



## EXPEDITED SOLAR PHOTOVOLTAIC FOR ONE- AND TWO-FAMILY DWELLINGS MICRO-INVERTER SYSTEMS

This guide is for a streamlined permitting process for solar photovoltaic (PV) projects 10 kW in size or smaller, and includes information about submittal requirements for plan review, required fees and inspections.

### 1. Approval Requirements

- a) Planning department approval is required.
- b) A building permit is required.
- c) An electrical permit is required.
- d) A fire department permit is not required.
- e) Silicon Valley Power approval is required.

### 2. Submittal Requirements

- a) Completed permit application form. This permit application form can be downloaded at <http://santaclaraca.gov/government/departments/community-development>.
- b) Demonstrate compliance with the eligibility checklist for expedited permitting.
- c) A completed Standard Electrical Plan. The standard plan may be used for proposed solar installations 10 kW in size or smaller. This will include:
  - *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*
  - *Equipment cut sheets including inverters, modules, AC and DC disconnects, combiners and racking system.*
  - *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) Complete expedited Structural Criteria along with required documentation.

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
- Provide manufacturer documentation of the rack system, maximum allowable weight the system can support, attachment methods, and product evaluation information or structural design.

### 3. Plan Review

Permit applications can be submitted to the Building Division, City of Santa Clara Community Development Department, in person at 1500 Warburton Ave, Santa Clara, CA 95050. Permit applications utilizing the standard plan may be approved “over the counter.” Permits not approved “over the counter” will be reviewed in one to fifteen business days. Permits submitted on line cannot be an expedited review.

### 4. Fees

See current [Building 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 the building division by our automated telephone system (408) 615-2400. Inspection requests are scheduled on a first-come first-served basis. If there is no other related work on the permit (such as a service upgrade) the first scheduled inspection can be the building and electrical final – menu codes 599 and 299 on the automated system.

Compliance with current smoke and carbon-monoxide alarm requirements is mandatory for all building permits.

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 for which applicant should be prepared to show compliance. If not available, common checks include the following.

- Number of PV modules and model number match plans and specification sheets number match plans and specification sheets.
- Array conductors and components are installed in a neat and workman-like manner.
- PV array is properly grounded.
- Electrical boxes are accessible and connections are suitable for environment.
- Array is fastened and sealed according to attachment detail.
- Conductors ratings and sizes match plans.
- Appropriate signs are properly constructed, installed and displayed, including the following.
  - Sign identifying PV power source system attributes at DC disconnect
  - Sign identifying AC point of connection
  - Sign identifying switch for alternative power system
- Equipment ratings are consistent with application and installed signs on the installation, including the following.
  - Inverter has a rating as high as max voltage on PV power source sign.
  - DC-side overcurrent circuit protection devices (OCPDs) are DC rated at least as high as max voltage on sign.
  - Switches and OCPDs are installed according to the manufacturer’s specifications (i.e., many 600VDC switches require passing through the switch poles twice in a specific way).
  - 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.



## ELIGIBILITY CHECKLIST FOR EXPEDITED SOLAR PHOTOVOLTAIC PERMITTING FOR ONE- AND TWO-FAMILY DWELLINGS

### 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 (next page)  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.

# Eligibility Checklist – Structural Criteria for Residential Flush-Mounted Solar Arrays

## 1. ROOF CHECKS

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- 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

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- 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, hips, gable ends, eaves)?  Y  N
- B. Do the modules plus support components weigh no more than:  
4 psf for photovoltaic arrays or 5 psf for solar thermal arrays?  Y  N
- C. Does the array cover no more than half of the total roof area (all roof planes)?  Y  N
- D. Are solar support component manufacturer’s project-specific completed worksheets, tables with relevant cells circled, or web-based calculator results attached?  Y  N
- E. Is a roof plan of the module and anchor layout attached? (see samples & last page)  Y  N
- F. Downward Load Check (Anchor Layout Check):
- 1) Proposed anchor horizontal spacing: \_\_\_\_\_' - \_\_\_\_\_"(ft-in)
  - 2) Manufacturer specification for anchor spacing: \_\_\_\_\_' - \_\_\_\_\_"(ft-in)
- G. Wind Uplift Check (Anchor Fastener Check):
- 1) Anchor fastener data (provide cut sheets):
    - 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 embedded 2.5” into the rafters or does the anchor fastener have a different manufacturer specification?  Y  N

## 3. SUMMARY

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- A. All items above are checked YES. No additional calculations are required.
- B. One or more items are checked NO. Attach project-specific drawings and calculations stamped and signed by a California-licensed civil or structural engineer.

Job Address: \_\_\_\_\_ Permit #: \_\_\_\_\_  
 Contractor/Installer: \_\_\_\_\_ License # & Class: \_\_\_\_\_  
 Signature: \_\_\_\_\_ Date: \_\_\_\_\_ Phone #: \_\_\_\_\_



**SOLAR PV STANDARD PLAN – SIMPLIFIED MICROINVERTER AND ACM SYSTEM  
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: \_\_\_\_\_

**1. General Requirements and System Information**

Microinverter  AC Module (ACM)  
 Number of PV modules installed: \_\_\_\_\_ Number of ACMs installed: \_\_\_\_\_  
 Number of Microinverters installed: \_\_\_\_\_ *Note: Listed Alternating-Current Module (ACM) is defined in CEC 690.2 and installed per CEC 690.6*

- 1.1 Number of Branch Circuits, 1, 2 or 3: \_\_\_\_\_
- 1.2 Actual number of Microinverters or ACMs per branch circuit: 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_
- 1.3 Total AC system power rating = (Total Number of Microinverters or ACMs) \* (AC inverter power output) = \_\_\_\_\_ Watts
- 1.4 Lowest expected ambient temperature for this plan in Table 1: For -1° to -5° C use 1.12 or for -6° to -10° C use 1.14 correction factors.
- 1.5 Average ambient high temperature for this plan: = +47° C  
 Note: For lower expected ambient or higher average ambient high temperatures, use Comprehensive Standard Plan.

**2. Microinverter or ACM Information and Ratings**

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

Microinverter or ACM Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

2.1 Rated (continuous) AC output power: \_\_\_\_\_ Watts

2.2 Nominal AC voltage rating: \_\_\_\_\_ Volts

2.3 Rated (continuous) AC output current: \_\_\_\_\_ Amps

**If installing ACMs, skip [STEPS 2.4]**

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

2.5 Maximum AC output overcurrent protection device (OCPD) \_\_\_\_\_ Amps

2.6 Maximum number of microinverters or ACMs per branch circuit: \_\_\_\_\_

**3. PV Module Information**

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

PV Module Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

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

3.1 Module  $V_{OC}$  at STC (from module nameplate): \_\_\_\_\_ Volts

3.2 Module  $I_{SC}$  at STC (from module nameplate): \_\_\_\_\_ Amps

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

Table 1. Module $V_{OC}$ at STC Based on Inverter Maximum DC Input Voltage Derived from CEC 690.7																
Microinverter Max. DC Input [STEP 2.4] (Volts)	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79
Max. Module $V_{OC}$ @ 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 $V_{OC}$ @ 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

**4. Branch Circuit Output Information**

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

Table 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 69° C, which includes 22° C adder, exposed to direct sunlight, mounted > 0.5 inches above rooftop, ≤ 6 current carrying conductors (3 circuits) in a circular raceway. Otherwise use Comprehensive Standard Plan.

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

## 5. Solar Load Center (if used)

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

5.2 Circuit Power see [STEP 1] = \_\_\_\_\_ Watts

5.3 Circuit Current = (Circuit Power) / (AC voltage) = \_\_\_\_\_ Amps

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

## 6. Point of Connection to Utility:

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

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

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

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

Table 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 <sup>†</sup>	60 <sup>†</sup>	40	60 <sup>†</sup>	60 <sup>†</sup>	45
Maximum Combined Inverter OCPD with 100% of bus bar rating (Amps)	0	25	0	50	25	0	50	25	0

<sup>†</sup>This plan limits the maximum system size to less than 10 kW, therefore the OCPD size is limited to 60 A. Reduction of Main Breaker is not permitted with this plan.

## 7. Grounding and Bonding

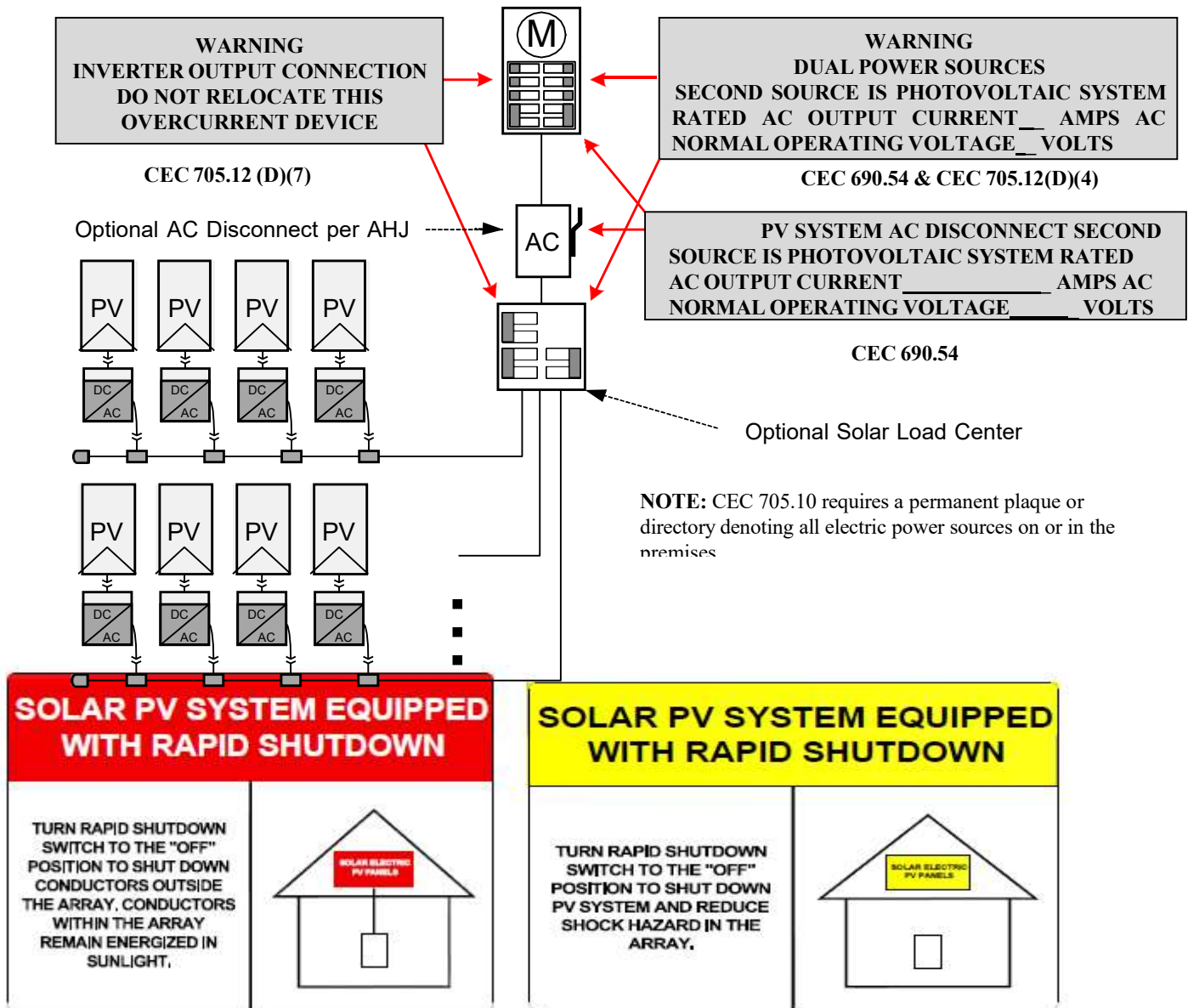
Check one of the boxes for whether system is grounded or ungrounded:  Grounded  Ungrounded

For Microinverters with a grounded DC input, systems must follow the requirements of GEC (CEC 690.47) and EGC (CEC 690.43).

For ACM systems and Microinverters with ungrounded a DC input follow the EGC requirements of (CEC 690.43).

## 8. Markings

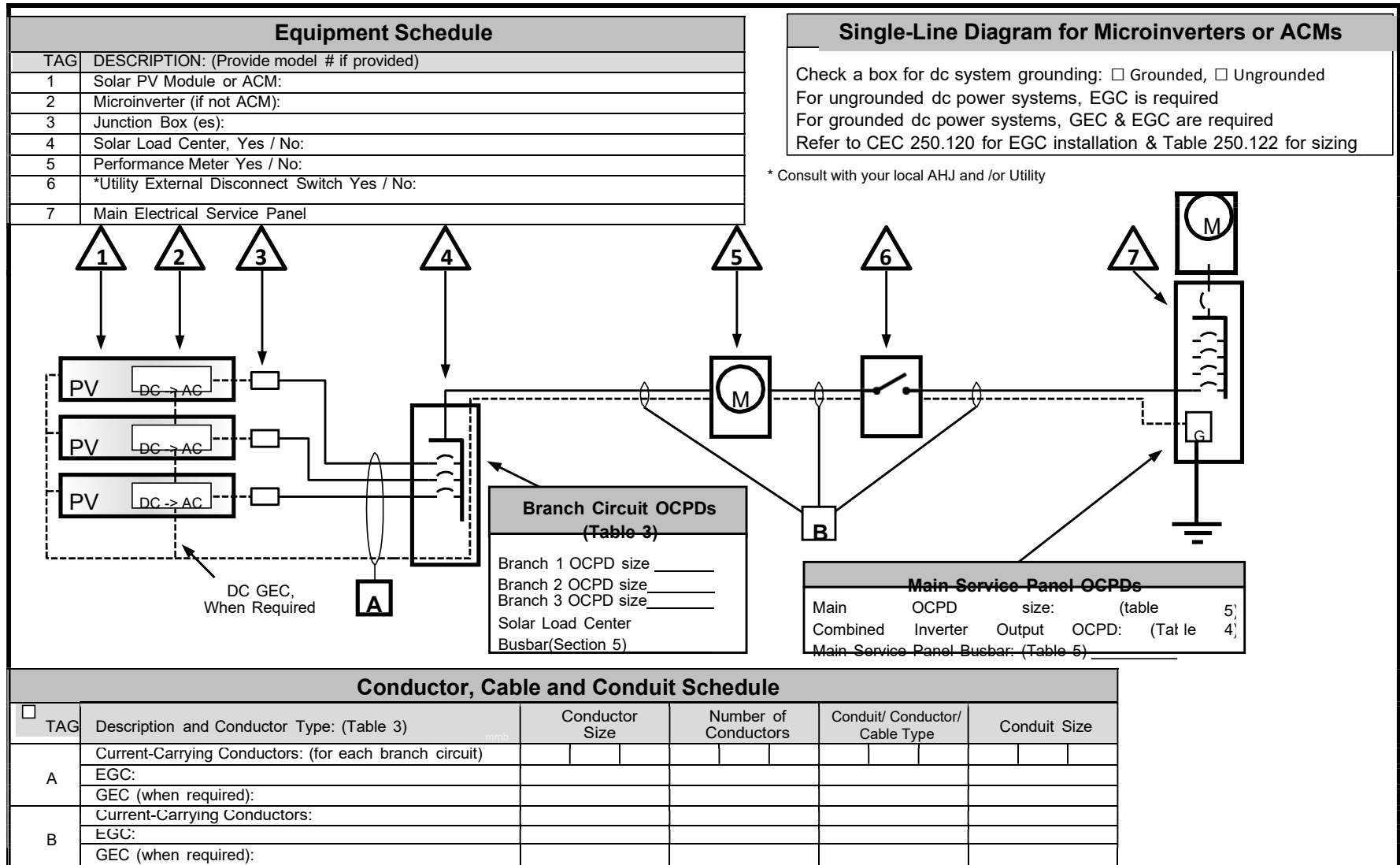
Informational note: ANSI Z535.4 provides guidelines for the design of safety signs and labels for application to products. A phenolic plaque with contrasting colors between the text and background would meet the intent of the code for permanency. No type size is specified, but 20 point (3/8") should be considered the minimum.





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

## 9. Single-Inverter Line Diagram



# **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

