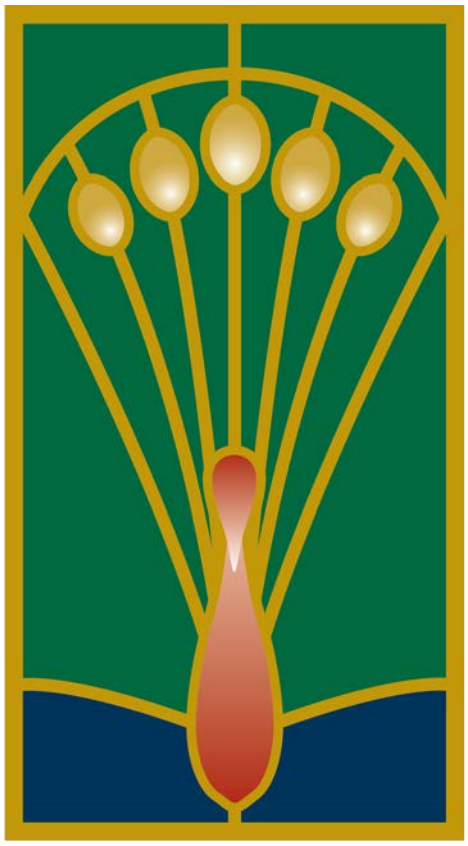
City of Arcadia Solar Permitting Guidebook

Fall 2014
Second Edition



CITY OF
ARCADIA

PV Toolkit for Local Governments

Template permitting documents that local governments can edit are available at

energycenter.org/permittingtoolkit

TOOLKIT DOCUMENT #1

Submittal Requirements Bulletin — Solar Photovoltaic Installations 10 kW or Less in One- and Two-Family Dwellings

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.

*Note: Language in **ALL CAPS** below indicates where local jurisdictions need to provide information specific to the jurisdiction. Language in italics indicates explanatory notes from the authors of this Guidebook.*

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) [LIST TYPE OF PERMIT(S) REQUIRED BY THE LOCAL JURISDICTION, i.e., ELECTRICAL OR BUILDING PERMIT].

Planning review [IS/IS NOT] required for solar PV installations of this size.
Fire Department approval [IS/IS NOT] required for solar PV installations of this size.

2. Submittal Requirements

a) Completed permit application form. This permit application form can be downloaded at [WEBSITE ADDRESS].

b) Demonstrate compliance with the eligibility checklist for expedited permitting. These criteria can be downloaded at [WEBSITE ADDRESS].

This Guidebook recommends use of a simple checklist to clearly identify eligibility criteria for expedited permitting, where established.

c) A completed Standard Electrical Plan. The standard plan may be used for proposed solar installations 10 kW in size or smaller and can be downloaded at [WEBSITE ADDRESS].

This Guidebook recommends use of a standard plan that allows permit applicants to simply fill in information regarding a solar system's electrical configuration. Template standard plans are provided in this Guidebook (Toolkit Documents 3 and 4).

If standard electrical plans are not provided for use, an electrical plan should be submitted that includes the following.

- *Locations of main service or utility disconnect*
- *Total number of modules, number of modules per string and the total number of strings*
- *Make and model of inverter(s) and/or combiner box if used*
- *One-line diagram of system*
- *Specify grounding/bonding, conductor type and size, conduit type and size and number of conductors in each section of conduit*
- *If batteries are to be installed, include them in the diagram and show their locations and venting*

- *Equipment cut sheets including inverters, modules, AC and DC disconnects, combiners and wind generators*
- *Labeling of equipment as required by CEC, Sections 690 and 705*
- *Site diagram showing the arrangement of panels on the roof or ground, north arrow, lot dimensions and the distance from property lines to adjacent buildings/structures (existing and proposed)*

d) 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**.

e) Completed expedited Structural Criteria along with required documentation. Structural Criteria can be downloaded at [WEBSITE ADDRESS].

For non-qualifying systems, provide structural drawings and calculations stamped and signed by a California-licensed Civil or Structural Engineer, along with the following information.

- The type of roof covering and the number of roof coverings installed
- Type of roof framing, size of members and spacing
- Weight of panels, support locations and method of attachment
- Framing plan and details for any work necessary to strengthen the existing roof structure
- Site-specific structural calculations
- Where an approved racking system is used, provide documentation showing manufacturer of the rack system, maximum allowable weight the system can support, attachment method to the roof or ground and product evaluation information or structural design for the rack system

This Guidebook recommends that local jurisdictions adopt a prescriptive approach to establishing minimal structural requirements that avoids the need for structural calculations. A simple list of criteria is provided in this Guidebook (Toolkit Document 5). A full explanation of the methods and calculations used to produce these criteria can be found in the Structural Technical Appendix for Residential Rooftop Solar Installations, which is available at **http://www.opr.ca.gov/docs/Solar_Structural_Technical_Appendix.pdf**.

3. Plan Review

Permit applications can be submitted to [DEPARTMENT NAME] in person at [ADDRESS] and [IF APPLICABLE] electronically through the following website: [WEBSITE/EMAIL/FAX].

Permit applications utilizing standard plan may be approved "over the counter" at [ADDRESS]. Permit applications may also be submitted electronically for "over the counter" approval [IF APPLICABLE] at the following website: [WEBSITE/EMAIL/FAX].

Permits not approved "over the counter" should be reviewed in [ONE TO THREE] days.

4. Fees

[PROVIDE CLEAR FEE SCHEDULE]

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 [DEPARTMENT] by telephone at [PHONE NUMBER] or electronically at [WEBSITE OR EMAIL ADDRESS]. Inspection requests received within business hours are typically scheduled for the next business day. If next business day is not available, inspection should happen within a five-day window.

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 property 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).
  - 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 consult our departmental website at [WEBSITE] or contact [DIVISION NAME] at [PHONE NUMBER].

GENERAL REQUIREMENTS

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

ELECTRICAL REQUIREMENTS

A.	No more than four photovoltaic module strings are connected to each Maximum Power Point Tracking (MPPT) input where source circuit fusing is included in the inverter	☐ Y	☐ N
	1) No more than two strings per MPPT input where source circuit fusing is not included	☐ Y	☐ N
	2) Fuses (if needed) are rated to the series fuse rating of the PV module	☐ Y	☐ N
	3) No more than one noninverter-integrated DC combiner is utilized per inverter	☐ Y	☐ N
B.	For central inverter systems: No more than two inverters are utilized	☐ Y	☐ N
C.	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	☐ Y	☐ N
D.	The PV system is connected to the load side of the utility distribution equipment	☐ Y	☐ N
E.	A Solar PV Standard Plan and supporting documentation is completed and attached	☐ Y	☐ N

STRUCTURAL REQUIREMENTS

A.	A completed Structural Criteria and supporting documentation is attached (if required)	☐ Y	☐ N

FIRE SAFETY REQUIREMENTS

A.	Clear access pathways provided	☐ Y	☐ N
B.	Fire classification solar system is provided	☐ Y	☐ N
C.	All required markings and labels are provided	☐ Y	☐ N
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	☐ Y	☐ N

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.*

Your City logo here

TOOLKIT DOCUMENT #3

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.)

Inverter 1 AC Output Power Rating: _____ Watts

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

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:

Module Manufacturer:_____ Model: _____	
2) Module V_{oc} (from module nameplate):_____ Volts	3) Module I_{sc} (from module nameplate):_____ Amps
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	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:		

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 — 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 $-1 \le T_L \le -5°C$, STEP 1) = V

☐ A2. Module V_{OC} (STEP 2) = x # in series (STEP 5) x 1.14 (If $-6 \le T_L \le -10°C$, 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

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 $-1 \le T_L \le -5°C$, STEP 1) = V

☐ B2. Module V_{OC} (STEP 2) = x # of modules per converter (STEP 6) x 1.14 (If $-6 \le T_L \le -10°C$, 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) 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 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 (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									
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

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 x (100% or 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
Max Combined PV System OCPD(s) at 100% Bus Bar Rating	0	25	0	50	25	0	50	25	0

*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.

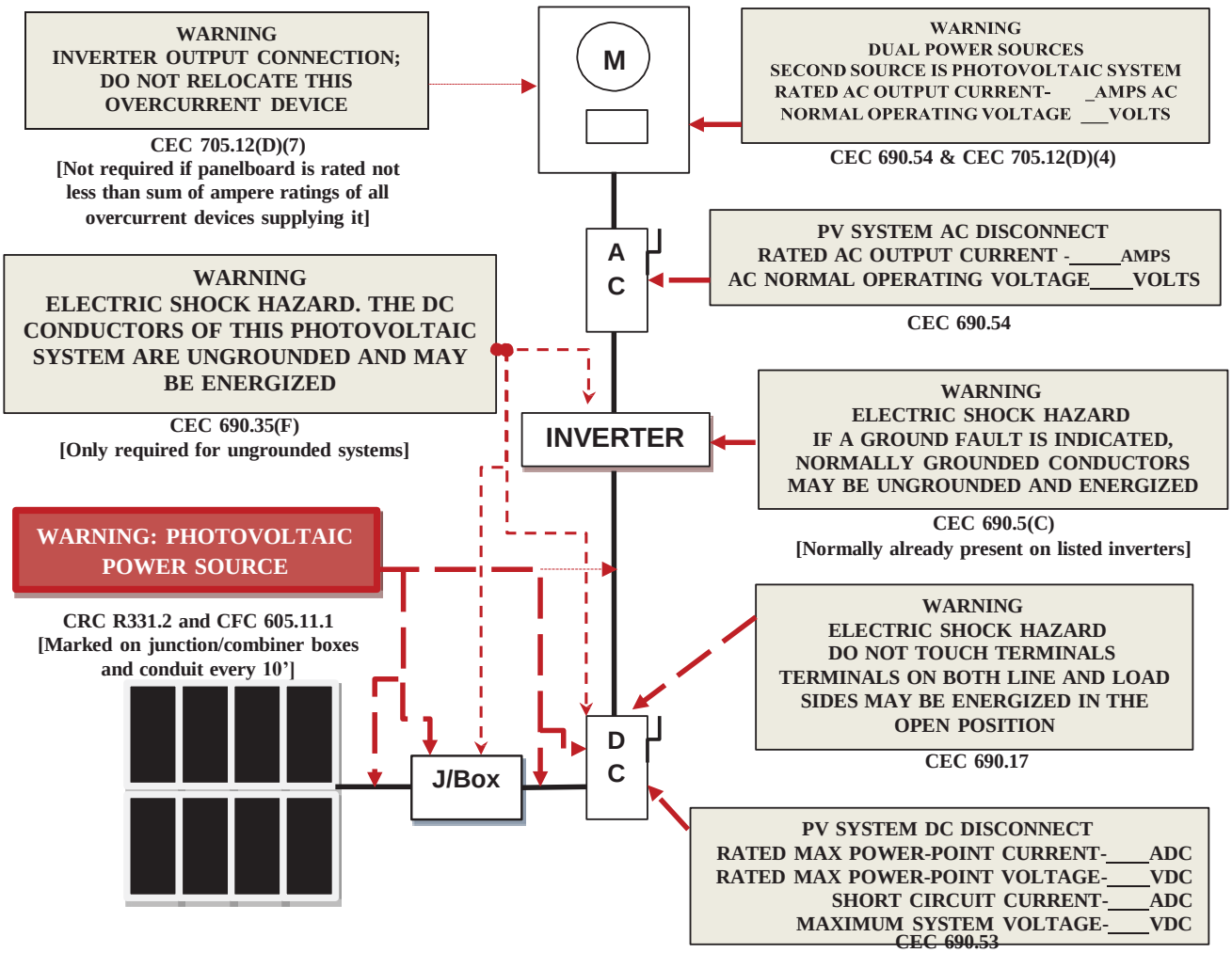
17 & 18 & 19) Labels and Grounding and Bonding

This content is covered by the labels on the next page and the Single Line Diagram(s). For background information, refer to the Comprehensive Standard Plan.

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

Markings

CEC Articles 690 and 705 and CRC Section R331 require the following labels or markings be installed at these components of the photovoltaic system:



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.

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 Systems for One- and Two-Family Dwellings

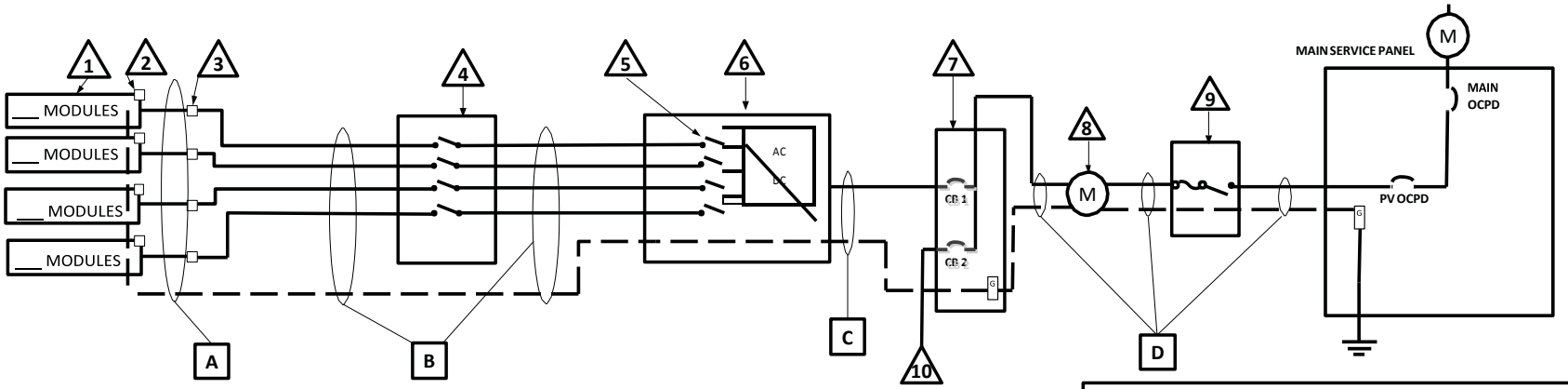
TAG	DESCRIPTION
1	SOLAR PV MODULE / STRING
2	DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)
3	SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO
4	SEPARATE DC DISCONNECT INSTALLED?: YES / NO
5	INTERNAL INVERTER DC DISCONNECT: YES / NO
6	CENTRAL INVERTER
7	LOAD CENTER INSTALLED?: YES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

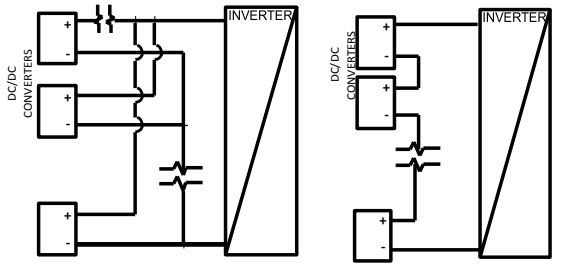
FOR UNGROUNDED SYSTEMS:
- DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT
- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.



☐					

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 Systems for One- and Two-Family Dwellings

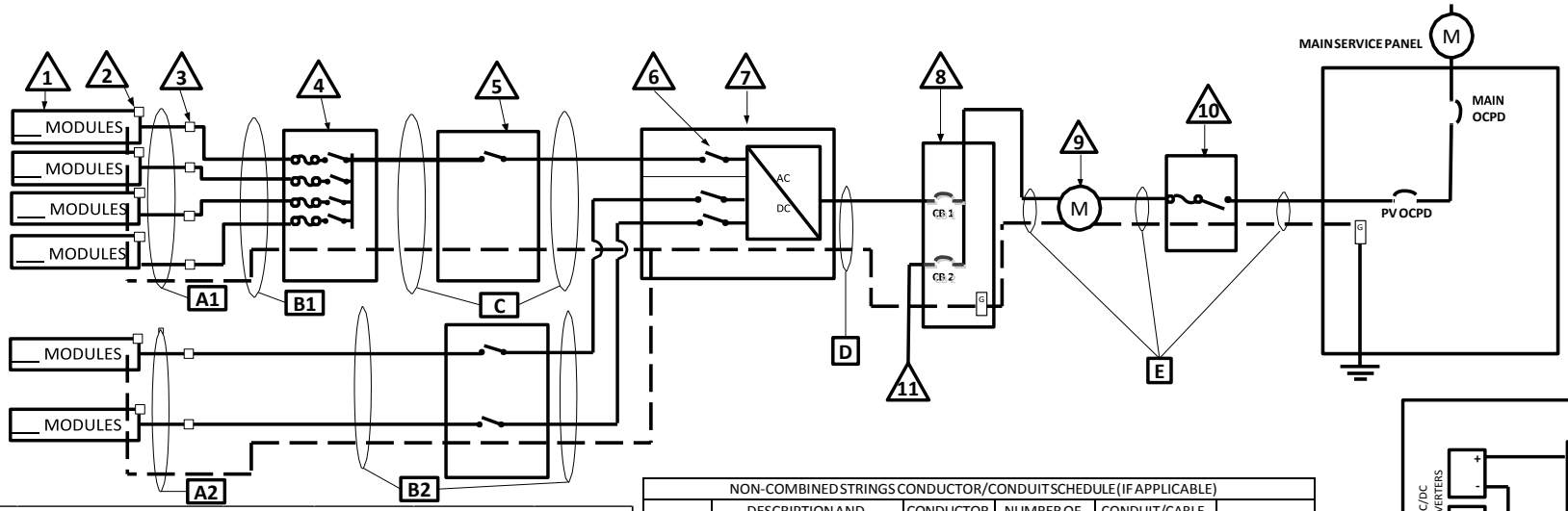
TAG	DESCRIPTION
1	SOLAR PV MODULE / STRING
2	DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)
3	SOURCE CIRCUIT JUNCTION BOX INSTALLED?: YES / NO
4	COMBINER BOX (STEPS 11 & 12 REQUIRED)
5	SEPARATE DC DISCONNECT INSTALLED?: YES / NO
6	INTERNAL INVERTER DC DISCONNECT: YES / NO
7	CENTRAL 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.

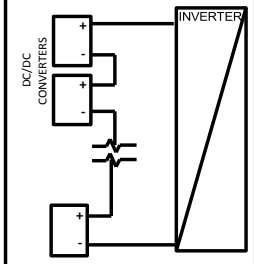


☐					

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:

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

S7) Maximum 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) = x # in series (STEP S5) x 1.12 (If $-1 \le T_L \le -5°C$, STEP S1) = V

☐ A2. Module V_{OC} (STEP S2) = x # in series (STEP S5) x 1.14 (If $-6 \le T_L \le -10°C$, STEP S1) = 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) = x # of modules per converter (STEP S6) x 1.12 (If $-1 \le T_L \le -5°C$, STEP S1) = V

☐ B2. Module V_{OC} (STEP S2) = x # of modules per converter (STEP S6) x 1.14 (If $-6 \le T_L \le -10°C$, STEP S1) = 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

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

Maximum System DC Voltage =_____Volts

S9) Maximum Source Circuit Current

Is Module ISC below 9.6 Amps (Step S3)? ☐ Yes ☐ No (If No, use Comprehensive Standard Plan)

S10) 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.

S11) Are PV source circuits combined prior to the inverter? ☐ Yes ☐ No

If No, use Single Line Diagram 1 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

S12) Sizing PV Output Circuit Conductors — If a combiner box will NOT be used (Step S11),

Output Circuit Conductor Size = Min. #6 AWG copper conductor

S13) 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 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

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 Systems 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

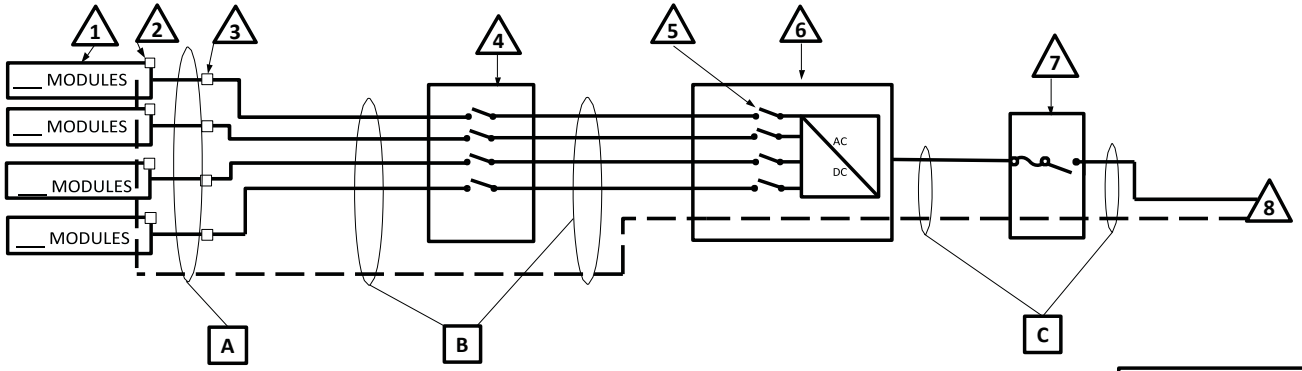
* Consult with your local AHJ and /or Utility

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**

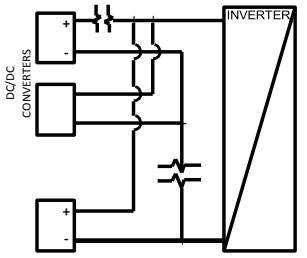
FOR UNGROUNDED SYSTEMS:
- **DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT**
- **UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.**



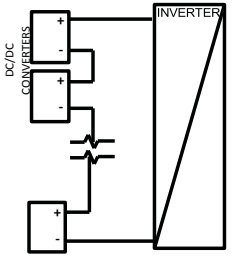
☐					

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 Systems 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

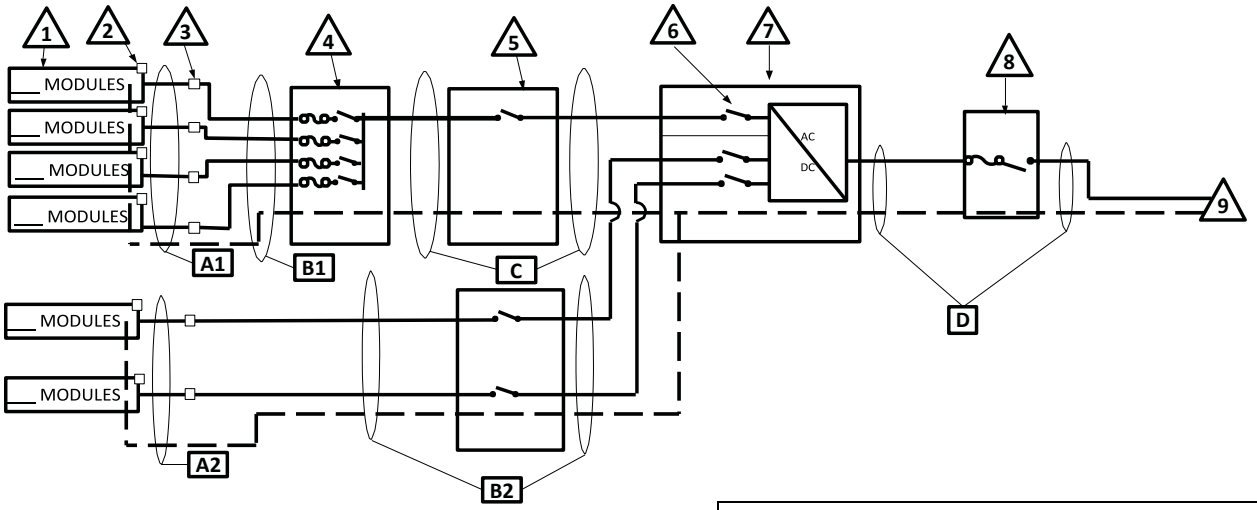
* Consult with your local AHJ and /or Utility

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

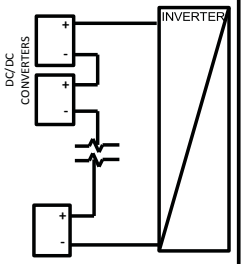
FOR UNGROUNDED SYSTEMS:
- DC OCPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT
- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.



☐					

☐					

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.

Your City logo here

TOOLKIT DOCUMENT #4

Solar PV Standard Plan — Simplified Microinverter and ACM Systems for One- and Two-Family Dwellings

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.

MANUFACTURER'S 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: _____

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***

Number of Branch Circuits, 1, 2 or 3: _____

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

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

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.

Average ambient high temperature for this plan: = +47 OC
Note: For lower expected ambient or higher average ambient high temperatures, use Comprehensive Standard Plan.

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: ____

_____

Rated (continuous) AC output power:_____Watts

Nominal AC voltage rating:_____Volts

Rated (continuous) AC output current:_____Amps

If installing ACMs, skip [STEPS 0]

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

Maximum AC output overcurrent protection device (OCPD)_____Amps

Maximum number of Microinverters or ACMs per branch circuit: _____

PV Module Information

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

PV Module Manufacturer: _____

Model: _____

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

Module V_{OC} at STC (from module nameplate):_____Volts

Module I_{SC} at STC (from module nameplate):_____Amps

Adjusted PV Module DC voltage at minimum temperature = [Table 1]_____[cannot exceed Step 0]

Table 1. Module V_{OC} at STC Based on Inverter Maximum DC Input Voltage Derived from CEC 690.7																
Microinverter Max. DC Input [STEP 0] (Volts)	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79
Max. Module VOC @ STC, 1.12 (-1 to -5°C) Correction Factor (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. Module VOC @ STC, 1.14 (-6 to -10°C) Correction Factor (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

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 2. Branch Circuit OCPD and Minimum Conductor Size*				
Circuit Current (Amps)	Circuit Power (Watts)	OCPD (Amps)	Minimum Conductor Size (AWG)	Minimum Metal Conduit Size for 6 Current Carrying Conductors
12	2880	15	12	¾"
16	3840	20	10	¾"
20	4800	25	8	1"
24	5760	30	8	1"

*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 69OC, which includes 22 OC 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.

Table 3. PV Array Configuration Summary			
	Branch 1	Branch 2	Branch 3
Number of Microinverters or ACMs [Step 0]			
Selected Conductor Size [Table 2] (AWG)			
Selected Branch and Inverter Output OCPD [Table 2]			

Solar Load Center (if used)

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

Circuit Power see [STEP 0] =_____Watts

Circuit Current = (Circuit Power) / (AC voltage) =_____Amps

Table 4. Solar Load Center and Total Inverter Output OCPD and Conductor Size**				
Circuit Current (Amps)	Circuit Power (Watts)	OCPD (Amps)	Minimum Conductor Size (AWG)	Minimum Metal Conduit Size
24	5760	30	10	½"
28	6720	35	8	¾"
32	7680	40	8	¾"
36	8640	45	8	¾"
40	9600	50	8	¾"
41.6	≤ 10000	60	6	¾"

**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 47OC (no rooftop temperature adder in this calculation), ≤ 3 current carrying conductors in a circular raceway. Otherwise use Comprehensive Standard Plan.

Point of Connection to Utility:

Load Side Connection only! Otherwise use the Comprehensive Standard Plan.
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)
Per 705.12(D)(2): (Combined inverter output OCPD size + Main OCPD size) ≤ [bus bar size × (100% or 120%)]

Table 5. Maximum Combined Inverter Output CIrcuit OCPD									
Bus Bar Size (Amps)	100	125	125	200	200	200	225	225	225
Main OCPD (Amps)	100	100	125	150	175	200	175	200	225
Maximum Combined Inverter OCPD with 120% of bus bar rating (Amps)	20	50	25	60†	60†	40	60†	60†	45
Maximum Combined Inverter OCPD with 100% of bus bar rating (Amps)	0	25	0	50	25	0	50	25	0

†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.

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).

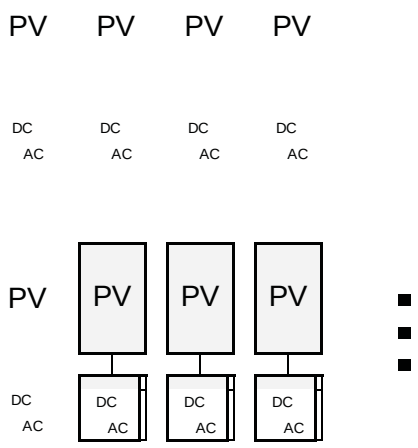
Markings

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.

WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS
OVERCURRENT DEVICE

CEC 705.12 (D)(7)

Optional AC Disconnect per AHJ



M

AC

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
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
RATED AC OUTPUT CURRENT_____ AMPS AC
NORMAL OPERATING VOLTAGE_____ VOLTS

CEC 690.54

Optional Solar Load Center

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

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

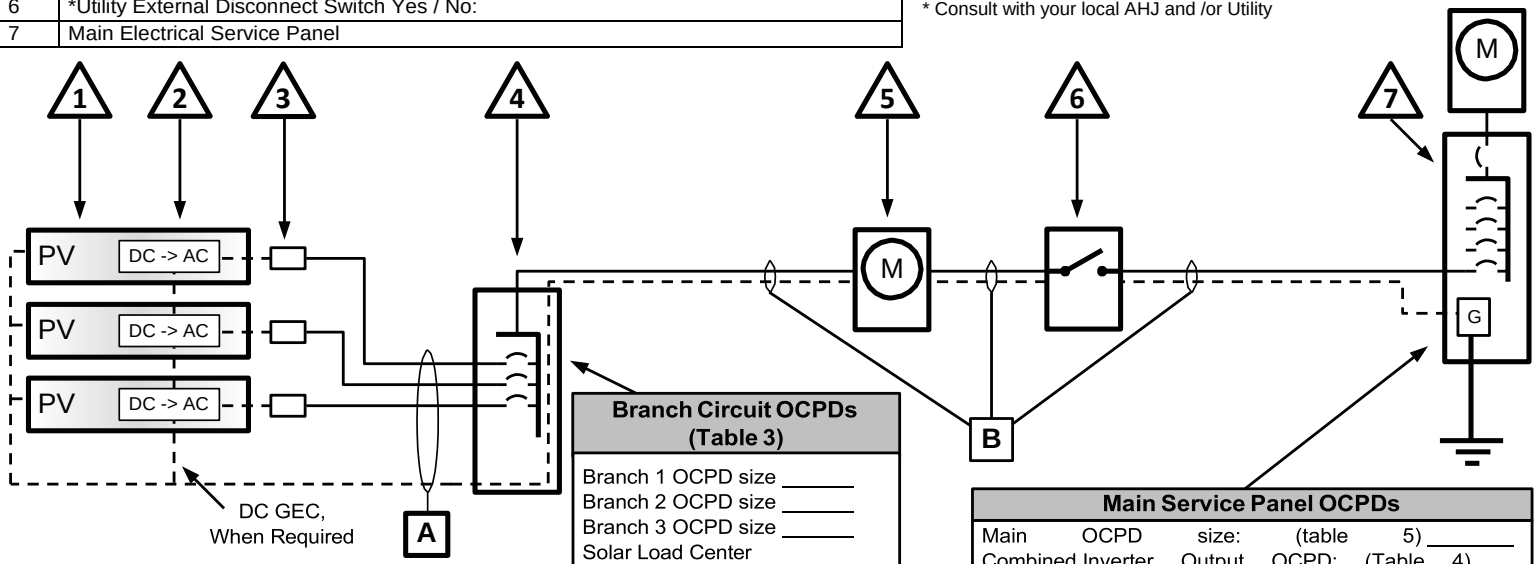
Single-Inverter Line Diagram

Equipment Schedule	
△ TAG	DESCRIPTION: (Provide model # if provided)
1	Solar PV Module or ACM:
2	Microinverter (if not ACM):
3	Junction Box (es):
4	Solar Load Center, Yes / No:
5	Performance Meter Yes / No:
6	*Utility External Disconnect Switch Yes / No:
7	Main Electrical Service Panel

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



Branch Circuit OCPDs (Table 3)

Branch 1 OCPD size _____
Branch 2 OCPD size _____
Branch 3 OCPD size _____
Solar Load Center
Busbar(Section 5) _____

Main Service Panel OCPDs

Main OCPD size: (table 5) _____
Combined Inverter Output OCPD: (Table 4)____
Main Service Panel Busbar: (Table 5) _____

Conductor, Cable and Conduit Schedule

☐ TAG	Description and Conductor Type: (Table 3)	Conductor Size	Number of Conductors	Conduit/ Conductor/ Cable Type	Conduit Size
A	Current-Carrying Conductors: (for each branch circuit)				
	EGC:				
	GEC (when required): Current-				
B	Carrying Conductors: EGC:				
	GEC (when required):				

SOLAR PV STANDARD PLAN — SIMPLIFIED

Microinverter and ACM Systems for One- and Two-Family Dwellings

ROOF LAYOUT PLAN

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

TOOLKIT DOCUMENT #5

Structural Criteria for Residential Rooftop Solar Energy Installations

Use of this document

This toolkit document includes a one-page list of structural criteria for over-the-counter or online approval, as well as attached tables and figures that supplement the criteria and explain their use.

This document applies to flush-mounted solar arrays installed on the roofs of wood-framed one- and two-family dwellings. "Flush-mounted" means the modules are installed parallel to, and relatively close to, the roof surface (see the "Solar Array Check" section of the Structural Criteria for specific qualifying requirements). This list is intended to be a simple pre-installation check to gain reasonable assurance that the design of the solar array complies with the structural provisions of the 2013 California Building Code (CBC) and 2013 California Residential Code (CRC). It is not intended to provide post-installation inspection criteria.

Currently Used Expedited Solar Permitting Approaches

This document is intended for jurisdictions without an expedited process for residential solar structural permitting, and is not intended to replace or supplant procedures for jurisdictions with an expedited process already in place. Good examples from jurisdictions with provisions for expedited structural permitting include the City of Los Angeles, which exempts residential solar installations from structural permitting if five simple requirements are met, and the East Bay Green Corridor's streamlined solar permitting process, which uses structural criteria tailored to typical conditions for that consortium of nine cities.

Regional and Site Assumptions

This document is based on the following regional and site assumptions:

- The dwelling is located in a ZERO snow load area (see Map 1).
- The dwelling is not in Wind Exposure D (within 200 yards of the ocean or a large coastal bay).
- If in Wind Exposure B (urban, suburban or wooded areas), the dwelling may be located:
  - in a Special Wind Region (see Map 2) with design wind speeds between 110 and 130 mph, or
  - on a tall hill, provided average slope is no steeper than 15%.
- If in Wind Exposure C (within 500 yards of large open fields or grasslands), the dwelling is:
  - in a standard 110 mph design wind speed region, and
  - not on a hill with a grade steeper than 5%.

Additional Options

The Chief Building Official (CBO) may consider adding rows to the structural criteria, based on personal judgment and their jurisdiction's conditions and history. Possible additional questions include:

- Regional and Site Checks
  - If the jurisdiction is in a mixed snow load area, with zero snow load only at lower elevations, consider asking "is the dwelling lower than elevation____feet?"

(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

  - If the jurisdiction is in a coastal region, consider asking "is the dwelling farther than 200 yards from the ocean or a large coastal bay?" to verify the dwelling is not in Wind Exposure D.
  - If the jurisdiction is in a Special Wind Region with design wind speeds between 115 and 130 mph, consider verifying that the dwelling is in Wind Exposure B by asking "is the dwelling in an urban, suburban or wooded area, and *not* within 500 yards of open fields and grasslands?"
  - If the jurisdiction is in a Special Wind Region with design wind speeds between 115 and 130 mph, consider verifying that there are no significant topographic wind speed-up effects by asking "is the dwelling in a relatively flat area (grade less than 5%) and not within 500 yards of the crest of a tall hill?"
- Roof Check
  - Based on the jurisdiction's one- and two-family housing stock and code compliance history, many CBOs will find it reasonable to assume that most dwellings' roof structures were designed to the building code in effect at the time the houses were built. If so, the roof structure code compliance check consists of the Contractor's visual roof audit, checking for unusual sagging or deterioration, without requiring additional measurements of existing rafters to check against span tables.
  - For CBOs of jurisdictions with evidence of structurally deficient one- and two-family housing stock or poor structural code compliance history, the CBO may elect to add the rafter span check option described in the criteria.

The Structural Toolkit and CRC Wind Speeds

The 2013 CRC contains an inconsistency related to wind speeds. Despite referencing ASCE 7-10 as its standard, the 2013 CRC's text and tables use outdated ASCE 7-05 wind speeds. Under the old ASCE 7-05 / CBC 2010, the basic design wind speed in most regions of the state was 85 mph (max. 3 second gust in 50 years). Under ASCE 7-10 / CBC 2013, the design wind speed has increased to 110 mph (max. 3 second gust in 700 years). Despite the different definitions of wind speed, design wind pressures remain essentially unchanged.

Because the Toolkit's structural document is intended to be forward looking, all wind speeds in the Toolkit document are based on the ASCE 7-10. This is clearly stated in the caption to the state wind speed map, and in the Table 1 footnotes. This anticipates an obvious and expected correction to the CRC; otherwise the Toolkit would become immediately outdated when the CRC is amended to change the base design wind speed from 85 mph to 110 mph.

2013 CRC text (ASCE 7-05) wind speeds equivalent to the 2013 CRC and CBC Reference Standard (ASCE 7-10) are shown below. See ASCE 7-10 Table C26.5-6 for additional information.

2013 CRC text ASCE 7-05	2013 CRC and CBC Referenced Standard ASCE 7-10
85 mph	110 mph
90 mph	115 mph
95 mph	120 mph
100 mph	126 mph
105 mph	133 mph

(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

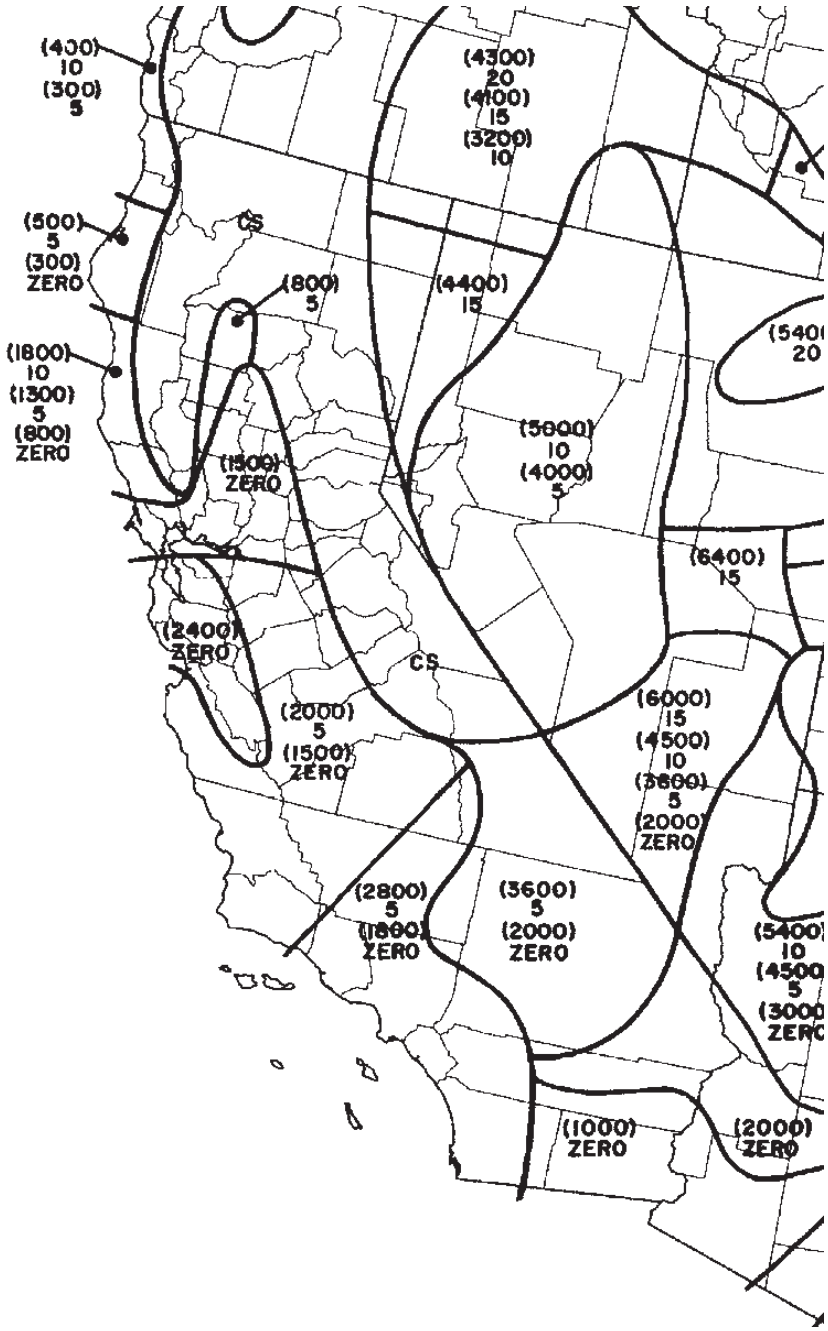
Structural Technical Appendix

This toolkit document is supported by a Structural Technical Appendix that describes the technical analysis behind these criteria, which are based on structural engineering principles and the California Building and Residential Codes. The Technical Appendix also provides some additional guidance to address non-conforming items, such as when an anchor layout is not based on a solar support component manufacturer's guidelines, or when a coastal site is located within 200 yards of the ocean (Exposure D). This document can be found **online**.

Probability of Code Compliance

The Structural Technical Appendix includes a section that examines the probabilities associated with the assumptions behind Table 1 that allows six feet cross-slope anchor spacing in some circumstances. That statistical analysis estimates that the probability of code noncompliance for six feet anchor spacing is only 2 in a thousand installations (0.2%). Note that probability of structural failure is orders of magnitude lower than the probability of code *noncompliance.*

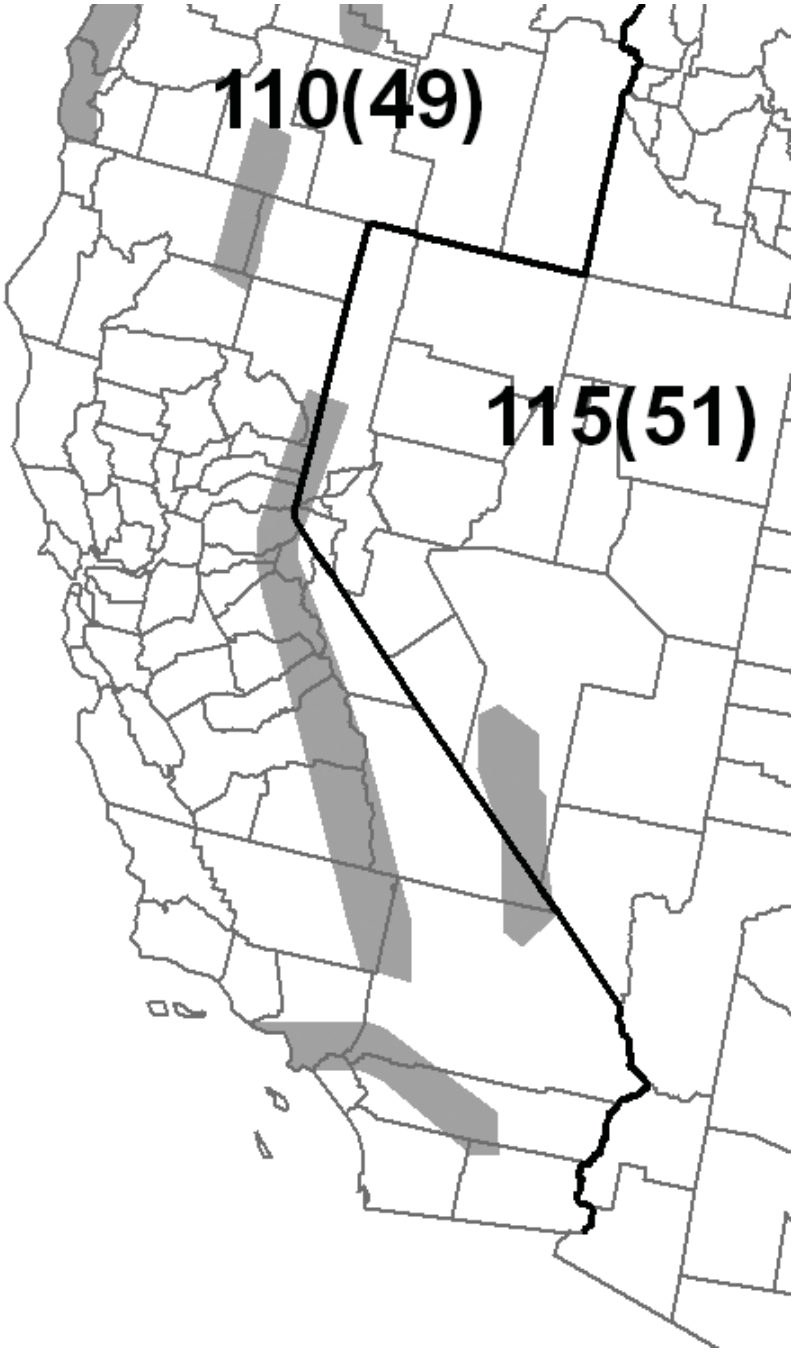
(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)



Map 1. California Ground Snow Load Map (Ref: ASCE 7-10).

The numbers in parentheses represent the upper elevation limits in feet for the ground snow load in psf listed below the elevation. Example: (2400) ZERO in the South San Francisco bay area indicates that zero ground snow loads occur from sea level up to an elevation of 2400 feet. CS indicates "Case Studies" where extreme local variations in ground snow loads occur. Non-zero snow load areas and Case Study (CS) areas are excluded from the use of this structural toolkit document. See the Technical Appendix for additional information.

(Map provided for jurisdiction's reference only. Do not attach to Criteria that follow.)



Map 2. California Design Wind Speed Map (Ref: ASCE 7-10).

The number outside the parentheses represents the design wind speed in mph. Typical design wind speed is 110 mph. The grey shaded areas on the map indicate "special wind regions" where higher wind speeds may apply. When the project is in a grey shaded area, contact the local building department for the design wind speed.

(Map provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

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): _____:12
- 2) Measured rafter spacing (center-to-center): _____inch
- 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 componenets 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 toal 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 #: _____

_____ License # & Class: _____

Contractor/Installer: _____ Phone #: _____

Signature: _____ Date: _____

Optional Additional Rafter Span Check Criteria

[At option of CBO, insert rows (4) to (7) below into table above after row 1.B.(3)]

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

(Jurisdictions may delete "Optional Additional Rafter Span Check" at bottom of this page, or incorporate into main list of Structural Criteria above)

Table 1. Maximum Horizontal Anchor Spacing				
Roof Slope		Rafter Spacing		
		16" o.c.	24" o.c.	32" o.c.
Photovoltaic Arrays (4 psf max)				
Flat to 6:12	0° to 26°	5'-4"	6'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	1'-4"	2'-0"	2'-8"
Solar Thermal Arrays (5 psf max)				
Flat to 6:12	0° to 26°	4'-0"	4'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	Calc. Req'd	Calc. Req'd	Calc. Req'd

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)1								
Assumed Vintage	Nominal Size	Actual Size	Non-Tile Roof[2]			Tile Roof[3]		
			Rafter Spacing					
			16" o.c.	24" o.c.	32" o.c.	16" o.c.	24" o.c.	32" o.c.
Post-1960	2x4	1½"x3½"	9'-10"	8'-0"	6'-6"	8'-6"	6'-11"	5'-6"
	2x6	1½"x5½"	14'-4"	11'-9"	9'-6"	12'-5"	10'-2"	8'-0"
	2x8	1½"x7¼"	18'-2"	14'-10"	12'-0"	15'-9"	12'-10"	10'-3"
Pre-1960	2x4	1¾"x3¾"	11'-3"	9'-9"	7'-9"	10'-3"	8'-6"	6'-9"
	2x6	1¾"x5¾"	17'-0"	14'-0"	11'-3"	14'-9"	12'-0"	9'-9"
	2x8	1¾"x7¾"	22'-3"	18'-0"	14'-6"	19'-0"	15'-6"	12'-6"

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.

(Attach Table 2 ONLY if the Optional Additional Rafter Span Check is added to the list of Structural Criteria)

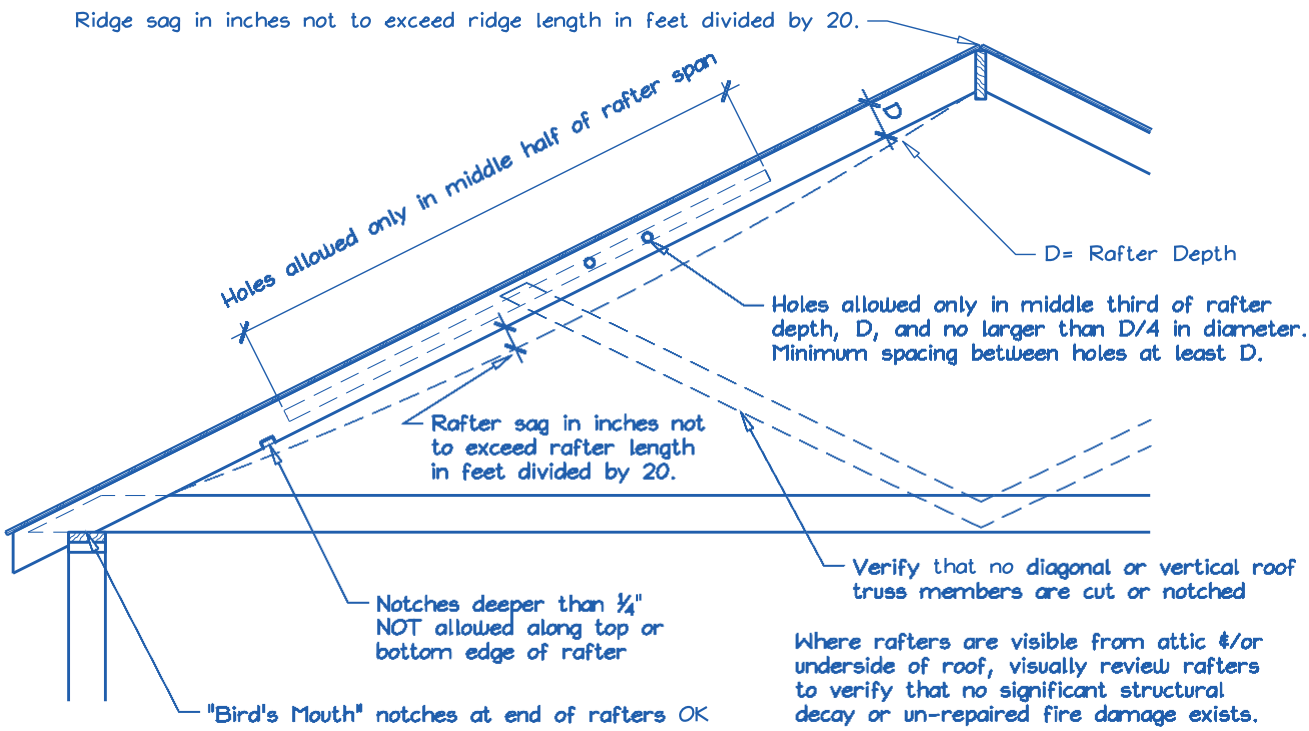


Figure 1. Roof Visual Structural Review (Contractor's Site Audit) of Existing Conditions.

The site auditor should verify the following:

1. No visually apparent disallowed rafter holes, notches and truss modifications as shown above.
2. No visually apparent structural decay or un-repaired fire damage.
3. 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.

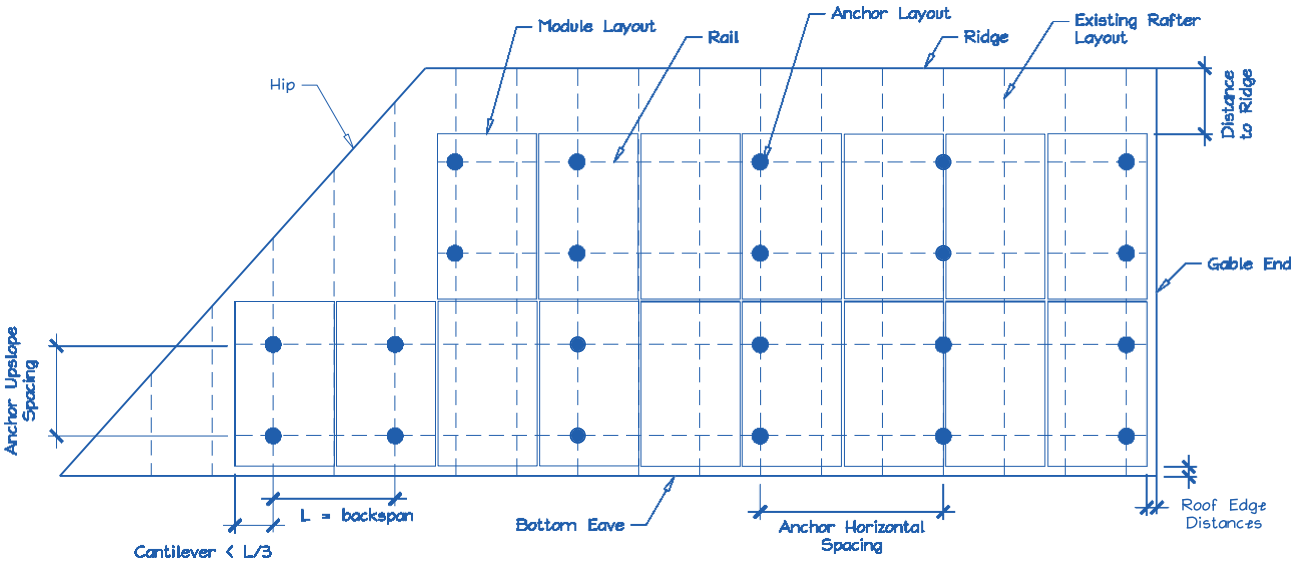


Figure 2. Sample Solar Panel Array and Anchor Layout Diagram (Roof Plan).

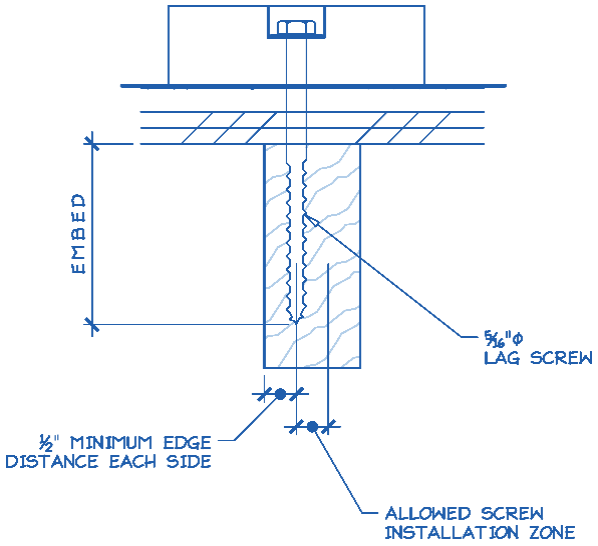


Figure 3. Typical Anchor with Lag Screw Attachment.

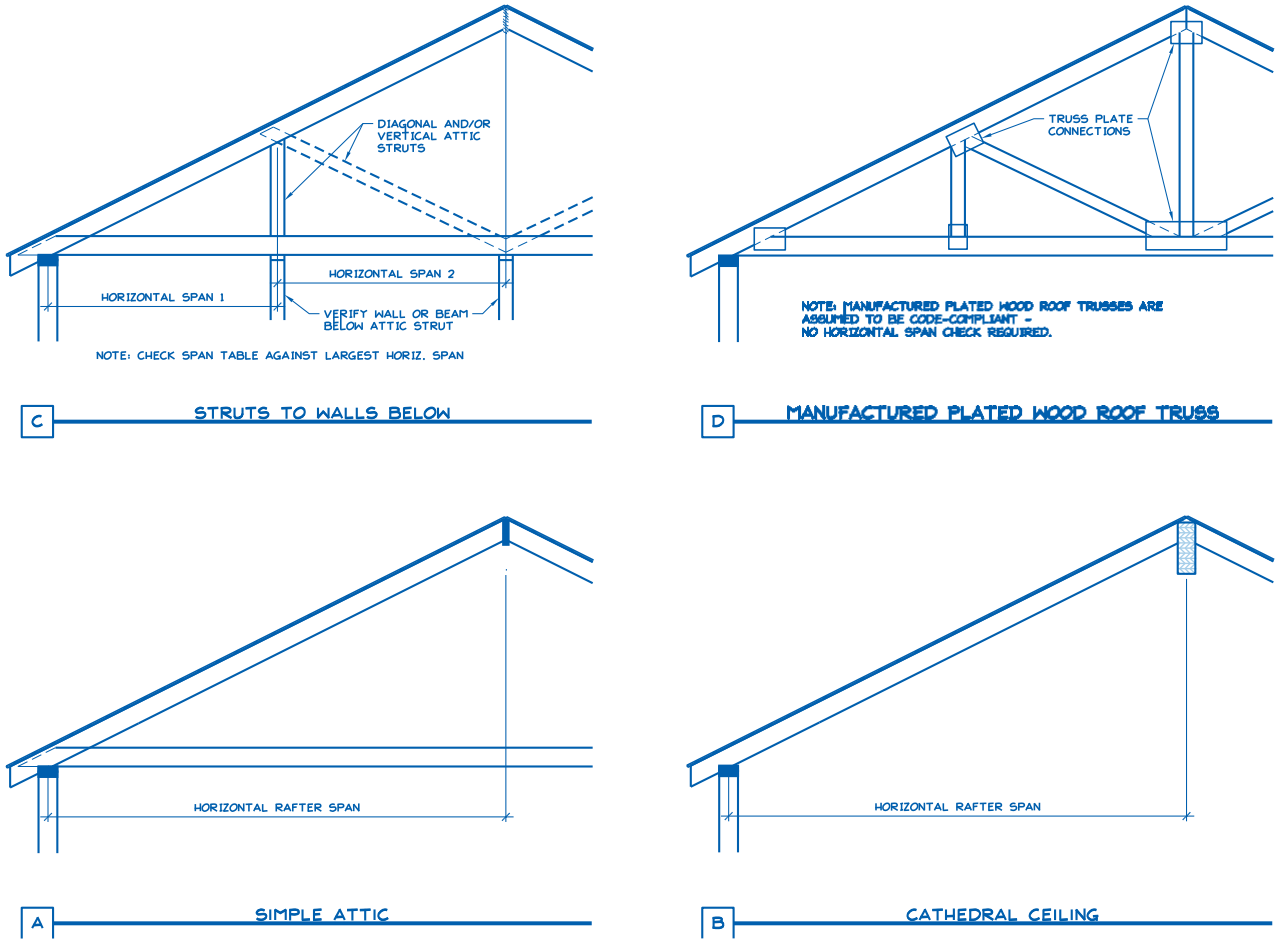


Figure 4. Definition of Rafter Horizontal Span.

(Attach Figure 4 ONLY if the Optional Additional Rafter Span Check is added to the list of Structural Criteria)

TOOLKIT DOCUMENT #6

[ADMINISTERING AGENCIES] Agreement Number: [NUMBER]

MOU (Memorandum of Understanding) Regarding Solar Photovoltaic Plan Review and Inspection Services

This memorandum of understanding (MOU) formalizes coordination by local agencies regarding plan review and inspection services for solar photovoltaic installations.

Note: Language in CAPS below indicates where local jurisdiction needs to provide information specific to the jurisdiction.

This agreement is made at [LOCATION], California, by and between [FIRE AUTHORITY] and [BUILDING AUTHORITY].

Recitals

WHEREAS, Sections 1.8.2.1 and 1.11.2 of the currently adopted version of the California Residential Code charges the local building authority and local fire authority with the responsibility of enforcement of residential building standards within the jurisdictions boundaries; and

WHEREAS, the [FIRE AUTHORITY] desires the [BUILDING AUTHORITY] to perform these services on its behalf subject to the following terms and conditions; and

WHEREAS, the [BUILDING AUTHORITY] is willing to perform said services provided it can charge and collect all fees for services rendered subject to the following terms and conditions.

Services Agreement

1. **Services** The [BUILDING AUTHORITY] shall conduct the services outlined in Exhibit A for the review of plans and inspection of solar photo voltaic systems within the [JURISDICTION] boundaries during the term of this agreement.

2. **Term** The term of this agreement shall commence on_____, and shall be for _____. The term of this agreement may be extended upon agreement of [FIRE AUTHORITY] and the [BUILDING AUTHORITY].

3. **Plan Review and Inspection Fees/Charges** The [BUILDING AUTHORITY] shall charge and collect its standard fees for plan review and inspection. The [FIRE AUTHORITY] shall receive no portion of said fees.

4. **Facilities, Equipment and Other Materials** The [BUILDING AUTHORITY] shall, at its cost and expense, furnish all facilities, equipment and other materials that may be required for furnishing services pursuant to this agreement.

5. **No Agency** No agency relationship is created by this agreement.

6. **Records** The [BUILDING AUTHORITY] shall maintain, at all times, complete detailed records with regard to work performed under this agreement. The [FIRE AUTHORITY] shall have the right to inspect said records with reasonable notice to the county. All such records shall be maintained by the [BUILDING AUTHORITY] in its [OFFICE LOCATION] offices.

7. **Insurance** It is agreed that each party shall maintain at all times during the performance of this agreement insurance coverage or self-insurance in the amount of not less than [DOLLAR AMOUNT] to cover all of its operations, including general liability, automobile liability and workers' compensation.

8. **Indemnification** The [BUILDING AUTHORITY] shall indemnify, defend and hold harmless the [FIRE AUTHORITY] and its elected and appointed officials, employees, agents and contractors (collectively, "indemnities") from and against any and all loss, liability, cost, claim, cause of action, demand, judgment, expense, (including reasonable attorneys' fees) or damage (collectively "claims") arising from or related to [BUILDING AUTHORITY] performance or failure to perform its obligations pursuant to this agreement, except to the extent the same are attributable to the gross negligence or willful misconduct of the Indemnities. The [FIRE AUTHORITY] shall indemnify, defend and hold harmless the [BUILDING AUTHORITY] and its elected and appointed officials, employees, agents and contractors (collectively, "building indemnities") from and against any and all claims arising from or related to the [BUILDING AUTHORITY] performance or failure to perform its obligations pursuant to this agreement, except to the extent the same are attributable to the gross negligence or willful misconduct of building indemnities.

9. **Entirety of Agreement – Modifications** This agreement contains the entire agreement of the [FIRE AUTHORITY] and the [BUILDING AUTHORITY] with respect to the subject matter hereof, and no other agreement, statement, or promise made by any party, or to any employee, officer or agent of any party, which is not contained in this agreement, shall be binding or valid.

10. **Early Termination** Either party may serve notice of early termination of this agreement pursuant to Section 11 below. Upon termination of this agreement, the [FIRE AUTHORITY] shall take over all plan review and inspections covered by this agreement. For plan review and/or inspections that are in process at the time of termination, the county shall complete these.

11. **Notice** Any notice or demand desired or required to be given hereunder shall be in writing and deemed given when personally delivered or deposited in the mail, postage prepaid and addressed to the parties as follows:

[BUILDING AUTHORITY ADDRESS]	**[FIRE AUTHORITY ADDRESS]**
_____	_____
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____
Fax: _____	Fax: _____

Any notice so delivered personally shall be deemed to be received on the date of delivery, and any notice mailed shall be deemed to be received five (5) days after the date on which it was mailed.

[BUILDING AUTHORITY ADDRESS]	**[FIRE AUTHORITY ADDRESS]**
By: _____	By: _____
Date: _____	Date: _____

Exhibit A – Scope of Work

TOOLKIT DOCUMENT #7

Inspection Guide for PV Systems in One- and Two-Family Dwellings

(For Rooftop Photovoltaic Systems meeting the Standard Plan)

This document has two sections. Neither section is all-inclusive as this document is simply a tool to aid the inspection process.

SECTION 1 – Field Inspection Guide: The purpose of this section is to give the field inspector a single-page reminder of the most important items in a field inspection.

SECTION 2- Comprehensive Reference: This reference details items that may be relevant in the field inspection of rooftop PV systems that comply with the comprehensive or simplified versions of the "Solar PV Standard Plan." Not all items outlined in this section are relevant to each PV system. This inspection reference details most of the issues that relate to the PV system during the inspection process.

All California Electrical Code (CEC), California Residential Code (CRC), California Building Code (CBC) and California Fire Code (CFC) references are to the 2013 versions unless otherwise noted.

SECTION 1: Field Inspection Guide for Rooftop Photovoltaic (PV) Systems Standard Plan

Make sure all PV system AC/DC disconnects and circuit breakers are in the open position and verify the following.

1. All work done in a neat and workmanlike manner (CEC 110.12).
2. PV module model number, quantity and location according to the approved plan.
3. Array mounting system and structural connections according to the approved plan.
4. Roof penetrations flashed/sealed according to the approved plan.
5. Array exposed conductors are properly secured, supported and routed to prevent physical damage.
6. Conduit installation according to CRC R331.3 and CEC 690.4(F).
7. Firefighter access according to approved plan.
8. Roof-mounted PV systems have the required fire classification (CBC 1505.9 or CRC R902.4).
9. Grounding/bonding of rack and modules according to the manufacturer's installation instructions that are approved and listed.
10. Equipment installed, listed and labeled according to the approved plan (e.g., PV modules, DC/DC converters, combiners, inverters, disconnects, load centers and electrical service equipment).
11. For grid-connected systems, inverter is marked "utility interactive."
12. For ungrounded inverters, installation complies with CEC 690.35 requirements.
13. Conductors, cables and conduit types, sizes and markings according to the approved plan.
14. Overcurrent devices are the type and size according to the approved plan.
15. Disconnects according to the approved plan and properly located as required by the CEC.
16. Inverter output circuit breaker is located at opposite end of bus from utility supply at load center and/or service panelboard (not required if the sum of the inverter and utility supply circuit breakers is less than or equal to the panelboard bus rating).
17. PV system markings, labels and signs according to the approved plan.
18. Connection of the PV system to the grounding electrode system according to the approved plan.
19. Access and working space for operation and maintenance of PV equipment such as inverters, disconnecting means and panelboards (not required for PV modules) (CEC 110.26).

SECTION 2: Comprehensive Inspection Reference

GENERAL

1. Module manufacturer, make, model and number of modules match the approved plans. (CBC 107.4)
2. DC PV modules are listed to UL 1703. Ac modules are listed to UL 1703 and UL 1741. (CEC 110.3, 690.4 & CBC 1509.7.4 & CRC R908.1.5)
3. Modules are attached to the mounting structure according to the manufacturer's instructions and the approved plans. (CEC 110.3[B], CBC 107.4 & CRC R908.1.4)
4. Roof penetrations/attachments are properly flashed. (CBC Chapter 15 & 2012 CRC Chapter 9)
5. Rooftop systems are designed in accordance with the CBC. (CBC 1509.7 & CRC R908.1)
6. Roof access points, paths and clearances need to comply with the CFC. (CFC 605.11.3.1 - 605.11.3.3.3, CRC R331.4.1 through R331.4.2.4)
7. PV installation shall comply with requirements of the standard plan.
8. PV system operating at 80 volts or greater shall be protected by a listed DC arc fault protection. (CEC 690.11)
9. All work done in a neat and workmanlike manner. (CEC 110.12)

ELECTRICAL REQUIREMENTS

PV Array Configuration

10. DC modules are properly marked and labeled. (CEC 110.3, 690.4[D] & 690.51)
11. AC modules are properly marked and labeled. (CEC 110.3, 690.4[D] & 690.52)
12. PV modules are in good condition (i.e., no broken glass or cells, no discoloration, frames not damaged, etc.). (CEC 110.12[B])
13. Residential one and two family dwelling limited to maximum PV system voltage of 600 volts. (CEC 690.7)

Bonding and grounding

14. A complete grounding electrode system is installed. (CEC 690.47[A] & [B])
15. Modules are bonded and grounded in accordance with the manufacturer's installation instructions, that are listed and approved, using the supplied hardware or listed equipment specified in the instructions and identified for the environment. (CEC 690.43 & 110.3[B])
16. Racking systems are bonded and grounded in accordance with the manufacturer's installation instructions, that are listed and approved, using the supplied hardware or listed equipment specified in the instructions and identified for the environment. (CEC 690.43 & 110.3[B])
17. Properly sized equipment grounding conductor is routed with the circuit conductors. (CEC 690.45, 250.134[B] & 300.3[B])
18. AC and DC grounding electrode conductors are properly connected as required by code. Separate electrodes, if used, are bonded together. (CEC 690.47, 250.50 & 250.58)

19. Bonding fittings are used on concentric/eccentric knockouts with metal conduits for circuits over 250 volts. (CEC 250.97) (see also exceptions 1 through 4)

20. Bonding fittings are used for ferrous metal conduits enclosing grounding electrode conductors. (CEC 250.64[E])

PV Source/output Circuit Conductor Management

21. Cables are secured by staples, cable ties, straps, hangers or similar fittings at intervals that do not exceed 4.5 feet. (CEC 334.30 & 338.12[A][3])

22. Cables are secured within 12 inches of each box, cabinet, conduit body or other termination. (CEC 334.30 & 338.12[A][3])

23. Cable closely follows the surface of the building finish or of the running boards. (CEC 690.4[F] & CFC 605.11.2 & CRC R331.3) NOTE: see Section 12 below for additional requirements on routing of conductors for fire fighter safety concerns.

24. Exposed single conductors, where subject to physical damage, are protected. (CEC 230.50[B] & 300.5[D])

25. Exposed single conductors used for ungrounded systems are listed and identified as "PV wire." (CEC 690.35[D][3]) For other conductor requirements for ungrounded systems, see CEC 690.35(D).

Conductors

26. Exposed single conductor wiring is a 90° C, wet rated and sunlight resistant type USE-2 or approved/listed PV wire. (CEC 690.31[B] & 110.2) If the wiring is in a conduit, it is 90° C, wet rated type RHW-2, THWN-2, or XHHW-2. (CEC 310.15)

27. Conductor insulation is rated at 90° C to allow for operation at 70° C+ near modules. (CEC 310.15)

28. Grounded conductor is identified white or gray. (CEC 200.6)

29. Open conductors are supported, secured and protected. (CEC 338.12[A][3] & 334.30)

30. Conductors are not in contact with the roof surface. (CEC 334.30)

31. DC conductors inside a building are in a metal raceway or MC metal-clad cable that complies with 250.118(10), or metal enclosures. (CEC 690.31[E])

32. DC wiring methods shall not be installed within 25cm (10") of the roof decking or sheathing except where directly below the roof surface covered by the PV modules and associated equipment. (CEC 690.31[E][1])

33. If more than one nominal voltage system conductor is installed in the raceway, permanent identification and labeling is required. (CEC 200.6[D] & 210.5[C])

34. For underground conductor installations, the burial depth is appropriate and warning tape is in place. (CEC 300.5[D][3] & Table 300.5)

35. Aluminum is not placed in direct contact with concrete. (CEC 250.120[B] & 110.11)

36. PV circuit and premises wiring is separated. (CEC 690.4[B])

37. PV system conductors shall be grouped and identified. (CEC 690.4[B])

Overcurrent Protection

38. Overcurrent protection devices (OCPD) in the DC circuits are listed for DC operation. (CEC 110.3[A], [B] & 690.9[D])

39. Overcurrent protection devices shall be provided per the approved plans. (CEC 690.9[A])

40. Combiner box is listed to UL 1741.

41. PV output OCPD is located at the opposite end of the bus from the feeder connection, unless otherwise approved. (CEC 705.12[D][7])

Electrical Connections

42. Crimp terminals are listed and installed using a listed tool specified for use in crimping those specific crimps. (CEC 110.3[B] & 110.14)

43. Pressure terminals are listed for the environment and tightened to manufacturer recommended torque specifications. (CEC 110.11, 110.3[B] & 110.14)

44. Connectors are listed for the voltage of the system and have appropriate temperature and ampere ratings. (CEC 110.3[B] & 110.14)

45. Twist-on wire connectors are listed for the environment (i.e., wet, damp, direct burial, etc.) and installed per manufacturer's instructions. (CEC 110.11, 110.3[B], 110.14 & 300.5[B])

46. Power distribution blocks are listed. (CEC 690.4 & 2011 NEC 314.28[E])

47. Terminals containing more than one conductor are listed for multiple conductors. (CEC 110.14[A] & 110.3[B])

48. Connectors and terminals used other than class B and C stranded conductors (fine stranded conductors) are listed and identified for use with specific conductor class or classes.. (CEC 110.14[A] & 110.3[B])

49. Connectors that are readily accessible and operating at over 30 volts require a tool for opening. (CEC 690.33[C])

50. All connectors are fully engages, tight and secure. (CEC 110.3[B] & 110.12)

51. Wiring and connections of inverters, PV source circuits, etc., and all interconnections are performed by qualified personnel. (CEC 690.4[E])

Disconnects

52. Disconnects used in DC circuits are listed for DC operation and located as allowed by the AHJ. (CEC 110.3)

53. Disconnects are installed for all current carrying conductors of the PV source. (CEC 690.13 - 690.14 & 690.35)

54. Disconnects are installed for the PV equipment. NOTE: For inverters and other equipment that are energized from more than one source, the disconnecting means must be grouped and identified per AHJ's requirements. (CEC 690.15)

55. Disconnects and overcurrent protection are installed for all ungrounded conductors in ungrounded PV power systems. (CEC 240.15 & 690.35)

56. Where connectors are used as disconnecting means, they shall be used in accordance with CEC 690.33.E (CEC 690.33.E & 690.17)

Inverters

57. Inverters are listed to UL 1741. (CEC 690.4[D]) NOTE: grid-tied system inverters need to be identified for use in interactive power systems.

58. Point of connection is at a dedicated breaker or disconnect. (CEC 705.12[D][1])

59. Where a back-fed breaker is used as a utility interconnection means, the breaker is not marked "line and load." (CEC 110.3[B], 705.12[D][5])

60. Listed AC and DC disconnects and overcurrent protection are grouped and identified. (CEC 690.15)

61. No multiwire branch circuits are installed where single 120-volt inverters are connected to 120/240-volt load centers. (CEC 690.10[C])

62. The barrier is reinstalled between the AC, DC wiring and communication wires. (CEC 110.3[B] & 110.27)

Signs and Labels

63. All interior and exterior DC conduit, enclosures, raceways, cable assemblies, junction boxes, combiner boxes and disconnects are marked. (CFC 605.11.1, CEC 690.31[E][3], CEC 690.31[E][4], 690.17 & 690.53 & CRC R331.2)

64. The markings on the conduits, raceways and cable assemblies are every 10 feet, within one foot of all turns or bends and within one foot above and below all penetrations of roof/ceiling assemblies, walls and barriers. (CFC 605.11.1.4, CRC R331.2.4, CEC 690.31[E][3] & CEC 690.31[E][4])

65. Marking is placed adjacent to the main service disconnect in a location clearly visible from where the disconnect is operated. (CFC 605.11.1.3 & CRC R331.2.3)

66. The markings say "WARNING: PHOTOVOLTAIC POWER SOURCE" and have 3/8-inch (9.5 mm) minimum-sized white letters on a red background. The signs are made of reflective weather resistant material. (CFC 605.11.1.1, 605.11.1.2 & CRC R331.2.1 - R331.2.2 & CEC 690.31[E)][3] & 690.31[E][4])

67. Where PV circuits are embedded in built-up, laminate or membrane roofing materials in roof areas not covered by PV modules and associated equipment, the location of circuits shall be clearly marked. (CEC 690.4[F])

68. Required labels shall be permanent and suitable for the environment. The following labels are required as applicable.

Table 1. Signage Requirements for PV systems		
Code Section	Location of Label	Text
CEC 690.5(C)	Utility-interactive inverter & battery enclosure	WARNING: ELECTRIC SHOCK HAZARD IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED
CEC 690.35(F)	All enclosures with ungrounded circuits or devices which are energized and may be exposed during service	WARNING: ELECTRIC SHOCK HAZARD. THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED.
CEC 690.14(C)(1)	On the main service when DC wiring is run through the building and the DC disconnect is located other than at the main service	DC DISCONNECT IS LOCATED….
CEC 690.14(C)(2)	On the AC and DC disconnects	PHOTOVOLTAIC SYSTEM DISCONNECT
CEC 690.53	On the DC disconnects	OPERATING CURRENT _____ OPERATING VOLTAGE _____ MAXIMUM SYSTEM VOLTAGE SHORT CIRCUIT CURRENT _____
CEC 690.54	At interactive points of interconnection, usually the main service	RATED AC OUTPUT CURRENT _____AMPS NORMAL OPERATING AC VOLTAGE _____VOLTS
CEC 690.56(B)/ 690.14(D)(4), 705.10 2011 CEC 690.4(H)	At the electrical service and at the PV inverter if not at the same location	A directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means
CEC 690.17	On the DC disconnect and on any equipment that stays energized in the off position from the PV supply	WARNING! ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.
CEC 705.12 (D)(7)	Inverter output OCPD	WARNING: INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE.
CFC 605.11.1.4, CEC 690.31(E)(3), 690.31(E)(4), CRC R331.2.4	On conduit, raceways and enclosures, mark every 10 feet, at turns, above/ below penetrations	WARNING: PHOTOVOLTAIC POWER SOURCE. *Note: This label shall have a red background with white lettering*

FIRE SAFETY REQUIREMENTS

1. Rooftop-mounted PV panels and modules have the proper fire classification rating. (CBC 1509.7.2 & CRC R908.1.2)

2. Conduit, wiring systems and raceways for photovoltaic circuits are located as close as possible to the ridge, hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. (CFC 605.11.2 & CRC R331.3)

3. Conduit runs between sub arrays and to DC combiner boxes are installed in a manner that minimizes total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. (CFC 605.11.2 & CRC R331.3)

4. DC Combiner Boxes are located so that conduit runs are minimized in the pathways between arrays. (CFC 605.11.2 & CRC 331.3)

5. DC wiring in enclosed spaces in buildings is installed in metallic conduit or raceways. Conduit runs along the bottom of load bearing members. (CFC 605.11.2 & CEC 690.4[F] & CRC R331.3)

6. All roofs have an access point that does not place ground ladders over openings such as windows or doors, are located at strong points of building construction, and in locations where the access point does not conflict with overhead obstructions such as tree limbs, wires, or signs. (CFC 605.11.3.1 & CRC R331.3)

7. Roofs with slopes greater than 2:12 have solar panel layouts with access pathways that comply with approved roof plan that meet the following criteria: (some exceptions apply, see diagrams in the California Solar Permitting Guidebook)

    A. Hip Roofs: Panels/modules are located so that there is a 3-foot wide clear access pathway from the eave to the ridge on each roof slope where panels/modules are located. (CFC 605.11.3.2.1 & CRC R331.4.2.1)

    B. Hips and Valleys: If panels/modules are placed on both sides of a hip or valley they are located no closer than 18 inches to a hip or valley. If the panels are located on only one side of a hip or valley that is of equal length, then the panels can be placed directly adjacent to the hip or valley. (CFC 605.11.3.2.3 & CRC R 331.4.2.3)

    C. Single Ridges: Panels/modules are located so that there are two 3-foot wide access pathways from the eave to the ridge on each roof slope where there are panels/modules installed. (CFC 605.11.3.2.2 & CRC R331.4.2.2)

    D. Ridges: Panels/modules are located no higher than 3 feet from the top of the ridge in order to allow for fire department smoke ventilation operations. (CFC605.11.3.2.4 & CRC R331.4.2.4)

    E. Access pathways are located at a structurally sound location capable of supporting the load of fire fighters accessing the roof. (CFC 605.11.3.2.1 & CRC R331.4.2.1)

STRUCTURAL AND OTHER CODE REQUIREMENTS

List the structural requirements by the Authority Having Jurisdiction.

Part 4

RECOMMENDATIONS FOR EXPEDITED SOLAR THERMAL INSTALLATIONS

THERMAL TOOLKIT: STREAMLINED SOLAR THERMAL TEMPLATES

Under development for next edition (2015)

Part 5

RESOURCES AND INFORMATION

Understanding the Code

Code Requirements for Solar Photovoltaic (PV) Systems for One and Two-Family Dwellings

Based on the 2013 California Building Code (CBC), the 2013 California Residential Code (CRC) and the California Energy Code (CEC)

PURPOSE

The purpose of this information bulletin is to clarify requirements of the State Building Standards Codes (Title 24) that pertain to solar PV installations on one- and two-family dwellings. This bulletin can serve as a reference guide for permit applicants and enforcing agencies to clarify how state code requirements are practically applied in the local jurisdiction. It is intended to minimize permitting uncertainty and differing interpretation regarding specific code requirements for solar PV installations. This information bulletin primarily clarifies requirements pertaining to the California Building Code and the California Residential Code, since these codes in their current form require significant local interpretation. This information bulletin does not address local regulations.

The implementation of uniform standards to achieve the timely and cost-effective installation is consistent with the California Solar Rights Act that views solar installation as a matter of statewide concern and prohibits local jurisdictions from adopting unreasonable barriers to the installation of solar energy systems (CA Government Code Section 65850.5).

PART I: BUILDING AND RESIDENTIAL CODE REQUIREMENTS

1. Definitions

1.1 Solar photovoltaic system: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load (CEC Article 100 and Article 690.2)

1.2 Module: A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight (CEC Article 690.2)

1.3 Panel: A collection of modules mechanically fastened together, wired and designed to provide a field-installable unit (CEC Article 690.2)

1.4 Building integrated photovoltaics (BIPV): Photovoltaic cells, devices, modules or modular materials that are integrated into the outer surface or structure of a building and serve as the outer protective surface of the building (CEC Article 690.2)

1.5 Alternating-current (AC) module (alternating-current photovoltaic module): A complete, environmentally protected unit consisting of solar cells, optics, inverter and other components, exclusive of tracker, designed to generate AC power when exposed to sunlight (CEC Article 690.2

1.6 Photovoltaic modules/shingles: A roof covering composed of flat-plate photovoltaic modules fabricated into shingles. (CRC Chapter 2, Section 202)

2. Solar Ready Requirements

The California Energy Code (Section 110.10) contains mandatory requirements for solar readiness in certain newly constructed single-family and multifamily residences. Although these requirements apply to new construction only, these requirements are briefly outlined for informational purposes.

2.1 Solar Zone: Newly constructed homes are required to have an area on the roof or overhang available for future solar installations that meets certain requirements:

2.1.1 Minimum area: The solar zone must be a minimum of 250 square feet, subject to certain exceptions outlined in the code (Section 110.10.b.1.[b]).

2.1.2 Orientation: All sections of the solar zone located on steep-sloped roofs (defined as a roof whose pitch is greater than 2:12) shall be oriented between 110 degrees and 270 degrees of true north.

2.1.3 Shading: The solar zone must be free of obstructions and may not be shaded by certain obstructions outside the zone (Section 110.10.b.3).

2.2 Documentation: Construction documentation must clearly show the dead and live load for the solar zone. Collateral loads for future solar energy systems do not need to be shown on the construction documents. (Section 110.10[b][4])

Construction documentation must also show pathways for electrical or plumbing interconnections. This includes a location for inverters and metering equipment and a pathway for routing of conduit from the solar zone to the point of interconnection with the electrical service. For single-family residences, the point of interconnection will be the main service panel. (Section 110.10[c])

This information must also be provided to the occupant. (Section 110.10[d])

2.3 Main Electrical Service Panel: The main electrical service panel shall have a minimum bus bar rating of 200 amps and a marked reserved space for future solar electric installation. (Section 110.10[e])

3. Structural Requirements

3.1 PV systems positively anchored to the building

3.1.1 Exemption from structural calculations: The building official may waive the requirement for structural calculations for solar PV installations on top of existing roofs if the official can readily determine that the additional weight of the new solar PV system on the roof does not affect the structural integrity of the building. Some jurisdictions may choose to use the provided Structural Criteria for Flush-Mounted PV and Thermal Systems as a prescriptive approach for when structural calculations can be waived, however, that varies by the enforcing agency.

3.1.2 Structural calculations for non-prequalified systems: When structural calculations are required, calculations shall demonstrate that the primary structure will support the additional vertical and lateral loads from the panels and related equipment.

Note 1: See the Appendix for additional guidance on structural calculations.

3.1.2.1 Roof dead load: The weight of solar PV systems shall be considered as dead load in the design of the structure (CBC Section 1606, CRC Section R301.4).

For installation of conventional (not BIPV) solar PV panels on existing roofs, roof live load is not imposed where PV panels occur, provided the clear distance under the panels to top of the roof is less than 42" and provided the roof design is adequate for the concentrated loads from the solar PV panel support frames. See Structural Engineers Association of California (SEAOC) Solar PV-3 Live Load document for additional information.

When the roof live load is allowed to be reduced, consideration should be given to the possibility that a roof may have more than one layer of existing roofing. For pre-1960 wood-framed construction, structural calculations may be based on actual (field-measured) lumber sizes (typically greater than modern lumber sizes), and Douglas fir Grade 1 may be assumed unless field conditions indicate otherwise.

3.1.2.2 Roof live load: Roof live load is not considered in areas covered by roof-mounted panels where there is less than 42" clear under the panels. Roof surfaces not covered by solar PV panels shall be designed for the roof live load (CBC Section 1607, CRC R301.6).

The building official may determine that live load need not be considered for solar PV panels and associated supporting members that are built on grade. Such interpretation is generally based on the assumption that the solar PV panels will not be stepped on or used by anyone to support any live load

3.1.2.3 Wind design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist wind loads. For ballasted PV systems, see Section 2.2 of this information bulletin (CBC Section 1609, CRC R301.2.1).

Photovoltaic modules/shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from CRC Table R905.2.4.1(2) Classification of Asphalt Shingles Per ASTM D 3161 (CRC Section R905.16.3).

For ballasted PV systems, see Code Requirements for Solar Photovoltaic (PV) Systems – General, Section 2.2 of this information

3.1.2.4 Seismic design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist earthquake loads.

3.1.2.5 For wood construction, supports shall be attached with fasteners of sufficient length and size to achieve minimum required embedment into solid wood taking into consideration the plywood and multiple layers of roofing that may exist, unless otherwise approved by the enforcing agency (CRC Section R301.1.3).

3.1.2.6 Snow load: When applicable, include snow loads and loads from snowdrift (CBC Section 1608, CRC R301.2.3).

3.1.2.7 Requirements for load combinations: The applicable load combinations in CBC 1605 may be applied to all loading conditions, including evaluating the effects of dead load to counteract wind uplift.

3.1.2.8 The Division of the State Architect (DSA) Interpretation of Regulations Article 16.8, intended for public schools, provides useful code interpretation guidance to non-DSA code officials regarding several types of solar systems, both ground- and roof-mounted.

3.2 Structural strength of PV panels: The structural strength of solar PV panels is not addressed in the code.

UL 1703, Third Edition, published March 15, 2002, requires that solar PV panels be tested to withstand a superimposed load of 30 PSF. Therefore, all solar PV panels that are listed per UL 1703 are considered to meet this requirement.

When used as a building component and depending on the load values that the solar PV panels are subjected to, the enforcing agency may require a test report from an agency recognized by the enforcing agency showing the strength of the solar PV panels.

3.3 Condition of existing roof: Solar PV systems shall not be installed on an existing roof that is deteriorated to the point where it is not adequate as a base (this interpretation is based on CRC R907).

3.4 Premanufactured support systems: Premanufactured support systems must support the PV system and allow the system to stay attached to the structure when exposed to wind, snow or seismic load. Compliance of the PV support system with appropriate building codes is accomplished through a design specified by a licensed engineer or architect or through research reports from approved sources as addressed in CBC Section 1703.4.2. Solar support component manufacturers often provide structural engineering design guidelines, worksheets, code compliance reports and Internet website calculators. The manufacturer's engineering guidelines are intended to ensure that the PV system above the roof and its connection to the roof assembly are code compliant. Additional requirements may be imposed by the enforcing agency (CRC Section R301.1.3).

4. Fire Safety Provisions

4.1 Fire/roof classification of photovoltaic (PV) panels

4.1.1 Solar PV panels installed on top of a building's roof structure

4.1.1.1 Solar PV systems installed on top of a roof where the space between the solar PV panels and the roof has no use and no potential use are generally considered equipment. These solar PV panels/models shall comply with the minimum fire/roof classification requirements or roof covering as required by the current CRC Section R902.4

For installations in State Responsibility Areas (SRA) or High Fire Hazard Severity Zones, additional provisions adopted by the local enforcing agency may be applicable. Check with the enforcing agency for any additional requirements.

4.1.1.2 Solar PV panels used as roofing on an independent (stand-alone) structure: Solar PV panels/modules that are designed to be on the roof and span to structural supports, and have a use or occupancy underneath, shall comply with the minimum fire/roof classification requirements for roof covering as required by CRC Section R902.4. An example of this type of installation is a carport structure having solar PV panels as the roof.

4.1.1.3 Solar PV panels installed as a part of a building's roof structure: Solar PV panels installed as integrated roofing material shall comply with the minimum fire/roof classification requirements for roof covering as required by the current CRC Section R902. An example of this type of installation is PV modules integrated into the roofing shingles (BIPV systems).

4.1.2 Solar PV systems installed on grade: Solar PV panels that are part of a stand-alone, ground-mounted solar PV panel structure, with no use and no potential use underneath are generally considered equipment and therefore the fire/roof classification requirements would not apply. The solar PV panels will require a clear, brush-free area of 10 feet around the installation (based on the definition of a roof assembly in CRC Section R202 and R331.5).

4.2 **Area, height and story limitations:** Where there is a use between the solar PV panels and the roof/grade underneath, adding such solar PV structures may constitute additional floor area, story and/or height. Solar PV panels supported by framing that has sufficient uniformly distributed and

unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency, are generally considered equipment.

4.3 Location from property line and adjacent buildings: Solar PV panels and associated framing, with no use and no potential use between the panels and the grade underneath, are generally treated as equipment. When not considered equipment, they may be considered a structure and shall be located and protected based upon the code required fire separation distance to property lines and adjacent buildings. (CRC Section R302.1)

4.4 Roof Access and Pathways: The installation of solar PV systems must allow for fire department smoke ventilation operations. Roof access point, clear access pathways, solar PV systems spacing and layout must comply with the requirements outlined in CRC Section R331.

4.5 Markings: The solar PV systems must be marked or labeled in accordance with CRC Section R331 and CEC Article 690. Markings are to be placed every 10 feet and in other areas as required.

4.6 Other fire safety requirements or guidelines: The installation of solar PV systems may be subject to additional provisions adopted by the local enforcing agency. Check with the enforcing agency for additional requirements.

5. Roof drainage: Roof-mounted solar PV systems shall not cause excessive sagging of the roof that results in water ponding. They shall also not block or impede drainage flows to roof drains and scuppers. (CRC Section R903.4; CPC Section 1101.11 also applies)

6. Roof penetrations: All roof penetrations shall be sealed using approved methods and products to prevent water leakage. Such methods include but not limited to caulking, roof jacks and sheet metal flashing. (CRC Section R903.2)

7. Skylights: Solar PV panels shall maintain a minimum clearance around the perimeter of skylights as not to interfere with the function of the skylight, as determined by the enforcing agency

8. Plumbing vent, mechanical equipment and mechanical exhaust terminations: Solar PV panels shall not obstruct or interfere with the function of plumbing vents or mechanical equipment. (CPC Sections 901.1 & 906, CMC Section 304)

PART II: ELECTRICAL CODE REQUIREMENTS

1. **Product listing (certification):** The solar PV panel/module and other equipment used in the PV system shall be listed/certified by a nationally recognized listing/certification agency in accordance with the applicable standards.

2. **Installation:** The installation of the solar PV system must conform to the requirements of the California Electrical Code (CEC).

3. **Signage:** Signage must conform to the requirements of the CEC. Signage requirements and location of certain equipment for solar PV systems may be subject to additional provisions adopted by the enforcing agency.

PART III: LOCAL ELECTRIC UTILITY REQUIREMENTS

Check with the local utility for any incentives, interconnection, operating and metering requirements.

Code Requirements for PV on Buildings other than One- and Two- Family Dwellings

Based on the 2013 California Building Code (CBC), California Residential Code (CRC) and California Energy Code (CEC)

PURPOSE

The purpose of this information bulletin is to clarify requirements of the State Building Standards Codes (Title 24) that pertain to solar PV installations. This bulletin can serve as a reference guide for permit applicants and enforcing agencies to clarify how state code requirements are practically applied in the local jurisdiction. It is intended to minimize permitting uncertainty and differing interpretation regarding specific code requirements for solar PV installations. This information bulletin primarily clarifies requirements pertaining to the California Building Code and the California Residential Code, since these codes in their current form require significant local interpretation. This information bulletin does not address local regulations.

The implementation of uniform standards to achieve the timely and cost-effective installation is consistent with the California Solar Rights Act that views solar installation as a matter of statewide concern and prohibits local jurisdictions from adopting unreasonable barriers to the installation of solar energy systems (CA Government Code Section 65850.5).

PART I: BUILDING AND RESIDENTIAL CODE REQUIREMENTS

1. Definitions

1.1 Solar photovoltaic (PV) system: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load (CEC Article 100 and Article 690.2)

1.2 Module: A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight (CEC Article 690.2)

1.3 Panel: A collection of modules mechanically fastened together, wired and designed to provide a field-installable unit (CEC Article 690.2)

Building integrated photovoltaics (BIPV): Photovoltaic cells, devices, modules or modular materials that are integrated into the outer surface or structure of a building and serve as the outer protective surface of the building (CEC Article 690.2).

1.4.1 Photovoltaic modules/shingles: A roof covering composed of flat-plate photovoltaic modules fabricated in sheets that resemble three-tab composite shingles (CBC Chapter 2, Section 202).

1.5 Alternating-current (AC) module (alternating-current photovoltaic module): A complete, environmentally protected unit consisting of solar cells, optics, inverter and other components, exclusive of tracker, designed to generate AC power when exposed to sunlight (CEC Article 690.2).

1.6 Ballasted photovoltaic system: A roof-mounted system composed of solar photovoltaic panels and supporting members that are unattached or partially attached to the roof and must rely on its weight, aerodynamics and friction to counter the effect of wind and seismic forces (CBC Chapter 16, 1613.5.1 [1.2]).

2. Solar Ready Requirements

The California Energy Code (Section 110.10) contains mandatory requirements for solar readiness in certain newly constructed single-family and multifamily residences. Although these requirements apply to new construction only, they are briefly outlined here for informational purposes.

2.1 Solar Zone: Subject to certain exceptions outlined in the code, newly constructed homes are required to have an area designated for future solar installations on the roof or overhang of the building, the roof or overhang of another structure located within 250 feet of the building or covered parking installed with the building project. This area must meet certain requirements. The minimum solar zone area must have the following.

2.1.1 Minimum area: The solar zone must be no less than 15 percent of the total roof area of the building excluding any skylight area.

2.1.2 Orientation: All sections of the solar zone located on steep-sloped roofs (defined as a roof whose pitch is greater than 2:12) shall be oriented between 110 degrees and 270 degrees of true north.

2.1.3 Shading: The solar zone must be free of obstructions and may not be shaded by certain obstructions outside the zone (Section 110.10.b.2).

2.2 Documentation: Construction documentation must clearly show the dead and live load for the solar zone. Collateral loads for future solar energy systems do not need to be shown on the construction documents.

Construction documentation must also show pathways for electrical or plumbing interconnections. This includes a location for inverters and metering equipment and a pathway for routing of conduit from the solar zone to the point of interconnection with the electrical service. For single-family residences, the point of interconnection will be the main service panel.

This information must also be provided to the occupant.

2.3 Main Electrical Service Panel

The main electrical service panel shall have a minimum bus bar rating of 200 amps and a marked reserved space for future solar electric installation.

3. Structural Requirements

3.1 PV systems positively anchored to the building

3.1.1 Exemption from structural calculations: The building official may waive the requirement for structural calculations for solar PV installations on top of existing roofs if the official can readily determine that the additional weight of the new solar PV system on the roof does not affect the structural integrity of the building. Some jurisdictions may have a prescriptive approach for when structural calculations can be waived, however, that varies by the enforcing agency.

To help streamline and simplify the permitting process for roof-mounted solar PV systems, it is highly recommended that local jurisdictions develop a prescriptive approach to meeting the structural requirements so that structural calculations are not always required. Some parameters to consider under such prescriptive approach include the following.

- Maximum distributed weight of the solar PV system in PSF
- Maximum perpendicular distance between the solar PV system and the roof below
- Maximum concentrated load imposed by the PV panel support onto the building's roof
- Minimum size and spacing of rafters or joists for portion of the roof that is supporting the solar PV system
- Maximum span of rafters or joists for portion of the roof that is supporting the solar PV system
- Anchoring requirements such as type of fasteners, minimum fastener size, minimum embedment and minimum number of attachment points
- Any limitation on the type of building construction

3.1.2 Structural calculations: When structural calculations are required, calculations shall demonstrate that the primary structure will support the additional vertical and lateral loads from the panels and related equipment.

Note 1: See the appendix to this document for additional guidance on structural calculations.

3.1.2.1 Roof dead load: The weight of solar PV systems shall be considered as dead load in the design of the structure (CBC Section 1606, CRC Section R301.4).

For installation of conventional (not BIPV) solar PV panels on existing roofs, roof live load is not imposed where PV panels occur, provided the clear distance under the panels to top of the roof is less than 42" and provided the roof design is adequate for the concentrated loads from the solar PV panel support frames. See Structural Engineers Association of California (SEAOC) Solar PV-3 Live Load document for additional information.

When the roof live load is allowed to be reduced, consideration should be given to the possibility that a roof may have more than one layer of existing. For pre-1960 wood-framed construction, structural calculations may be based on actual (field-measured) lumber sizes (typically greater than modern lumber sizes) and Douglas fir Grade 1 may be assumed unless field conditions indicate otherwise.

Section 3403.3 of the CBC states, in part, that "Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased load required by this code for new structures."

3.1.2.2 Roof live load: Roof live load is not considered in areas covered by roof-mounted panels where there is less than 42" clear under the panels. Roof surfaces not covered by solar PV panels shall be designed for the roof live load (CBC Section 1607, CRC R301.6).

The building official may determine that live load need not be considered for solar PV panels and associated supporting members that are built on grade. Such interpretation is generally based on the assumption that the solar PV panels will not be stepped on or used by anyone to support any live load

3.1.2.3 Wind design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist wind loads. For ballasted PV systems, see Section 2.2 of this information bulletin (CBC Section 1609, CRC R301.2.1).

Photovoltaic modules/shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from CBC Table 1507.2.7.1(2) Classification of Asphalt Shingles Per ASTM D 3161 (CBC Section 1507.2.7.1[2]).

The Structural Engineering Association of California has released a white paper titled "Wind Loads on Low-Profile Solar Photovoltaic Systems on Flat Roofs." This document is available at http://files.engineering.com/download.aspx?folder=7ae26414-8066-4d06-b001-198e5aaf6d88&file=2012-08_SEAOC_Solar_PV_wind_document_Final.pdf.

3.1.2.4 Seismic design: Calculations shall demonstrate that the solar PV panels and associated supporting members are designed to resist earthquake loads. For ballasted PV systems, see Section 2.2 of this information bulletin (CBC Section 1613, CRC 301.2.2).

Note that Section 3404.4 of the CBC states, in part, that "Any existing lateral load-carrying structural element whose demand-capacity ratios with alteration considered is no more than 5 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. . . ."

3.1.2.5 For wood construction, supports shall be attached with fasteners of sufficient length and size to achieve minimum required embedment into solid wood taking into consideration the plywood and multiple layers of roofing that may exist, unless otherwise approved by the enforcing agency (ASCE/SEI 7 Section 13.4, CRC Section R301.1.3).

3.1.2.6 Snow load: When applicable, include snow loads and loads from snowdrift (CBC Section 1608, CRC R301.2.3).

3.1.2.7 Requirements for load combinations: The applicable load combinations in CBC 1605 shall be applied to all loading conditions, including evaluating the effects of dead load to counteract wind uplift for ballasted and anchored systems (CBC Section 1605, CRC Section R301.1.3).

3.1.2.8 Alterations, additions and repairs: Sections 3403, 3404, and 3405 of the CBC shall apply to additions, alterations and repairs associated with PV systems. Roof structural components, their connections, additions, alterations and repairs shall be designed to support the loads from the PV panel support frames

3.1.2.9 The Division of the State Architect (DSA) Interpretation of Regulations Article 16.8, intended for public schools, provides useful code interpretation guidance to non-DSA code officials regarding several types of solar systems, both ground- and roof-mounted.

3.2 Ballasted PV system: PV panels in a ballasted system are typically not attached to the roof and rely on their weight, aerodynamics and friction to counter the effect of wind and seismic forces. In some cases, ballasted systems have few attachment points to supplement the friction forces. Ballasted systems have low ratios of height-to-base width or length, which makes them inherently stable against overturning.

Section 13.4 of ASCE/SEI 7-10 requires that nonstructural components and their supports be attached (or anchored) to the structure. Ballasted solar PV systems are not addressed in the ASCE/SEI 7 and not part of the 2010 CBC.

During the 2012 Triennial Code Adoption Cycle, the Department of Housing and Community Development and the Building Standards Commission proposed an amendment in CBC Section 1613.5, which provides a definition for ballasted photovoltaic systems and allows local governments to approve such systems if they are inclined to accept the weight and friction methodology. This amendment was developed by the Structural Engineers Association of California – Solar Photovoltaic Systems Committee and was based on recently approved Item S72-12 at the ICC Code Development Hearing.

This new language, as written, provides building officials with additional criteria under which a ballasted solar system can be permitted.

Note 1: Electrical connections and wiring in a ballasted system should be designed to accommodate movements within the system.

Note 2: The Structural Engineering Association of California is in the process of developing a white paper, titled "Structural Seismic Requirements and Commentary for Rooftop Solar Photovoltaic Systems," addressing the seismic design of ballasted systems. Once available, a link to the white paper will be included in this document.

3.3 Structural strength of PV panels: The structural strength of solar PV panels is not addressed in the code.

UL 1703, Third Edition, published March 15, 2002, requires that solar PV panels be tested to withstand a superimposed load of 30 PSF. Therefore, all solar PV panels that are listed per UL 1703 are considered to meet this requirement. When used as a building component and depending on the load values that the solar PV panels are subjected to, the enforcing agency may require a test report from an agency recognized by the enforcing agency showing the strength of the solar PV panels.

3.4 Condition of existing roof: Solar PV systems shall not be installed on an existing roof that is deteriorated to the point where it is not adequate as a base. (This interpretation is based on CBC Section 1510 and CRC R907.)

3.5 Premanufactured support systems: Premanufactured support systems must support the PV system and allow the system to stay attached to the structure when exposed to wind, snow or seismic loads. Compliance of the PV support system with appropriate building codes is accomplished through a design specified by a licensed engineer or architect or through research reports from approved sources as defined in CBC Section 1703.4.2. Solar support component manufacturers often provide structural engineering design guidelines, worksheets, code compliance reports and Internet website calculators. The manufacturer's engineering guidelines are intended to ensure that the solar array above the roof and its connection to the roof are code compliant. Additional requirements may be imposed by the enforcing agency (CRC Section R301.1.3, CBC Section 1703.4.2).

4. Fire Safety Provisions

4.1 Fire/roof classification of photovoltaic (PV) panels

4.1.1 Solar PV panels installed on top of a building's roof structure

4.1.1.1 Solar PV systems installed on top of a roof where the space between the solar PV panels and the roof has no use and no potential use are generally considered to be equipment. These solar PV panels/modules shall comply with the minimum fire/roof classification requirements for roof covers as required by CBC Section 1505.

For installations in State Responsibility Areas (SRA) or High Fire Hazard Severity Zones, additional provisions adopted by the local enforcing agency may be applicable. Check with the enforcing agency for any additional requirements.

4.1.1.2 Solar PV panels used as roofing on an independent (stand-alone) structure: Solar PV panels/modules that are designed to be on the roof and span to structural supports, and have a use or occupancy underneath, shall comply with the minimum fire/roof classification requirements for roof covering as required by CRC Section R902. An example of this type of installation is a carport structure having solar PV panels as the roof.

4.1.1.3 Solar PV panels installed as a part of a building's roof structure: Solar PV panels installed as integrated roofing material shall comply with the minimum fire/roof classification requirements for roof covering as required by the current CRC Section R902. An example of this type of installation is PV modules integrated into the roofing shingles (BIPV systems).

4.1.2 Solar PV systems installed on grade: Solar PV panels that are part of a stand-alone, ground-mounted solar PV panel structures, with no use and no potential use underneath are generally considered equipment and therefore the fire/roof classification requirements would not apply. The solar PV panels will require a clear, brush free area of 10 feet around the installation. (Based on the definition of a roof assembly in CRC Section R202/CBC Section 1502.)

4.2 Area, height, and story limitations: Where there is a use between the solar PV panels and the roof/ grade underneath, adding such solar PV structures may constitute additional floor area, story and/or height. Solar PV panels supported by framing that has sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency, are generally considered equipment. Provisions relating to solar PV height and area requirements are contained in CBC Section 503 and Table 503.

4.3 Location from property line and adjacent buildings: Solar PV panels and associated framing, with no use and no potential use between the panels and the grade underneath, are generally treated as equipment. When not considered equipment, they may be considered a structure and shall be located and protected based upon the code required fire separation distance to property lines and adjacent buildings (CRC Section R302.1, CBC Section 602).

4.4 Fire proofing of structural support: Depending on the type of building, support structures of solar PV systems that have a use or have potential for use underneath (such as carports) may be required to be fire proofed in accordance with CBC Section 602.

4.4.1 The following installations are generally considered equipment and are not subject to this requirement provided that the structural members are noncombustible.

Stand-alone PV panel structures with no use and no potential use underneath (based on definition of a roof assembly in CBC Section 202).

Solar PV panels supported by framing that has sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency (based on definition of a roof assembly in CBC Section 202).

4.4.2 Alternate designs can be considered when approved by the enforcing agency as an alternative material, design or method of construction pursuant to CBC Sections 1.2.2, 1.8.7, or 1.11.2.4 as applicable.

4.5 Rooftop structures: Unenclosed rooftop structures supporting solar PV systems with no use underneath are generally not subject to CBC Section 1509.2.

4.6 Fire sprinklers: In buildings that are required to be provided with fire sprinklers, the CBC requires that all parts of the building have sprinkler coverage except where an exemption is specifically required. See amendments to NFPA section 8.15.7.6 in Chapter 35 of the CBC.

4.6.1 Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency, are generally not subject to this requirement (CBC Section 903.3.3).

4.6.2 Solar PV panels placed above the roof, with no use and no potential use between the panels and the roof, are generally not subject to this requirement (based on definition of a roof assembly in CBC Section 1502 and CRC Section R202).

4.6.3 Existing exemptions in the code may be used for a solar PV installation if it meets the intent of the exemption. This will be subject to approval by the enforcing agency.

4.7 Roof Access and Pathways: The installation of solar PV systems must allow for fire department smoke ventilation operations. Roof access point, clear access pathways, solar PV systems spacing and layout must comply with the recruitments outlined in CRC Section R331

4.8 Markings: The solar PV systems must be marked or labeled in accordance with CRC Section R331 and CEC Article 690. Markings are to be placed every 10 feet and in other areas as required.

4.9 Other fire safety requirements or guidelines: The installation of solar PV systems may be subject to additional provisions adopted by the local enforcing agency. Check with the enforcing agency for additional requirements.

5. Roof drainage: Roof-mounted solar PV systems shall not cause excessive sagging of the roof that results in water ponding. They shall also not block or impede drainage flows to roof drains and scuppers. See CBC Section 1503.4 and CRC Section R903.4. CPC Section 1101.11 also applies.

6. Roof penetrations: All roof penetrations shall be sealed using approved methods and products to prevent water leakage. Such methods include but not limited to caulking, roof jacks and sheet metal flashing (CBC Section 1503.2, CRC Section R903.2).

7. Skylights: Solar PV panels shall maintain a minimum clearance around the perimeter of skylights as not to interfere with the function of the skylight, as determined by the enforcing agency.

8. Plumbing vent, mechanical equipment and mechanical exhaust terminations: Solar PV panels shall not obstruct or interfere with the function of plumbing vents or mechanical equipment (CPC Sections 901.1 & 906, CMC Section 304).

9. Guard rails: When required by the enforcing agency, guard rails may apply to solar PV systems (CBC Section 1013.6).

10. Disabled access requirements

10.1 Nonresidential, hotel, motel buildings, facilities or structures (See CBC Chapter 11B)

10.1.1 Scope: Accessibility to solar PV support structures that create a use or occupancy shall be provided for all occupancy classifications in accordance with Chapter 11B.

10.1.2 General: When alterations, structural repairs or additions are made to existing buildings or facilities for the purpose of installing a solar PV system, they shall comply with Chapter 11B.

Note: New solar PV systems that do not create or expand a use or occupancy and consist only of installation of the solar PV system and related electrical work that does not affect disabled access requirements for existing buildings regulated by Chapter 11B are not considered alterations for the purpose of accessibility and should not be subject to accessibility upgrades.

10.2 Residential buildings, facilities or structures

10.2.1 Scope: New solar PV systems serving covered multifamily dwellings that create a use or occupancy shall comply with the provisions of Chapter 11A.

10.2.2 Existing buildings: The building standards contained in Chapter 11A do not apply to the installation of solar PV systems serving privately funded multifamily dwellings constructed for first occupancy prior to March 13, 1991.

10.3 Parking: Required accessible parking spaces shall be provided and maintained in accordance with the applicable provisions of Chapter 11A, Sections 1109A and Chapter 11B.

Note: Alterations: Where parking lots, parking structures or parking facilities are re-striped or otherwise altered to accommodate solar PV systems, required accessible parking spaces shall be maintained or shall be provided in accordance with the applicable provisions of Section 1109A and Chapter 11B.

PART II: ELECTRICAL CODE REQUIREMENTS

1. **Product listing (certification):** The solar PV panel/module and other equipment used in the PV system shall be listed/certified by a nationally recognized listing/certification agency in accordance with the applicable standards.

2. **Installation:** The installation of the solar PV system must conform to the requirements of the California Electrical Code (CEC).

3. **Signage:** Signage must conform to the requirements of the (CEC). Signage requirements and location of certain equipment for solar PV systems may be subject to additional provisions adopted by the enforcing agency.

PART III: LOCAL ELECTRIC UTILITY REQUIREMENTS

Check with the local utility for any incentives, interconnection, operating and metering requirements.

GLOSSARY

AHJ: Acronym that stands for authority having jurisdiction. AHJ is often used to describe the designated department or agency that enforces certain laws or regulations. It is often used interchangeably with the term enforcing agency.

BIPV: Acronym that stands for building integrated photovoltaics, which is a form of photovoltaic solar energy technology that is integrated into the building envelope to become a part of the roof, skylight or facade.

California Building Standards Commission: State entity that administers California's building codes, including the adoption, approval and publication. They follow a triennial code adoption cycle in which state agencies submit their proposals for code changes.

California Department of Housing and Community Development (HCD): State department responsible for preserving and expanding safe and affordable housing opportunities. HCD develops the building standards that govern construction and maintenance on all forms of housing and ensures that the standards are properly enforced, identifies California's housing needs and develops policies to meet those needs.

California State Fire Marshal: State office that supports CAL FIRE by focusing on fire prevention through fire prevention engineering, training, education and enforcement.

Contractor: A contractor licensed by the State of California performing work within the scope of their license.

Dead load: The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items and the weight of fixed service equipment, such as cranes, plumbing stacks and risers; electrical feeders; heating, ventilating and air-conditioning systems; and automatic sprinkler systems.

Enforcement: (As defined in Title 24) A diligent effort to secure compliance, including review of plans and permit applications, response to complaints, citation of violations and other legal process. Except as otherwise provided in this part, "enforcement" may, but need not, include inspections of existing buildings on which no complaint or permit application has been filed and effort to secure compliance as to these existing buildings.

Enforcing agency: The designated department or agency that enforces certain laws or regulations, as specified by statute or regulation. In regard to solar PV installations, this entity is can also be referred to as the "permitting agency," since it is often the entity that issues a permit to allow for solar installations to be constructed.

General plan: A document adopted by a city or county to create a long-term vision to guide the jurisdictions future growth and land use. It includes a statement of development policies and implementing actions to achieve its development objectives.

Live load: Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

Photovoltaic: A method of generating electrical power by converting solar radiation (sunlight) into direct current electricity using semiconductors.

Qualified person: One who has the required state license and has proper skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

Solar photovoltaic system: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load.

Title 24: The section of the California Code of Regulations that governs the design and construction of all buildings and associated facilities and equipment in California.

ADDITIONAL RESOURCES

Alternative Energy Equipment and Systems Marking and Application Guide

Underwriters Laboratories (UL) publishes the ***Alternative Energy Equipment and Systems Marking and Application Guide***. The guide provides application and UL product category information for PV systems, thermal solar systems, fuel cells and hydrogen generators, engine generators, microturbines and wind turbine generating systems. This guide is available online and can be found in Appendix A of the most recent UL White Book.

California Solar Initiative Incentives

Information about state incentives offered for solar installations. Most incentives allocated for PV installations have been exhausted, but incentives remain for new construction homes and solar thermal installations.

California Solar Energy Industries Association (CALSEIA)

CALSEIA provides a ready-made forum for public agencies to communicate with contractors and/or seek feedback on changes to local permitting requirements or processes. Local chapters of CALSEIA exist throughout the state.

Center for Sustainable Energy (CSE)

CSE provides implementation expertise and training to public agencies on solar permitting. CSE is the statewide awardee of the Department of Energy's Rooftop Solar Challenge, a component of the SunShot Initiative. Template permitting documents and AB 2188 Implementation Guide are available **online**.

Energy Aware Planning Guide

Developed by the California Energy Commission, the ***Energy Aware Planning Guide*** is a comprehensive resource for local governments seeking to reduce energy use, improve energy efficiency and increase adoption of renewable energy across all sectors. The guide presents a menu of strategies and best management practices to help local governments improve energy efficiency, reduce energy consumption through transportation and land use and enhance renewable sources of energy.

Energy Aware Facility Siting and Permitting Guide

Developed by the California Energy Commission, the ***Energy Aware Facility Siting and Permitting Guide*** assists local governments with developing general plan energy and transmission elements and provides guidance on utility-scale electricity generation and transmission planning and permitting. The guide discusses the increasing role of local governments in energy planning and permitting, describes the energy regulations and policies (both federal and state) and planning processes that define future electricity generation and transmission needs, and identifies opportunities for local government involvement in electricity infrastructure planning and permitting.

Expedited Permit Process for PV System

Recommendations developed for the Solar American Board for Codes and Standards (Solar ABCs) by Bill Brooks, P.E., Brooks Engineering. This **document** outlines a standardized review process for small-scale PV systems.

Incentive and Interconnection Information

Following are weblinks to information on major utilities' interconnection rules and procedures.

Los Angeles Department of Water and Power (LADWP)

Pacific Gas and Electric (PG&E)

- Standard Net Energy Metering (includes links to Interconnection forms)

Sacramento Municipal Utility District (SMUD)

San Diego Gas and Electric (SDG&E)

Southern California Edison (SCE)

- Net Metering FAQs
- Net Energy Metering Interconnection Handbook

Sharing Success — Emerging Approaches to Efficient Rooftop Solar Permitting

Published by the Interstate Renewable Energy Council (IREC) in May 2012, this report outlines innovative strategies being implemented across the U.S. to help increase the efficiency of permitting procedures for rooftop solar systems.

Solar America Board for Codes and Standards (Solar ABCs)

Solar ABCs is a collaborative effort funded by the Department of Energy. This entity publishes several helpful reports and recommendations, including a permit streamlining guideline.

Solar Energy Facilities Permit Streamlining Guide

A guide produced by the California County Planning Directors Association (CCPDA) to help counties facilitate development of solar energy facilities. The guide describes the laws and regulations applying to solar energy facilities, points to consider regarding solar energy development and lists current procurement and incentive programs for renewable energy. The guide also provides a model ordinance regarding solar energy facilities and further outlines policy options and guidance for counties regarding solar energy.

Solar Instructor Training Network

The Solar Instructor Training Network (SITN) promotes high-quality training in the installation of solar technologies. Nine regional resource and training providers support the professional development of trainers and instructors of solar PV and solar heating and cooling technologies across the country. The Interstate Renewable Energy Council (IREC) became the national administrator of the Solar Instructor Training Network in 2010. IREC also provides several guides and checklists on permitting best practices.

Structural Technical Appendix for Residential Rooftop Solar Installations

A detailed description of the structural engineering principles and assumptions behind Toolkit Document 5, Structural Criteria for Residential Rooftop Solar Energy Installations. This Appendix delineates how the document conforms to the California Residential Code and California Building Code and also discusses options that jurisdictions may want to consider in implementing Toolkit Document 5. Additionally, the Technical Appendix offers guidance to address some nonconforming items, such as when an anchor layout is not based on a solar support component manufacturer's guidelines or when a dwelling is located within 200 yards of the ocean (Wind Exposure D).

California Solar Rights Act: A Review of the Statutes and Relevant Cases

The Energy Policy Initiatives Center at the University of San Diego School of Law has produced this detailed analysis of the California Solar Rights Act. This review details the evolution of the act since its passage in the late 1970s. A series of court cases, detailed in this document, have shaped how the act is applied and practiced throughout the state.

Governor's Office of Planning and Research
Office of Governor Edmund G. Brown Jr.

City of Arcadia Building Department
POLICY AND PROCEDURE

Building Permit Reinspection Fee Requirements

PURPOSE

The California Building Code specifies assessment of reinspection fees in certain circumstances. The purpose of this policy is to provide guidelines to staff as to when to assess reinspection fees so that there is uniformity in the collection of the fees.

GENERAL

The California Building Code (CBC) Section 108.8 states in part: *"A reinspection fee may be assessed for each inspection or reinspection when such portion of work for which inspection is called is not complete or when corrections called for are not made. This section is not to be interpreted as requiring reinspection fees the first time a job is rejected for failure to comply with the requirements of this code, but as controlling the practice of calling for inspections before the job is ready for such inspection or reinspection"*....

It is the intent of this policy to provide guidelines for the consistent application of the reinspection fee to a project.

AUTHORITY

The Building Official shall have the authority to render interpretations of the code and adopt and enforce rules and supplemental regulations to clarify the application of its provisions per Section
104.2.1 of the California Building Code. Additionally, Section 108.8 "Reinspections" of the California Building Code.

POLICY

Building Inspectors are authorized to assess reinspection fees in the following cases:

A. The street address is not posted at the property and the property cannot be located after a reasonable effort has been made or a detailed site plan showing the location of the work is not available to the inspector resulting with the inability to locate the job. (Note: The street address must meet fire safe standards if these apply to the job. Failure to meet fire safe standards will be noted on a correction notice and will not be subject to reinspection fees unless the property cannot be located.)

B. Approved building plans or the job card are not available at the job site when the inspection is called for.

C. The job is not ready for inspection when the inspector arrives. (A previous correction notice where not all items were addressed is not justification for reinspection fee).

D. Corrections have not been made from previous inspections (this applies where the area needing correction would be covered up at the next routine inspection stage).

E. Required special inspections have not been completed or the reports are not available.

F. Substantial deviation from the approved set of plans without approval of the Plan Check Section.

G. A locked gate prevents access to the job site.

H. Dog prevents access to the job site.

I. Access to area of inspection hazardous or unsuitable and cannot be rectified in a reasonable time.

J. Driveway/roadway to job site not accessible (job site too far to walk).

APPLICATION:

A. Inspectors are expected to act reasonably in the application of these fees to recover costs associated with "wasted" inspections. If the situation is clearly out of the control of the permit holder the fees should not be assessed. If the Building Inspector has questions regarding the applicability of this policy, the Building Inspection Section Supervisor should be consulted.

B. Fees must be paid prior to the next inspection request. They may be paid in person at the department or by credit card over the phone.

C. The inspector is to note the reinspection fee on a correction notice. A copy shall be maintained in the active permit file and provided to the clerical support for entry into the permit system.

APPEALS: Any appeals to this policy shall be made first to the Building Inspection Supervisor and then to the Building Official after review by the Division Manager. Work may be authorized to proceed by the Building Inspection Section Supervisor, the Division Manager or the Building Official.

Approved by:

Don Stockham
Building Official