# BUILDING PERMIT APPLICATION

## OWNER BUILDER DECLARATION
I affirm that I signed the Owner's Acknowledgment and Verification of Information Declaration form as required by Section 19825 of the California Health and Safety Code.

<table>
<thead>
<tr>
<th>Name:</th>
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</thead>
<tbody>
<tr>
<td>Signature:</td>
<td>Date:</td>
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</tbody>
</table>

## LICENSED CONTRACTOR'S DECLARATION
I hereby affirm that I am licensed under provisions of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code, and my license is in full force and effect.

| Signature: | Date: |

## WORKERS' COMPENSATION DECLARATION
By my initial, I hereby affirm under penalty of perjury one of the following declarations:

- I have and will maintain a certificate of consent to self-insure for workers' compensation, issued by the Director of Industrial Relations as provided for by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.
- Certificate No.: 
- I have and will maintain workers' compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.
- I certify that, in the performance of the work for which this permit is issued, I shall not employ any person in any manner so as to become subject to the workers' compensation laws of California, and agree that, if I should become subject to the workers' compensation provisions of Section 3700 of the Labor Code, I shall forthwith comply with those provisions.

| Signature: | Date: |

## CONSTRUCTION LENDING AGENCY
I hereby affirm under penalty of perjury that there is a construction lending agency for the performance of the work for which this permit is issued in accordance with the requirements of Section 8172 of the California Civil Code.

| Lending Agency Name: |

## AUTHORIZATION OF ENTRY
I certify that I have read this application and state that the information given is correct. I agree to comply with all federal and state laws and city ordinances relating to building construction, and I authorize a representative of this City to enter upon the property for which I have applied for this permit for the purpose of making inspections.

<table>
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<tr>
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**ELECTRICAL PERMIT APPLICATION**

**OWNER BUILDER DECLARATION**
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Name: [ ]
Signature: [ ] Date: [ ]

**LICENSED CONTRACTOR'S DECLARATION**
I hereby affirm that I am licensed under provisions of Chapter 9 (commencing with Section 7600) of Division 3 of the Business and Professions Code, and my license is in full force and effect.

Signature: [ ] Date: [ ]

**WORKERS' COMPENSATION DECLARATION**
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- I have and will maintain a certificate of consent to self-insure for workers' compensation, issued by the Director of Industrial Relations as provided for by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.
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Signature: [ ] Date: [ ]

**CONSTRUCTION LENDING AGENCY**
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Lending Agency Name: [ ]

**AUTHORIZATION OF ENTRY**
I certify that I have read this application and state that the information given is correct. I agree to comply with all federal and state laws and city ordinances relating to building construction, and I authorize a representative of this City to enter upon the property for which I have applied for this permit for the purpose of making inspections.

Name: [ ]
Signature: [ ] Date: [ ]
Instructions

1. Fire Department Over the counter Plan checks are optional for solar systems complying with 2015 California Solar permitting guidebook. Although they are optional, they are highly recommended in order to ensure field inspection goes smoothly. Over the counter inspections are available on Mondays and Thursdays by appointment-call (626) 570-5193 to schedule. These are available at a cost of 75/hour-payable on the day of plan check.

2. Fire Department Inspections are required and available by appointment on Tuesdays and Wednesdays. See item number four for fees.

3. Answer the following Checklist; any “NO” answers will disqualify the project from the expedited plan check process and will require the normal plan check process.

4. If all of the bottom were answered with a “YES” Pay $75 at Building department or Fire department and call (626) 570-5193 to schedule the required fire safety Inspection. Proof of payment will be required at inspection site.

Fire Department Checklist

☐ Does the system comply with the minimum requirements per the Solar Permitting guide book for expediting?

☐ Does the installation comply with the roof layouts provided at ------------?(location to be posted online)

☐ Are verbatim notes provided? Download at----?

☐ Will the project be able to comply with the above-noted verbatim notes?

☐ Are AC/DC inverters, AC and DC shutoffs next to each other and on the same wall? If not, is there a correctly oriented (oriented so the building lines up in the same direction as the picture) pictorial directory provided?
This information bulletin is published to guide applicants through a streamlined permitting process for solar photovoltaic (PV) projects 10 kW in size or smaller. This bulletin provides information about submittal requirements for plan review, required fees and inspections.

1. **Approval Requirements**

   The following permits are required to install a solar PV system with a maximum power output of 10 kW or less:
   
   a) BUILDING PERMIT
   
   b) ELECTRICAL PERMIT

   Fire Department approval is NOT required for solar PV installations of this size.

2. **Submittal Requirements**

   a) Completed permit application (Building and Electrical Application)

   b) Demonstrate compliance with the eligibility checklist for expedited permitting. *(Form- Solar 1)*

   c) Completed expedited Structural Criteria along with required documentation. *(Form- Solar 2)*

   d) A completed Standard Electrical Plan. The standard plan shall be used for proposed solar installations 10 kW in size or smaller.

   A roof plan showing roof layout, PV panels and the following fire safety items: approximate location of roof access point, location of code-compliant access pathways, PV system fire classification and the locations of all required labels and markings. Examples of clear path access pathways are available in the State Fire Marshal Solar PV Installation Guide.  
   
   [http://osfm.fire.ca.gov/pdf/reports/solarphotovoltaicguideline.pdf](http://osfm.fire.ca.gov/pdf/reports/solarphotovoltaicguideline.pdf)

   *(Form- Solar 3 if Microinverter and ACM Systems proposed or Form- Solar 4 if Central/String Inverter Systems proposed)*

3. **Plan Review**

   Permit applications can be submitted to the Building Department in person or through mail along with a payment for plan check fee **ONLY**.

4. **Fees**

   PLAN CHECK FEE $227.20  PERMIT FEES $251.22

5. **Inspections**

   Once all permits to construct the solar installation have been issued and the system has been installed, it must be inspected before final approval is granted for the solar system. On-site inspections can be scheduled by contacting the Building Department by telephone at (626) 570 3240. Inspection requests received within business hours until 2.30 pm are typically scheduled for the next business day. If next
business day is not available, inspection should happen within a five-day window. Applicant shall also contact Fire Department by telephone at (626) 570 5193 to schedule fire department inspection.

To schedule inspections on the same day, we strongly advise applicants to contact first Fire Department to schedule the inspections considering Fire Department only provide inspections on Tuesdays and Thursdays. Once fire department inspection scheduled you may call building department inspection request line prior 2.30 pm and you may schedule building inspection for the next business day.

Permit holders must be prepared to show conformance with all technical requirements in the field at the time of inspection. The inspector will verify that the installation is in conformance with applicable code requirements and with the approved plans.

The inspection checklist provides an overview of common points of inspection that the applicant should be prepared to show compliance. If not available, common checks include the following.

- Number of PV modules and model number match plans and specification sheets number match plans and specification sheets.
- Array conductors and components are installed in a neat and workman-like manner.
- PV array is properly grounded.
- Electrical boxes are accessible and connections are suitable for environment.
- Array is fastened and sealed according to attachment detail.
- Conductors ratings and sizes match plans.
- Appropriate signs are properly constructed, installed and displayed, including the following.
  - Sign identifying PV power source system attributes at DC disconnect
  - Sign identifying AC point of connection
  - Sign identifying switch for alternative power system
- Equipment ratings are consistent with application and installed signs on the installation, including the following.
  - Inverter has a rating as high as max voltage on PV power source sign.
  - DC-side overcurrent circuit protection devices (OCPDs) are DC rated at least as high as max voltage on sign.
  - Switches and OCPDs are installed according to the manufacturer’s specifications (i.e., many 600VDC switches require passing through the switch poles twice in a specific way).
  - 600VDC switches require passing through the switch poles twice in a specific way).
  - Inverter is rated for the site AC voltage supplied and shown on the AC point of connection sign.
  - OCPD connected to the AC output of the inverter is rated at least 125% of maximum current on sign and is no larger than the maximum OCPD on the inverter listing label.
  - Sum of the main OCPD and the inverter OCPD is rated for not more than 120% of the bus bar rating.

6. Departmental Contact Information

For additional information regarding this permit process, please contact the Building Division at building@cityofalhambra.org or at (626) 570 5034

7. Alternative ways of expediting

Solar companies may elect to submit their own plans to be standardized.
### GENERAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. System size is 10 kW AC CEC rating or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. The solar array is roof-mounted on one- or two-family dwelling or accessory structure</td>
<td></td>
<td></td>
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<tr>
<td>C. The solar panel/module arrays will not exceed the maximum legal building height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Solar system is utility interactive and without battery storage</td>
<td></td>
<td></td>
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<tr>
<td>E. Permit application is completed and attached</td>
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<td></td>
</tr>
</tbody>
</table>

### ELECTRICAL REQUIREMENTS

No more than four photovoltaic module strings are connected to each Maximum Powerpoint Tracking (MPPT) input where source circuit fusing is included in the inverter

1. No more than two strings per MPPT input where source circuit fusing is not included
2. Fuses (if needed) are rated to the series fuse rating of the PV module
3. No more than one non-inverter-integrated DC combiner is utilized per inverter

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. For central inverter systems: No more than two inverters are utilized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. The PV system is interconnected to a single-phase AC service panel of nominal 120/220 Vac with a bus bar rating of 225 A or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. The PV system is connected to the load side of the utility distribution equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. A Solar PV Standard Plan and supporting documentation is completed and attached</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STRUCTURAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. A completed Structural Criteria and supporting documentation is attached (if required)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FIRE SAFETY REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Clear access pathways provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Fire classification solar system is provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. All required markings and labels are provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. A diagram of the roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points is completed and attached</td>
<td></td>
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</tbody>
</table>

### Notes:

1. **These criteria are intended for expedited solar permitting process.**
2. **If any items are checked NO, revise design to fit within Eligibility Checklist, otherwise permit application may go through standard process.**
STRUCTURAL CRITERIA FOR RESIDENTIAL FLUSH-MOUNTED SOLAR ARRAYS

1. ROOF CHECKS
   A. Visual Review/Contractor’s Site Audit of Existing Conditions:
      1) Is the roof a single roof without a reroof overlay? □ Y □ N
      2) Does the roof structure appear structurally sound, without signs of alterations or significant structural deterioration or sagging, as illustrated in Figure 1? □ Y □ N
   B. Roof Structure Data:
      1) Measured roof slope (e.g. 6:12):
      2) Measured rafter spacing (center-to-center):
      3) Type of roof framing (rafter or manufactured truss):
         □ Rafter □ Truss

2. SOLAR ARRAY CHECKS
   A. Flush-mounted Solar Array:
      1) Is the plane of the modules (panels) parallel to the plane of the roof? □ Y □ N
      2) Is there a 2” to 10” gap between underside of module and the roof surface? □ Y □ N
      3) Modules do not overhang any roof edges (ridges, hops, gable ends, eaves)? □ Y □ N
   B. Do the modules plus support components weigh no more than:
      4 psf for photovoltaic arrays or 5 psf for solar thermal arrays? □ Y □ N
   C. Does the array cover no more than half of the total roof area (all roof planes)? □ Y □ N
   D. Are solar support component manufacturer’s project-specific completed worksheets, tables with relevant cells circled, or web-based calculator results attached? □ Y □ N
   E. Is a roof plan of the module and anchor layout attached? (see Figure 2) □ Y □ N
   F. Downward Load Check (Anchor Layout Check):
      1) Proposed anchor horizontal spacing (see Figure 2):
         ___’-___”ft-in
      2) Horizontal anchor spacing per Table 1:
         ___’-___”ft-in
      3) Is proposed anchor horizontal spacing less than Table 1 spacing? □ Y □ N
   G. Wind Uplift Check (Anchor Fastener Check):
      1) Anchor fastener data (see Figure 3):
         a. Diameter of lag screw, hanger bolt or self-drilling screw:
            _______ inch
         b. Embedment depth of rafter:
            _______ inch
         c. Number of screws per anchor (typically one):
            _______
         d. Are 5/16” diameter lag screws with 2.5” embedment into the rafter used, OR does the anchor fastener meet the manufacturer’s guidelines? □ Y □ N

3. SUMMARY
   A. All items above are checked YES. No additional calculations are required.
   B. One or more items are checked NO. Attach project-specific drawings and calculations stamped and signed by a California-licensed Civil or Structural Engineer.

Job Address: ________________________________ Permit #: ________________________________
Contractor/Installer: __________________________ License # & Class: __________________________
Signature: __________________________ Date: ______________ Phone #: __________________________
Optional Additional Rafter Span Check Criteria

1. ROOF CHECKS

B. Roof Structure Data:

4) Measured rafter size (e.g. 13/4 x 33/4, not 2x4): _____ x _____ inch
5) Measured rafter horizontal span (see Figure 4): _____’- _____” ft-in
6) Horizontal rafter span per Table 2: _____’- _____” ft-in
7) Is measured horizontal rafter span less than Table 2 span? □ Y □ N □ Truss

<table>
<thead>
<tr>
<th>Table 1. Maximum Horizontal Anchor Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Slope</td>
</tr>
<tr>
<td>Photovoltaic Arrays (4 psf max)</td>
</tr>
<tr>
<td>Flat to 6:12</td>
</tr>
<tr>
<td>7:12 to 12:12</td>
</tr>
<tr>
<td>13:12 to 24:12</td>
</tr>
<tr>
<td>Solar Thermal Arrays (5 psf max)</td>
</tr>
<tr>
<td>Flat to 6:12</td>
</tr>
<tr>
<td>7:12 to 12:12</td>
</tr>
<tr>
<td>13:12 to 24:12</td>
</tr>
</tbody>
</table>

Solar support component manufacturer’s guidelines may be relied upon to ensure the array above the roof is properly designed, but manufacturer’s guidelines typically do NOT check to ensure that the roof itself can support the concentrated loads from the solar array. Table 1 assumes that the roof complied with the building code in effect at the time of construction, and places limits on anchor horizontal spacing to ensure that a roof structure is not overloaded under either downward loads or wind uplift loads. Note 4 below lists the basic assumptions upon which this table is based.

Table 1 Notes:

1. Anchors are also known as “stand-offs”, “feet”, “mounts” or “points of attachment”. Horizontal anchor spacing is also known as “cross-slope” or “east-west” anchor spacing (see Figure 2).
2. If anchors are staggered from row-to-row going up the roof, the anchor spacing may be twice that shown above, but no greater than 6’-0”.
3. For manufactured plated wood trusses at slopes of flat to 6:12, the horizontal anchor spacing shall not exceed 4’-0” and anchors in adjacent rows shall be staggered.
4. This table is based on the following assumptions:
   - The roof structure conformed to building code requirements at the time it was built.
   - The attached list of criteria are met.
   - Mean roof height is not greater than 40 feet.
   - Roof sheathing is at least 7/16” thick oriented strand board or plywood. 1x skip sheathing is acceptable.
   - If the dwelling is in Wind Exposure B (typical urban, suburban or wooded areas farther than 500 yards from large open fields), no more than one of the following conditions apply:
     - The dwelling is located in a special wind region with design wind speed between 115 and 130 mph per ASCE 7-10, or
     - The dwelling is located on the top half of a tall hill, provided average slope steeper is less than 15%.
   - If the dwelling is In Wind Exposure C (within 500 yards of large open fields or grasslands), all of the
• following conditions apply:
  - Design wind speed is 110 mph or less (not in a Special Wind Region), and
  - The dwelling is not located on the top half of a tall hill.
• The solar array displaces roof live loads (temporary construction loads) that the roof was originally
designed to carry.
• The Structural Technical Appendix provides additional information about analysis assumptions.

**Table 2. Roof Rafter Maximum Horizontal Span (feet - inches)**

<table>
<thead>
<tr>
<th>Assumed Vintage</th>
<th>Nominal Size</th>
<th>Actual Size</th>
<th>Non-Tile Roof ²</th>
<th>Tile Roof ³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rafter Spacing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16&quot; o.c.</td>
<td>24&quot; o.c.</td>
</tr>
<tr>
<td>Post-1960</td>
<td>2x4</td>
<td>1½&quot;x3¼&quot;</td>
<td>9'-0&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>2x6</td>
<td>1½&quot;x5½&quot;</td>
<td>14'-4&quot;</td>
<td>11'-9&quot;</td>
</tr>
<tr>
<td></td>
<td>2x8</td>
<td>1½&quot;x7¼&quot;</td>
<td>18'-2&quot;</td>
<td>14'-10&quot;</td>
</tr>
<tr>
<td>Pre-1960</td>
<td>2x4</td>
<td>1¾&quot;x3¼&quot;</td>
<td>11'-3&quot;</td>
<td>9'-9&quot;</td>
</tr>
<tr>
<td></td>
<td>2x6</td>
<td>1¾&quot;x5¼&quot;</td>
<td>17'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>2x8</td>
<td>1¾&quot;x7¼&quot;</td>
<td>22'-3&quot;</td>
<td>18'-0&quot;</td>
</tr>
</tbody>
</table>

Beyond a visual review by the Contractor checking for unusual sagging or deterioration, some CBOs may want additional assurance that the roof structure complies with structural building code requirements. Table 2 is an optional table some CBOs may elect to use to provide additional assurance by requiring a check of existing roof rafter spans, and supports optional criteria 1.B.5 and 1.B.6. For post-1960 construction, these span tables match the rafter span tables found in the 2013 California Building and Residential codes. For pre-1960 construction, the rafter span tables are based on structural calculations with lumber sizes and wood species & grade appropriate for older construction. Note 5 below lists the basic assumptions upon which this table is based.

**Table 2 Notes:**

1. See Figure 4 for definition of roof rafter maximum horizontal span.
2. “Non-tile Roof” = asphalt shingle, wood shingle & wood shake, with an assumed roof assembly weight of 10 psf.
3. “Tile Roof” = clay tile or cement tile, with an assumed roof assembly weight of 20psf
4. Unaltered manufactured plated-wood trusses may be assumed to be code compliant and meet intent of Table 2.
5. This table is based on the following assumptions:
   - Span/deflection ratio is equal to or greater than 180.
   - For post-1960 construction, wood species and grade is Douglas Fir-Larch No. 2.
   - For pre-1960 construction, wood species and grade is Douglas Fir-Larch No. 1.
   - Other wood species and/or grade are also acceptable if allowable bending stress is equal or greater to that listed above.
Figure 1. Roof Visual Structural Review (Contractor's Site Audit) of Existing Conditions.

The site auditor should verify the following:

6. No visually apparent disallowed rafter holes, notches and truss modifications as shown above.
7. No visually apparent structural decay or un-repaired fire damage.
8. Roof sag, measured in inches, is not more than the rafter or ridge beam length in feet divided by 20.

Rafters that fail the above criteria should not be used to support solar arrays unless they are first strengthened.
Figure 2. Sample Solar Panel Array and Anchor Layout Diagram (Roof Plan).

Figure 3. Typical Anchor with Lag Screw Attachment.
SCOPe: Use this plan ONLY for systems using utility-interactive Microinverters or AC Modules (ACM) not exceeding a combined system AC inverter output rating of 10 kW, with a maximum of 3 branch circuits, one PV module per inverter and with PV module ISC maximum of 10-A DC, installed on a roof of a one- or two-family dwelling or accessory structure. The photovoltaic system must interconnect to a single-phase AC service panel of 120/240 Vac with service panel bus bar rating of 225 A or less. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers or trackers. 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 section 690.3.

Manufacturers’ Specification Sheets MUST BE PROVIDED for proposed inverters, 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(D).

Applicant and Site Information

Job Address: ______________________________________________ Permit #: __________________________
Contractor /Engineer Name: _________________________________ License # and Class: _________________
Signature: _______________________________ Date: ___________ Phone Number: ____________________

1. General Requirements and System Information

☐ Microinverter
Number of PV modules installed: __________
Number of Microinverters installed: __________

☐ AC Module (ACM)
Number of ACMs installed: __________

Note: Listed Alternating-Current Module (ACM) is defined in CEC 690.2 and installed per CEC 690.6

1.1 Number of Branch Circuits, 1, 2 or 3: __________

1.2 Actual number of Microinverters or ACMs per branch circuit: 1 _______ 2. _______ 3. _______

1.3 Total AC system power rating = (Total Number of Microinverters or ACMs) * (AC inverter power output)

= __________ Watts

1.4 Lowest expected ambient temperature for this plan in Table 1: For -1 to -5°C use 1.12 or for -6 to -10°C use 1.14 correction factors.

1.5 Average ambient high temperature for this plan: = +47°C

Note: For lower expected ambient or higher average ambient high temperatures, use Comprehensive Standard Plan.

2. Microinverter or ACM Information and Ratings

Microinverters with ungrounded DC inputs shall be installed in accordance with CEC 690.35.

Microinverter or ACM Manufacturer: ______________________________
Model: ______________________________

2.1 Rated (continuous) AC output power: __________ Watts
2.2 Nominal AC voltage rating: __________ Volts

2.3 Rated (continuous) AC output current: __________ Amps

If installing ACMs, skip [STEPS 2.4]

2.4 Maximum DC input voltage rating: __________ Volts (limited to 79 V, otherwise use the Comprehensive Standard Plan)

2.5 Maximum AC output overcurrent protection device (OCPD) ___________ Amps

2.6 Maximum number of Microinverters or ACMs per branch circuit: ___________

3. PV Module Information

(If installing ACMs, skip to [STEP 4])

PV Module Manufacturer: _______________________________________________

Model: _______________________________________________________________

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

3.1 Module VOC at STC (from module nameplate): __________ Volts

3.2 Module ISC at STC (from module nameplate): ___________ Amps

3.3 Adjusted PV Module DC voltage at minimum temperature = [Table 1] __________ [cannot exceed Step 2.4]

<table>
<thead>
<tr>
<th>Microinverter Max. DC Input [STEP 2.4] (Volts)</th>
<th>34</th>
<th>37</th>
<th>40</th>
<th>43</th>
<th>46</th>
<th>49</th>
<th>52</th>
<th>55</th>
<th>58</th>
<th>61</th>
<th>64</th>
<th>67</th>
<th>70</th>
<th>73</th>
<th>76</th>
<th>79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Module VOC @ STC, 1.12 (-1 to -5°C) Correction Factor (Volts)</td>
<td>30.4</td>
<td>33.0</td>
<td>35.7</td>
<td>38.4</td>
<td>41.1</td>
<td>43.8</td>
<td>46.4</td>
<td>49.1</td>
<td>51.8</td>
<td>54.5</td>
<td>57.1</td>
<td>59.8</td>
<td>62.5</td>
<td>65.2</td>
<td>67.9</td>
<td>70.5</td>
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<tr>
<td>------------------------------------------------</td>
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<td>----</td>
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<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Max. Module VOC @ STC, 1.14 (-6 to -10°C) Correction Factor (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>
</tbody>
</table>

4. Branch Circuit Output Information

Fill in [Table 3] to describe the branch circuit inverter output conductor and OCPD size. Use [Table 2] for determining the OCPD and Minimum Conductor size.

<table>
<thead>
<tr>
<th>Circuit Current (Amps)</th>
<th>Circuit Power (Watts)</th>
<th>OCPD (Amps)</th>
<th>Minimum Conductor Size (AWG)</th>
<th>Minimum Metal Conduit Size for 6 Current Carrying Conductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>2880</td>
<td>15</td>
<td>12</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>16</td>
<td>3840</td>
<td>20</td>
<td>10</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>20</td>
<td>4800</td>
<td>25</td>
<td>8</td>
<td>1&quot;</td>
</tr>
<tr>
<td>24</td>
<td>5760</td>
<td>30</td>
<td>8</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

*CEC 690.8 and 210.19 (A)(1) Factored in Table 2, Conductors are copper, insulation must be 90°C wet-rated. Table 2 values are based on maximum ambient temperature of 69°C, which includes 22°C adder, exposed to direct sunlight, mounted > 0.5 inches above rooftop, ≤ 6 current carrying conductors (3 circuits) in a circular raceway. Otherwise use Comprehensive Standard Plan.
5. Solar Load Center (if used)

5.1 Solar Load Center is to have a bus bar rating not less than 100 Amps. Otherwise use Comprehensive Standard Plan.

5.2 Circuit Power see [STEP 1] = __________ Watts

5.3 Circuit Current = (Circuit Power) / (AC voltage) = __________ Amps

<table>
<thead>
<tr>
<th>Table 3. PV Array Configuration Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch 1</td>
</tr>
<tr>
<td>Number of Microinverters or ACMs [STEP 1]</td>
</tr>
<tr>
<td>Selected Conductor Size [Error! Reference source not found.] (AWG)</td>
</tr>
<tr>
<td>Selected Branch and Inverter Output OCPD [Error! Reference source not found.]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4. Solar Load Center and Total Inverter Output OCPD and Conductor Size**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Current (Amps)</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>28</td>
</tr>
<tr>
<td>32</td>
</tr>
<tr>
<td>36</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>41.6</td>
</tr>
</tbody>
</table>

**CEC 690.8 and 210.19 (A)(1) Factored in Table 4, Conductors are copper, insulation must be 90°C wet-rated. Table 4 values are based on maximum ambient temperature of 47°C (no rooftop temperature adder in this calculation), ≤ 3 current carrying conductors in a circular raceway. Otherwise use Comprehensive Standard Plan.

6. Point of Connection to Utility:

6.1 Load Side Connection only! Otherwise use the Comprehensive Standard Plan.

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

☐ Yes    ☐ No (If No, then use 100% row in Table 5)

6.3 Per 705.12(D)(2): (Combined inverter output OCPD size + Main OCPD size) ≤ [bus bar size × (100% or 120%)]

<table>
<thead>
<tr>
<th>Table 5. Maximum Combined Inverter Output Circuit OCPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus bar Size (Amps)</td>
</tr>
<tr>
<td>Main OCPD (Amps)</td>
</tr>
<tr>
<td>Maximum Combined Inverter OCPD with 120% of bus bar rating (Amps) 20</td>
</tr>
<tr>
<td>Maximum Combined Inverter OCPD with 100% of bus bar rating (Amps)</td>
</tr>
</tbody>
</table>

†This plan limits the maximum system size to less than 10 kW, therefore the OCPD size is limited to 60 A. Reduction of Main Breaker is not permitted
with this plan.
7. Grounding and Bonding
Check one of the boxes for whether system is grounded or ungrounded:  
☐ Grounded  ☐ Ungrounded
For Microinverters with a grounded DC input, systems must follow the requirements of GEC (CEC 690.47) and EGC (CEC 690.43).
For ACM systems and Microinverters with ungrounded a DC input follow the EGC requirements of (CEC 690.43).

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

9. Single-Inverter Line Diagram

Equipment Schedule

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION: (Provide model # if provided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solar PV Module or ACM:</td>
</tr>
<tr>
<td>2</td>
<td>Microinverter (if not ACM):</td>
</tr>
<tr>
<td>3</td>
<td>Junction Box(es):</td>
</tr>
<tr>
<td>4</td>
<td>Solar Load Center, Yes / No:</td>
</tr>
<tr>
<td>5</td>
<td>Performance Meter Yes / No:</td>
</tr>
<tr>
<td>6</td>
<td>Utility External Disconnect Switch Yes / No:</td>
</tr>
<tr>
<td>7</td>
<td>Main Electrical Service Panel</td>
</tr>
</tbody>
</table>

Single-Line Diagram for Microinverters or ACMs

Check a box for dc system grounding: □ Grounded, □ Ungrounded
For ungrounded dc power systems, EGC is required
For grounded dc power systems, GEC & EGC are required
Refer to CEC 250.120 for EGC installation & Table 250.122 for sizing

* Consult with your local AHJ and/or Utility

Conductor, Cable and Conduit Schedule

<table>
<thead>
<tr>
<th>TAG</th>
<th>Description and Conductor Type: (Table 3)</th>
<th>Conductor Size</th>
<th>Number of Conductors</th>
<th>Conduit/Conductor/Cable Type</th>
<th>Conduit Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Current-Carrying Conductors: (for each branch circuit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GEC (when required):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Current-Carrying Conductors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GEC (when required):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points.
Solar PV Standard Plan – Simplified
Central/String Inverter Systems for
One- and Two-Family Dwellings

**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 (noninverter-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[D]).

**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.)

1. **Inverter 1 AC Output Power Rating:** _________________ Watts
2. **Inverter 2 AC Output Power Rating (if applicable):** ____________ Watts
3. **Combined Inverter Output Power Rating:** _________________ ≤ 10,000 Watts

**Location Ambient Temperatures** (Check box next to which lowest expected temperature is used):

1) ☐ Lowest expected ambient temperature for the location \( T_L \) = **Between -1 to -5 °C**
   - ☐ Lowest expected ambient temperature for the location \( T_L \) = **Between -6 to -10 °C**

   Average ambient high temperature \( T_H = 47 °C \)

   *Note:* For a lower \( T_L \) or a higher \( T_H \), use the Comprehensive Standard Plan

**DC Information:**

<table>
<thead>
<tr>
<th>Module Manufacturer: ____________________________</th>
<th>Model: ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Module ( V_{oc} ) (from module nameplate): _____ Volts</td>
<td>3) Module ( I_{sc} ) (from module nameplate): _____ Amps</td>
</tr>
<tr>
<td>4) Module DC output power under standard test conditions (STC) = ________ Watts (STC)</td>
<td></td>
</tr>
</tbody>
</table>
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>
</tr>
</thead>
<tbody>
<tr>
<td>Identify, by tag, which source circuits on the roof are to be paralleled (if none, put N/A)</td>
</tr>
<tr>
<td>Combiner 1:</td>
</tr>
<tr>
<td>Combiner 2:</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>DC/DC Converter Model #:</th>
<th>DC/DC Converter Max DC Input Voltage: __________ Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max DC Output Current:</td>
<td>Max DC Output Voltage: __________ Volts</td>
</tr>
<tr>
<td>Max # of DC/DC Converters in an Input Circuit:</td>
<td>DC/DC Converter Max DC Input Power: __________ Watts</td>
</tr>
</tbody>
</table>

7) **Max. System DC Voltage** — Use A1 or A2 for systems without DC/DC converters, and B1 or B2 with DC/DC converters.

□ A1. Module $V_{OC}$ (STEP 2) = __________ x # in series (STEP 5) __________ x 1.12 (If $-1 \leq T_L \leq -5^\circ C$, STEP 1) = __________ V

□ A2. Module $V_{OC}$ (STEP 2) = __________ x # in series (STEP 5) __________ x 1.14 (If $-6 \leq T_L \leq -10^\circ C$, STEP 1) = __________ V

<table>
<thead>
<tr>
<th>Table 1. Maximum Number of PV Modules in Series Based on Module Rated $V_{OC}$ for 600 Vdc Rated Equipment (CEC 690.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Rated Module $V_{OC}$ (*1.12) (Volts)</td>
</tr>
<tr>
<td>29.76</td>
</tr>
<tr>
<td>Max. Rated Module $V_{OC}$ (*1.14) (Volts)</td>
</tr>
<tr>
<td>29.24</td>
</tr>
<tr>
<td>Max # of Modules for 600 Vdc</td>
</tr>
<tr>
<td>18</td>
</tr>
</tbody>
</table>

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

□ B1. Module $V_{OC}$ (STEP 2) __________ x # of modules per converter (STEP 6) __________ x 1.12 (If $-1 \leq T_L \leq -5^\circ C$, STEP 1) = __________ V

□ B2. Module $V_{OC}$ (STEP 2) __________ x # of modules per converter (STEP 6) __________ x 1.14 (If $-6 \leq T_L \leq -10^\circ C$, STEP 1) = __________ V

<table>
<thead>
<tr>
<th>Table 2. Largest Module $V_{OC}$ for Single-Module DC/DC Converter Configurations (With 80V AFCI Cap) (CEC 690.7 and 690.11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Rated Module $V_{OC}$ (*1.12) (Volts)</td>
</tr>
<tr>
<td>30.4</td>
</tr>
<tr>
<td>Max. Rated Module $V_{OC}$ (*1.14) (Volts)</td>
</tr>
<tr>
<td>29.8</td>
</tr>
<tr>
<td>DC/DC Converter Max DC Input (STEP #6) (Volts)</td>
</tr>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

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

Maximum System DC Voltage = __________ Volts

9) **Maximum Source Circuit Current**

Is Module $I_{SC}$ below 9.6 Amps (STEP 3)? □ Yes □ No (if No, use Comprehensive Standard Plan)
10) 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.

11) 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 13.
If Yes, use Single Line Diagram 2 with Single Line Diagram 4 and proceed to STEP 12.
Is source circuit OCPD required? □ Yes □ No
Source circuit OCPD size (if needed): 15 Amps

12) Sizing PV Output Circuit Conductors – If a combiner box will NOT be used from [STEP 11],
Output Circuit Conductor Size = Min. #6 AWG copper conductor

13) Inverter DC Disconnect
Does the inverter have an integrated DC disconnect? □ Yes □ No
If yes, proceed to STEP 14.
If no, the external DC disconnect to be installed is rated for _______ Amps (DC) and _______ Volts (DC)

14) Inverter information
Manufacturer: ____________________________________________ Model: ______________________________
Max. Continuous AC Output Current Rating: _______Amps
Integrated DC Arc-Fault Circuit Protection? □ Yes □ No (If No is selected, Comprehensive Standard Plan)
Grounded or Ungrounded System: □ Grounded □ Ungrounded

AC Information:

15) 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#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>

Integrated DC Arc-Fault Circuit Protection? □ Yes □ No (If No is selected, Comprehensive Standard Plan)
Grounded or Ungrounded System? □ Grounded □ Ungrounded
16) Point of Connection to Utility

Only load side connections are permitted with this plan. Otherwise, use Comprehensive Standard Plan.

Is the PV OCPD positioned at the opposite end from input feeder location or main OCPD location? ☐ Yes ☐ No

If Yes, circle the Max Combined PV System OCPD(s) at 120% value as determined from STEP 15 (or STEP S20), bus bar Rating, and Main OCPD as shown in Table 4.

If No, circle the Max Combined PV System OCPD(s) at 100% value as determined from STEP 15 (or STEP S20), bus bar Rating, and Main OCPD as shown in Table 4.

Per 705.12(D)(2): [Inverter output OCPD size [STEP #15 or S20] + Main OCPD Size]≤[bus size × (100% or 120%)]

<table>
<thead>
<tr>
<th>Table 4. Maximum Combined Supply OCPDs Based on Bus Bar Rating (Amps) per CEC 705.12(D)(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus bar Rating</td>
</tr>
<tr>
<td>Main OCPD</td>
</tr>
<tr>
<td>Max Combined PV System OCPD(s) at 120% of bus bar Rating</td>
</tr>
<tr>
<td>Max Combined PV System OCPD(s) at 100% of bus bar Rating</td>
</tr>
</tbody>
</table>

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

Reduction of the main breaker is not permitted with this plan. Otherwise, use Comprehensive Standard Plan.

17 & 18 & 19) Labels and Grounding and Bonding

This content is covered by the labels on Page 4 and the Single Line Diagram(s). For background information, refer to the Comprehensive Standard Plan.
CEC Articles 690 and 705 and 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)(7)
[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**

CRC R331.2 and CFC 605.11.1
[Marked on junction/combiner boxes and conduit every 10']

**WARNING**

**ELECTRIC SHOCK HAZARD**
IF A GROUND FAULT IS INDICATED, NORMALY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

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

**WARNING**

**PV SYSTEM DC DISCONNECT**
RATED MAX POWER-POINT CURRENT- ___ADC
RATED MAX POWER-POINT VOLTAGE- ___VDC
SHORT CIRCUIT CURRENT- ___ADC
MAXIMUM SYSTEM VOLTAGE- ___VDC

CEC 690.53

**WARNING**

**DUAL POWER SOURCES**
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
RATED AC OUTPUT CURRENT- ___AMPS
AC NORMAL OPERATING VOLTAGE- ___VOLTS

CEC 690.54 & CEC 705.12(D)(4)

**PV SYSTEM AC DISCONNECT**
RATED AC OUTPUT CURRENT- ___AMPS
AC NORMAL OPERATING VOLTAGE- ___VOLTS

CEC 690.54

**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

**WARNING**

**PHOTOVOLTAIC SYSTEM AC DISCONNECT**
RATED MAX POWER-POINT CURRENT- ___ADC
RATED MAX POWER-POINT VOLTAGE- ___VDC
SHORT CIRCUIT CURRENT- ___ADC
MAXIMUM SYSTEM VOLTAGE- ___VDC

CEC 690.54 & CEC 705.12(D)(4)

**WARNING**

**DUAL POWER SOURCES**
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
RATED AC OUTPUT CURRENT- ___AMPS
AC NORMAL OPERATING VOLTAGE- ___VOLTS

CEC 690.54 & CEC 705.12(D)(4)

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

**Code Abbreviations:**
California Electrical Code (CEC)
California Residential Code (CRC)
California Fire Code (CFC)

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.
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 LOAD CENTER INSTALLED: YES / NO
- PV PRODUCTION METER INSTALLED: YES / NO
- SEPARATE AC DISCONNECT INSTALLED: YES / NO

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

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>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>

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

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 LOAD CENTER INSTALLED?  YES / NO
PV PRODUCTION METER INSTALLED?  YES / NO
SEPARATE AC DISCONNECT INSTALLED?  YES / NO

CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:
GROUND (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

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

COMBINER CONDUCTOR/CONDUIT SCHEDULE

TAG | DESCRIPTION AND CONDUCTOR TYPE | CONDUCTOR SIZE | NUMBER OF CONDUCTORS | CONDUIT/CABLE TYPE | CONDUIT SIZE
--- | --- | --- | --- | --- | ---
A2 | 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)
### Solar PV Standard Plan — Simplified
### Central/String Inverter Systems for One- and Two-Family Dwellings
### Supplemental Calculation Sheets for Inverter #2
*(Only include if second inverter is used)*

#### DC Information:

<table>
<thead>
<tr>
<th>Module Manufacturer: __________________________</th>
<th>Model: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2) Module ( V_{oc} ) (from module nameplate): _____ Volts</td>
<td>S3) Module ( I_{sc} ) (from module nameplate): _____ Amps</td>
</tr>
<tr>
<td>S4) Module DC output power under standard test conditions (STC) = ________ Watts (STC)</td>
<td></td>
</tr>
</tbody>
</table>

#### 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>
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</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>DC/DC Converter Model #: __________________________</th>
<th>DC/DC Converter Max DC Input Voltage: ________ Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max DC Output Current: __________________________ Amps</td>
<td>Max DC Output Voltage: ________ Volts</td>
</tr>
<tr>
<td>Max # of DC/DC Converters in a source circuit: ________</td>
<td>DC/DC Converter Max DC Input Power: ________ Watts</td>
</tr>
</tbody>
</table>

---

---
Max. System DC Voltage – Use A1 or A2 for systems without DC/DC converters, and B1 or B2 with DC/DC converters.

- A1. Module \( V_{OC} \) (STEP S2) = \( \text{________} \times \text{# in series (STEP S5)} \times 1.12 \) (If \(-1\leq T_L\leq-5^\circ C, STEP S1) = \( \text{______ V} \)
- A2. Module \( V_{OC} \) (STEP S2) = \( \text{________} \times \text{# in series (STEP S5)} \times 1.14 \) (If \(-6\leq T_L\leq-10^\circ C, STEP S1) = \( \text{______ V} \)

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 |

Use for DC/DC converters. The value calculated below must be less than DC/DC converter max DC input voltage (STEP #S6).

- B1. Module \( V_{OC} \) (STEP #S2) \( \text{______} \times \text{# of modules per converter (STEP S6)} \times 1.12 \) (If \(-1\leq T_L\leq-5^\circ C, STEP S1) = \( \text{______ V} \)
- B2. Module \( V_{OC} \) (STEP #S2) \( \text{______} \times \text{# of modules per converter (STEP S6)} \times 1.14 \) (If \(-6\leq T_L\leq-10^\circ C, STEP S1) = \( \text{______ V} \)

Table 2. Largest Module \( V_{OC} \) for Single-Module DC/DC Converter Configurations (With 80V 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 |

Maximum System DC Voltage from DC/DC Converters to Inverter – Only required if Yes in STEP S6

Maximum System DC Voltage = \( \text{________} \) Volts

Maximum Source Circuit Current

Is Module ISC below 9.6 Amps (STEP S3)? 
- Yes
- No (if No, use Comprehensive Standard Plan)

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.

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 S13.
If Yes, use Single Line Diagram 2 with Single Line Diagram 4 and proceed to STEP S12.

Is source circuit OCPD required? 
- Yes
- No
Source circuit OCPD size (if needed): 15 Amps

Sizing PV Output Circuit Conductors – If a Combiner box will NOT be used from [STEP#S11],
Output Circuit Conductor Size = Min. #6 AWG copper conductor

Inverter DC Disconnect
Does the inverter have an integrated DC disconnect? 
- Yes
- No
If yes, proceed to STEP S14.
If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)
S14) Inverter information:
Manufacturer: __________________________ Model: ________________________________
Max. Continuous AC Output Current Rating: ______ Amps
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>
<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)

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

The sum of the ampere ratings of overcurrent devices in circuits supplying power to a bus bar or conductor shall not exceed 120 percent of the rating of the bus bar or conductor.
Solar PV Standard Plan – Simplified
Central/String Inverter System for One- and Two-Family Dwellings

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.

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

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 □ EGC/EGC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>EGC/EGC:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>EGC/EGC:</td>
<td></td>
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</tr>
</tbody>
</table>

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

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

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 3

* Consult with your local AHJ and/or Utility

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>
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<tr>
<td></td>
<td>EGC/GEC:</td>
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<tr>
<td>B1</td>
<td>EGC/GEC:</td>
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<td>C</td>
<td>EGC/GEC:</td>
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<tr>
<td>D</td>
<td>EGC/GEC:</td>
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</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>
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<tr>
<td></td>
<td>EGC/GEC:</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>EGC/GEC:</td>
<td></td>
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</tr>
</tbody>
</table>

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

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

IF DC/DC CONVERTERS ARE USED, THEY ARE RUN IN SERIES (FIXED SOURCE CIRCUIT/VOLTAGE DC/DC CONVERTERS).
Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points.
GABLE
SINGLE RIDGE

AREA AVAILABLE FOR
SOLAR PANELS

NO WINDOWS, DOORS, OPENINGS
OR OVERHEAD OBSTRUCTIONS
FLAT ROOF "SPANISH"

AREA AVAILABLE FOR SOLAR PANELS

VENTILATION/ACCESS

WALL/PARAPET
FLAT-ROOF-HIP / FLAT-ROOF-HIPS & VALLEYS
ROOF PITCH 2:12 OR LESS
COMBO FLAT, HIP, GABLE

- **Flat Roof**
- **Area Available for Solar Panels**
- **No Windows, Doors, Openings, or Overhead Obstructions**
- **Ventilation Access**

Dimensions and labels are indicated on the diagram.