



## EXPEDITED PERMIT PROCESS FOR PV SYSTEMS STANDARD STRING SYSTEM

The Solar America Board for Codes and Standards (Solar ABCs) Expedited Permit Process provides a means to differentiate systems that can be permitted quickly and easily due to their similarity with the majority of small-scale PV systems. Those systems with unique characteristics may be handled with small additions to this Expedited Permit Process or may require much more information, depending on the uniqueness of the installation.

The following pages contain forms for the Standard String System to use with the Expedited Permit Process. The Micro-Inverter, AC Module, and Supply-Side Connection forms are also available as interactive PDF files at [www.solarabcs.org/permitting](http://www.solarabcs.org/permitting). In jurisdictions that have adopted the Expedited Permit Process for PV Systems, these forms can be filled out electronically and submitted in either printed form and via email. An electronic format is used so that the supplied information is standardized and legible for the local jurisdiction.

# EXPEDITED PERMIT PROCESS FOR SMALL-SCALE PV SYSTEMS STANDARD STRING SYSTEM

The information in this guideline is intended to help local jurisdictions and contractors identify when PV system installations are simple, needing only a basic review, and when an installation is more complex. It is likely that 50%-75% of all residential systems will comply with these simple criteria. For projects that fail to meet the simple criteria, resolution steps have been suggested to provide as a path to permit approval.

## **Required Information for Permit:**

1. Site plan showing location of major components on the property. This drawing need not be exactly to scale, but it should represent relative location of components at site (see supplied example site plan). PV arrays on dwellings with a 3' perimeter space at ridge and sides may not need separate fire service review.
2. Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and ac connection to building (see supplied standard electrical diagram).
3. Specification sheets and installation manuals (if available) for all manufactured components including, but not limited to, PV modules, inverter(s), combiner box, disconnects, and mounting system.

## **Step 1: Structural Review of PV Array Mounting System**

**Is the array to be mounted on a defined, permitted roof structure?**  Yes  No

*If No due to non-compliant roof or a ground mount, submit completed worksheet for the structure WKS1.*

### **Roof Information:**

1. Is the roofing type lightweight (Yes = composition, lightweight masonry, metal, etc...)\_\_\_\_\_

*If No, submit completed worksheet for roof structure WKS1 (No = heavy masonry, slate, etc...).*

2. Does the roof have a single roof covering?  Yes  No

*If No, submit completed worksheet for roof structure WKS1.*

3. Provide method and type of weatherproofing roof penetrations (e.g. flashing, caulk).\_\_\_\_\_

### **Mounting System Information:**

1. Is the mounting structure an engineered product designed to mount PV modules with no more than an 18" gap beneath the module frames?  Yes  No

*If No, provide details of structural attachment certified by a design professional.*

2. For manufactured mounting systems, fill out information on the mounting system below:

- a. Mounting System Manufacturer \_\_\_\_\_ Product Name and Model# \_\_\_\_\_
- b. Total Weight of PV Modules and Rails \_\_\_\_\_ lbs
- c. Total Number of Attachment Points \_\_\_\_\_
- d. Weight per Attachment Point (b ÷ c) \_\_\_\_\_ lbs (if greater than 45 lbs, see WKS1)
- e. Maximum Spacing Between Attachment Points on a Rail \_\_\_\_\_ inches (see product manual for maximum spacing allowed based on maximum design wind speed)
- f. Total Surface Area of PV Modules (square feet) \_\_\_\_\_ ft<sup>2</sup>
- g. Distributed Weight of PV Module on Roof (b ÷ f) \_\_\_\_\_ lbs/ft<sup>2</sup>

*If distributed weight of the PV system is greater than 5 lbs/ft<sup>2</sup>, see WKS1.*

## **Step 2: Electrical Review of PV System (Calculations for Electrical Diagram)**

**In order for a PV system to be considered for an expedited permit process, the following must apply:**

1. PV modules, utility-interactive inverters, and combiner boxes are identified for use in PV systems.
2. The PV array is composed of 4 series strings or less per inverter.
3. The total inverter capacity has a continuous ac power output 13,440 Watts or less
4. The ac interconnection point is on the load side of service disconnecting means (690.64(B)).
5. One of the standard electrical diagrams (E1.1, E1.1a, E1.1b, or E1.1c) can be used to accurately represent the PV system. Interactive PDF diagrams are available at [www.solarabcs.org/permitting](http://www.solarabcs.org/permitting).

*Fill out the standard electrical diagram completely. A guide to the electrical diagram is provided to help the applicant understand each blank to fill in. If the electrical system is more complex than the standard electrical diagram can effectively communicate, provide an alternative diagram with appropriate detail.*

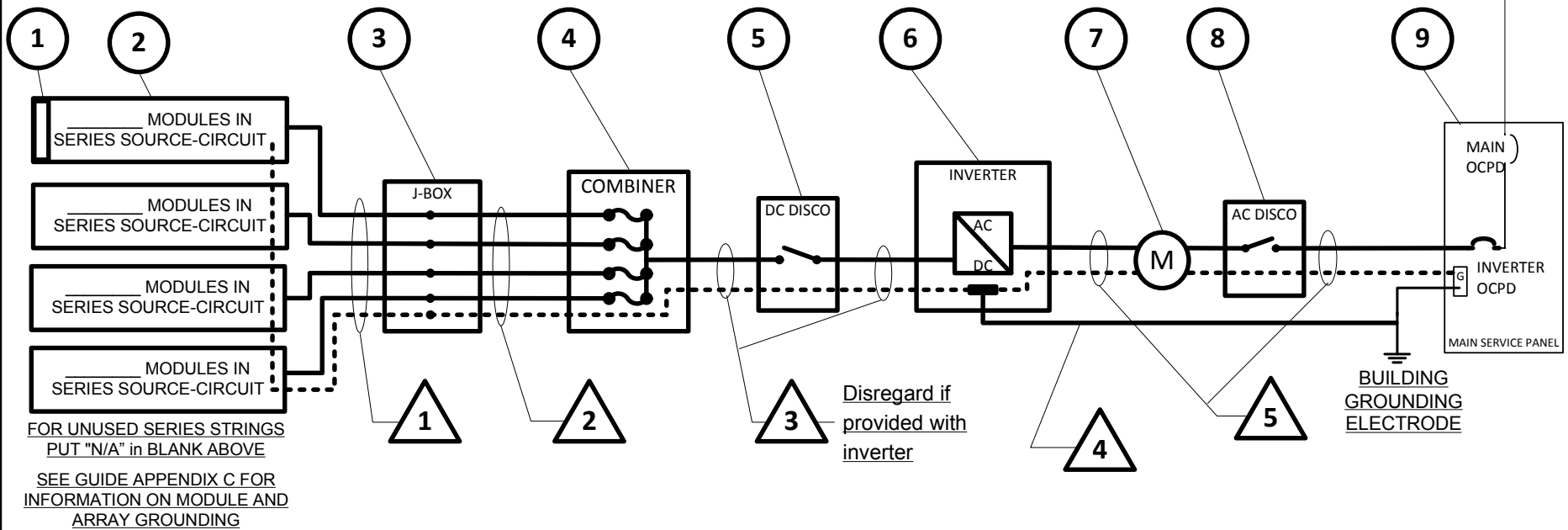
# STANDARD STRING SYSTEM SITE PLAN



Contractor Name, Address and Phone:	<b>Site Plan</b>			
	<b>for Small-Scale, Single-Phase PV Systems</b>			
	Site Name:			
	Site Address:			
	System AC Size:			
Drawn By:	SIZE	FSCM NO	DWG NO	REV
Checked By:	SCALE	NTS	Date:	SHEET

# STANDARD STRING SYSTEM ELECTRICAL DIAGRAM

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	SOLAR PV MODULE		
2	PV ARRAY		
3	J-BOX (IF USED)		
4	COMBINER (IF USED)		
5	DC DISCONNECT		
6	DC/AC INVERTER		
7	GEN METER (IF USED)		
8	AC DISCONNECT (IF USED)		
9	SERVICE PANEL		_____ VAC, _____ A MAIN, _____ A BUS, _____ A INVERTER OCPD (SEE NOTE 5 FOR INVERTER OCPDs, ALSO SEE GUIDE SECTION 9)



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 <input type="checkbox"/> or PV WIRE <input type="checkbox"/>			N/A	N/A
	BARE COPPER EQ. GRD. COND. (EGC)			N/A	N/A
2	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
3	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
	INSULATED EGC				
4	DC GROUNDING ELECTRODE COND.				
5	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
	INSULATED EGC				

Contractor Name, Address and Phone: _____ _____ _____		<b>One-Line Standard Electrical Diagram for Small-Scale, Single-Phase PV Systems</b> Site Name: _____ Site Address: _____ System AC Size: _____		
Drawn By: _____ Checked By: _____	SIZE _____	FSCM NO _____	DWG NO _____	REV _____
SCALE      NTS      Date: _____		SHEET		

# NOTES FOR STANDARD STRING SYSTEM ELECTRICAL DIAGRAM

## PV MODULE RATINGS @ STC (Guide Section 5)

MODULE MAKE	
MODULE MODEL	
MAX POWER-POINT CURRENT ( $I_{MP}$ )	A
MAX POWER-POINT VOLTAGE ( $V_{MP}$ )	V
OPEN-CIRCUIT VOLTAGE ( $V_{OC}$ )	V
SHORT-CIRCUIT CURRENT ( $I_{SC}$ )	A
MAX SERIES FUSE (OCPD)	A
MAXIMUM POWER ( $P_{MAX}$ )	W
MAX VOLTAGE (TYP 600V <sub>DC</sub> )	V
VOC TEMP COEFF (mV/°C □ or %/°C □)	
IF COEFF SUPPLIED, CIRCLE UNITS	

## NOTES FOR ALL DRAWINGS:

OCPD = OVERCURRENT PROTECTION DEVICE

NATIONAL ELECTRICAL CODE® REFERENCES SHOWN AS (NEC XXX.XX)

## INVERTER RATINGS (Guide Section 4)

INVERTER MAKE	
INVERTER MODEL	
MAX DC VOLT RATING	V
MAX POWER @ 40°C	W
NOMINAL AC VOLTAGE	V
MAX AC CURRENT	A
MAX OCPD RATING	A

## SIGNS—SEE GUIDE SECTION 7

### SIGN FOR DC DISCONNECT

PHOTOVOLTAIC POWER SOURCE	
RATED MPP CURRENT	A
RATED MPP VOLTAGE	V
MAX SYSTEM VOLTAGE	V
MAX CIRCUIT CURRENT	A
WARNING: ELECTRICAL SHOCK HAZARD—LINE AND LOAD MAY BE ENERGIZED IN OPEN POSITION	

### SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

SOLAR PV SYSTEM AC POINT OF CONNECTION	
AC OUTPUT CURRENT	A
NOMINAL AC VOLTAGE	V
THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)	

## NOTES FOR ARRAY CIRCUIT WIRING (Guide Section 6 and 8 and Appendix D):

1.) LOWEST EXPECT AMBIENT TEMPERATURE BASED ON ASHRAE MINIMUM MEAN EXTREME DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. LOWEST EXPECTED AMBIENT TEMP \_\_\_\_\_°C

2.) HIGHEST CONTINUOUS AMBIENT TEMPERATURE BASED ON ASHRAE HIGHEST MONTH 2% DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. HIGHEST CONTINUOUS TEMPERATURE \_\_\_\_\_°C

2.) 2005 ASHRAE FUNDAMENTALS 2% DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE UNITED STATES (PALM SPRINGS, CA IS 44.1°C). FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF-MOUNTED SUNLIT CONDUIT AT LEAST 0.5" ABOVE ROOF AND USING THE OUTDOOR DESIGN TEMPERATURE OF 47°C OR LESS (ALL OF UNITED STATES),

a) 12 AWG, 90°C CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH  $I_{sc}$  OF 7.68 AMPS OR LESS WHEN PROTECTED BY A 12-AMP OR SMALLER FUSE.

b) 10 AWG, 90°C CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH  $I_{sc}$  OF 9.6 AMPS OR LESS WHEN PROTECTED BY A 15-AMP OR SMALLER FUSE.

## NOTES FOR INVERTER CIRCUITS (Guide Section 8 and 9):

1) IF UTILITY REQUIRES A VISIBLE-BREAK SWITCH, DOES THIS SWITCH MEET THE REQUIREMENT? YES  NO  N/A

2) IF GENERATION METER REQUIRED, DOES THIS METER SOCKET MEET THE REQUIREMENT? YES  NO  N/A

3) SIZE PHOTOVOLTAIC POWER SOURCE (DC) CONDUCTORS BASED ON MAX CURRENT ON NEC 690.53 SIGN OR OCPD RATING AT DISCONNECT

4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)

5) TOTAL OF \_\_\_\_\_ INVERTER OCPD(s), ONE FOR EACH INVERTER. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES  NO

Contractor Name, Address and Phone:  _____ _____ _____		<b>Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems</b>		
		Site Name: _____		
		Site Address: _____		
		System AC Size: _____		
Drawn By:	SIZE	FSCM NO	DWG NO	REV
Checked By:	SCALE	NTS	Date:	SHEET