Two Family Dwellings

S7) Maximum System DC Voltage

Use for systems without DC/DC converters.

A. Module \( V_{DC} \) (STEP S2) = ______ \# of modules in series (STEP S5) \( x \) C\(_r\) (STEP 1) ______ = ______ V

<table>
<thead>
<tr>
<th>Max. Rated Module ( V_{DC} ) (*1.12) (Volts)</th>
<th>29.76</th>
<th>31.51</th>
<th>33.48</th>
<th>35.71</th>
<th>38.27</th>
<th>41.21</th>
<th>44.64</th>
<th>48.70</th>
<th>53.57</th>
<th>59.52</th>
<th>66.96</th>
<th>76.53</th>
<th>89.29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Rated Module ( V_{DC} ) (*1.14) (Volts)</td>
<td>29.24</td>
<td>30.96</td>
<td>32.89</td>
<td>35.09</td>
<td>37.59</td>
<td>40.49</td>
<td>43.86</td>
<td>47.85</td>
<td>52.63</td>
<td>58.48</td>
<td>65.79</td>
<td>75.19</td>
<td>87.72</td>
</tr>
<tr>
<td>Max # of Modules for 600Vdc</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

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

B. Module \( V_{DC} \) (STEP S2) = ______ \# of modules per converter (STEP S6) \( x \) C\(_r\) (STEP 1) ______ = ______ V

<table>
<thead>
<tr>
<th>Max. Rated Module ( V_{DC} ) (*1.12) (Volts)</th>
<th>30.4</th>
<th>33.0</th>
<th>35.7</th>
<th>38.4</th>
<th>41.1</th>
<th>43.8</th>
<th>46.4</th>
<th>49.1</th>
<th>51.8</th>
<th>54.5</th>
<th>57.1</th>
<th>59.8</th>
<th>62.5</th>
<th>65.2</th>
<th>67.9</th>
<th>70.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Rated Module ( V_{DC} ) (*1.14) (Volts)</td>
<td>29.8</td>
<td>32.5</td>
<td>35.1</td>
<td>37.7</td>
<td>40.4</td>
<td>43.0</td>
<td>45.6</td>
<td>48.2</td>
<td>50.9</td>
<td>53.5</td>
<td>56.1</td>
<td>58.8</td>
<td>61.4</td>
<td>64.0</td>
<td>66.7</td>
<td>69.3</td>
</tr>
<tr>
<td>DC/DC Converter Max DC Input (STEP #6) (Volts)</td>
<td>34</td>
<td>37</td>
<td>40</td>
<td>43</td>
<td>46</td>
<td>49</td>
<td>52</td>
<td>55</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>67</td>
<td>70</td>
<td>73</td>
<td>76</td>
<td>79</td>
</tr>
</tbody>
</table>

S8) Maximum System DC Voltage from DC/DC Converters to Inverter — Only required if Yes in Step S6

Maximum System DC Voltage = _____________ Volts

S9) 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 ⅛” from the roof covering. (CEC 310)
Note: For over 8 conductors in the conduit or mounting height of lower than ⅛” from the roof, this plan is not applicable.

S10) Are PV source circuits combined prior to the inverter? ☐ Yes ☐ No
If No, use Single Line Diagram 1 with Single Line Diagram 3 and proceed to Step S12.
If Yes, use Single Line Diagram 2 with Single Line Diagram 4 and proceed to Step S11 after this step.

Is source circuit OCPD required? ☐ Yes ☐ No
Source circuit OCPD size (if needed): 15 Amps
Are the source circuits combined on the roof? ☐ Yes ☐ No
If “Yes,” the DC output of the combiner shall have a load breaker disconnecting means located in the combiner or within 1.8m (6ft) of the combiner.

S11) Sizing PV Output Circuit Conductors — If strings are combined (answered “Yes” in Step S10), Output Circuit Conductor Size = Min. #6 AWG copper conductor.

S12) Inverter DC Disconnect

Does the inverter have an integrated DC disconnect? ☐ Yes ☐ No
If Yes, proceed to Step S13.
If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)
SOLAR PV STANDARD PLAN - SIMPLIFIED
Central/String Inverter Systems for One and Two Family Dwellings

S13) Inverter Information
Manufacturer: ___________________________ Model: ___________________________
Max. Continuous AC Output Current Rating: ________Amps
Integrated DC Arc-Fault Circuit Protection? ☐ Yes ☐ No (If No is selected, this plan is not applicable.)
Grounded or Ungrounded System? ☐ Grounded ☐ Ungrounded

AC Information:

S14) Sizing Inverter Output Circuit Conductors and OCPD
Inverter Output OCPD rating = ___________Amps (Table 3)
Inverter Output Circuit Conductor Size = ___________AWG (Table 3)

Table S3. Minimum Inverter Output OCPD and Circuit Conductor Size

<table>
<thead>
<tr>
<th>Inverter Continuous Output Current Rating (Amps) (Step 14)</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
<th>36</th>
<th>40</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum OCPD Size (Amps)</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Minimum Conductor Size (AWG, 75°C, Copper)</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

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

S18) Load Center Output:
Calculate the sum of the maximum AC outputs from each inverter.
Inverter #1 Max Continuous AC Output Current Rating [STEP S13] ________ x 1.25 = _______ Amps
Inverter #2 Max Continuous AC Output Current Rating [STEP S13] ________ x 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 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

**DESCRIPTION**

**Solar PV Central Standard Plan**

**V 1.0 -11/2016  2014 NEC**

Plan Reviewer Initials: ______

**SOLAR PV STANDARD PLAN - SIMPLIFIED**

Central/String Inverter Systems for One and Two Family Dwellings

---

**SOLAR PV STANDARD PLAN – SIMPLIFIED**

Central/String Inverter System for One and Two Family Dwellings

---

**DESCRIPTION**

**Solar PV Module / String**

DC/DC Converters Installed? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)

**Source Circuit Junction Box Installed? YES / NO**

**Separate DC Disconnect Installed? YES / NO**

**Internal Inverter DC Disconnect? YES / NO**

**Central Inverter**

**Separate AC Disconnect Installed? YES / NO**

**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

Refer to step 16 for rapid shutdown details

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**

<table>
<thead>
<tr>
<th>TAG</th>
<th>Description and Conductor Type</th>
<th>Conductor Size</th>
<th>Number of Conductors</th>
<th>Conduit/Cable Type</th>
<th>Conduit Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Use-2 □ OR PV-WIRE □</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CHECK**

- Enter "N/A" where suitable for when not using conduit or cable as permitted by code

---

**DC/DC Converters**

- Parallel DC/DC Converters on one source circuit (fixed unit voltage) (fixed source circuit 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 Systems for One and Two Family Dwellings

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

**DESCRIPTION**

**SOLAR PV MODULE / STRING**

- DC/DC CONVERTERS INSTALLED? **YES** / **NO** (IF YES, STEPS 6 & 8 REQUIRED)
- SOURCE CIRCUIT JUNCTION BOX INSTALLED? **YES** / **NO**
- COMBINER BOX (STEPS 11 & 12 REQUIRED)
- SEPARATE DC DISCONNECT INSTALLED? **YES** / **NO**
- INTERNAL INVERTER DC DISCONNECT: **YES** / **NO**
- CENTRAL INVERTER
- SEPARATE AC DISCONNECT INSTALLED? **YES** / **NO**
- TO LOAD CENTER ON LINE DIAGRAM

**COMBINER CONDUCTOR/CONDUIT SCHEDULE**

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION AND CONDUCTOR TYPE</th>
<th>CONDUCTOR SIZE</th>
<th>NUMBER OF CONDUCTORS</th>
<th>CONDUIT/CABLE TYPE</th>
<th>CONDUIT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>USE-2 □ OR PV-WIRE □</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NON-COMBINED STRINGS CONDUCTOR/CONDUIT SCHEDULE (IF APPLICABLE)**

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION AND CONDUCTOR TYPE</th>
<th>CONDUCTOR SIZE</th>
<th>NUMBER OF CONDUCTORS</th>
<th>CONDUIT/CABLE TYPE</th>
<th>CONDUIT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>USE-2 □ OR PV-WIRE □</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>EGC/GEC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

* Consult with your local AHJ and/or Utility

**Plan Reviewer Initials: ______**
Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means, roof access points, and rapid shutdown initiation device.