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Expedited Permit Process for Small-Scale PV Systems

by

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Revised Version Recently Updated:

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Purpose

- 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, a resolution step is suggested to provide a path to permit approval.

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Required Information for Permit

- 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 do not need fire service approval.
- Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and ac connection to building (see supplied standard electrical diagram).
- 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.

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Major Component and Array Electrical Information

- Inverter information
- Module information
- Combiner Box
- Disconnects

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Step 1: Structural Review of PV Array Mounting System

- Is the array to be mounted on a defined, permitted roof structure? Yes/No (structure designed for local conditions)
- *If No due to non-compliant roof or ground mount, submit completed worksheet for roof structure WKS1.*

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WKS1

- 1. Roof construction: l **Rafters l Trusses**
- 2. Describe site-built rafter or or site-built truss system.
- a. Rafter Size: ___ x ___ inches
- b. Rafter Spacing: _____ inches
- c. Maximum unsupported span: _____ feet, _____ inches
- d. Are the rafters over-spanned? (see the IRC span tables in **B.2.) l Yes l No**
- e. If ***Yes, complete the rest of this section.***

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B.2 Span Tables

- A framing plan is required only if the combined weight of the PV array exceeds 5 pounds per square foot (PSF) or the existing rafters are over-spanned. The following span tables from the 2009 International Residential Code (IRC) can be used to determine if the rafters are over-spanned. For installations in jurisdictions using different span tables, follow the local tables.

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Span Table R802.5.1(1),

Use this table for rafter spans that have conventional light-weight dead loads and do not have a ceiling attached.

10 PSF Dead Load Roof live load = 20 psf, ceiling not attached to rafters, L/Δ=180							
Rafter Size			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
Spacing (inches)	Species	Grade	The measurements below are in feet-inches (e.g. 9-10 = 9 feet, 10 inches).				
16	Douglas Fir-larch	#2 or better	9-10	14-4	18-2	22-3	25-9
16	Hem-fir	#2 or better	9-2	14-2	17-11	21-11	25-5
24	Douglas Fir-larch	#2 or better	8-0	11-9	14-10	18-2	21-0
24	Hem-fir	#2 or better	7-11	11-7	14-8	17-10	20-9

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Roof Information:

- 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…).*
- Does the roof have a single roof covering? Yes/No
  - *If No, submit completed worksheet for roof structure WKS1.*
- Provide method and type of weatherproofing roof penetrations (e.g. flashing, caulk)._____

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Mounting System Information:

- The mounting structure is an engineered product designed to mount PV modules? Yes/No
  - *If No, provide details of structural attachment certified by a design professional.*
- For manufactured mounting systems, fill out information on the mounting system below:

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Mounting System Information:

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^2

g) Distributed Weight of PV Module on Roof (b÷f)_____ lbs/ft^2

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

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Example 1: Standard String Inverter 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...)
   Yes— composition
   If No, submit completed worksheet for roof structure WKS1 (No = heavy masonry, slate, etc..).
2. If a composition shingle roof, 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).
   flashing

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 OmniRack Product Name and Model# ModMount 2.0
   b. Total Weight of PV Modules and Rails 1124 lbs
   c. Total Number of Attachment Points 34
   d. Weight per Attachment Point (b ÷ c) 33 lbs (if greater than 45 lbs, see WKS1)
   e. Maximum Spacing Between Attachment Points on a Rail 48 inches (see product manual for maximum spacing allowed based on maximum design wind speed)
   f. Total Surface Area of PV Modules (square feet) 402 ft^2
   g. Distributed Weight of PV System on Roof (b ÷ f) 2.79 lbs/ft^2
   If distributed weight of the PV system is greater than 5 lbs/ft^2, 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.
3. The Inverter has a continuous power output 13,440 Watts or less.
4. The ac interconnection point is on the load side of service disconnecting means (690.64(B), 705.12(D)).
5. One of the electrical diagrams (E1.1, E1.1a, E1.1b, E1.1c) can be used to accurately represent the PV system.

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Site Diagram

- Drawing does not need to be to scale, but it should basically show were the major components are located.
- If array is ground mounted, it should show that it conforms with allowable setbacks.

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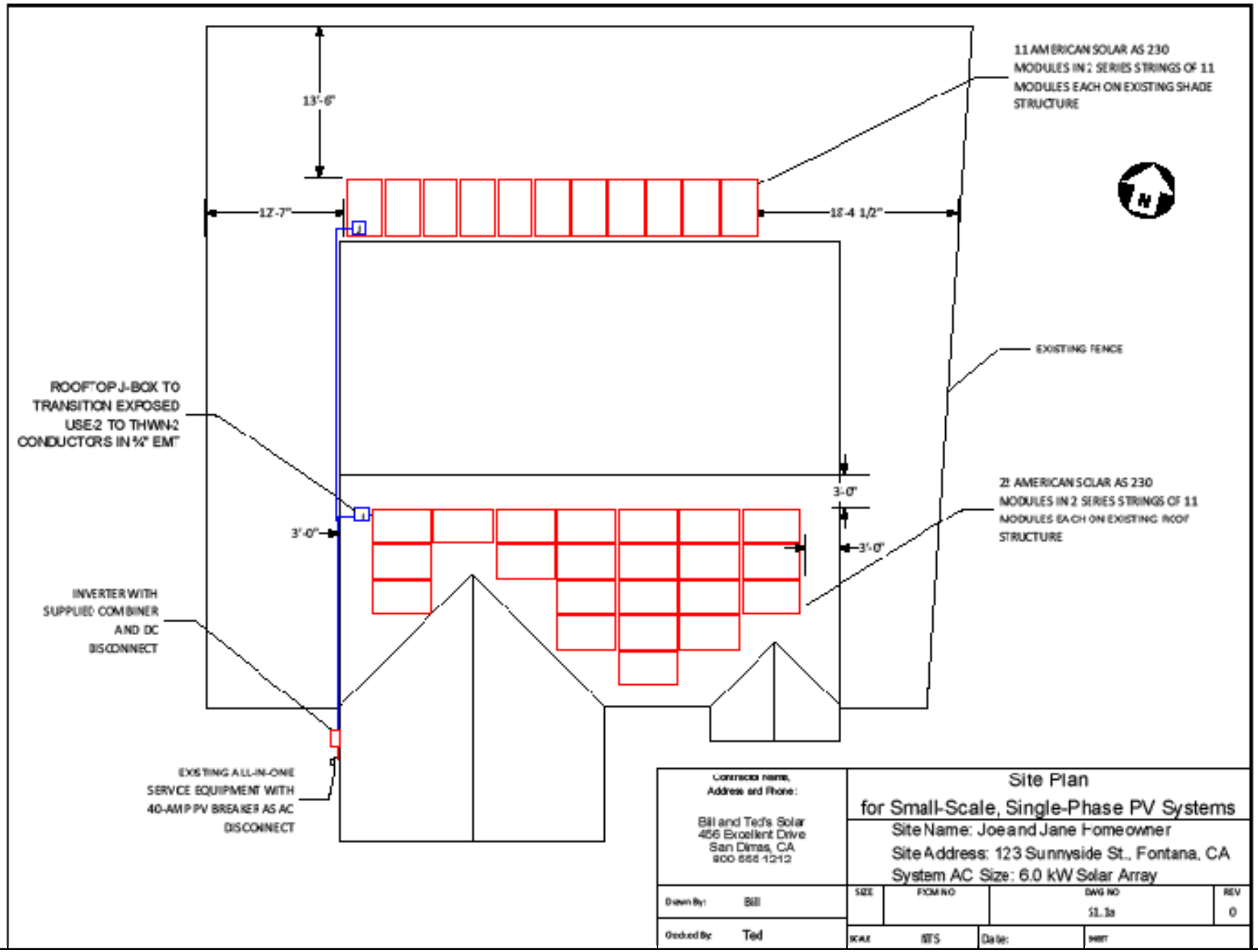
Site plan for example 1 - Standard String Inverter System



One-line Diagram

- Should have sufficient detail to call out the electrical components, the wire types and sizes, number of conductors, and conduit type and size where needed.
- Should include information about PV modules and inverter(s).
- Should include information about utility disconnecting means (required by many utilities).

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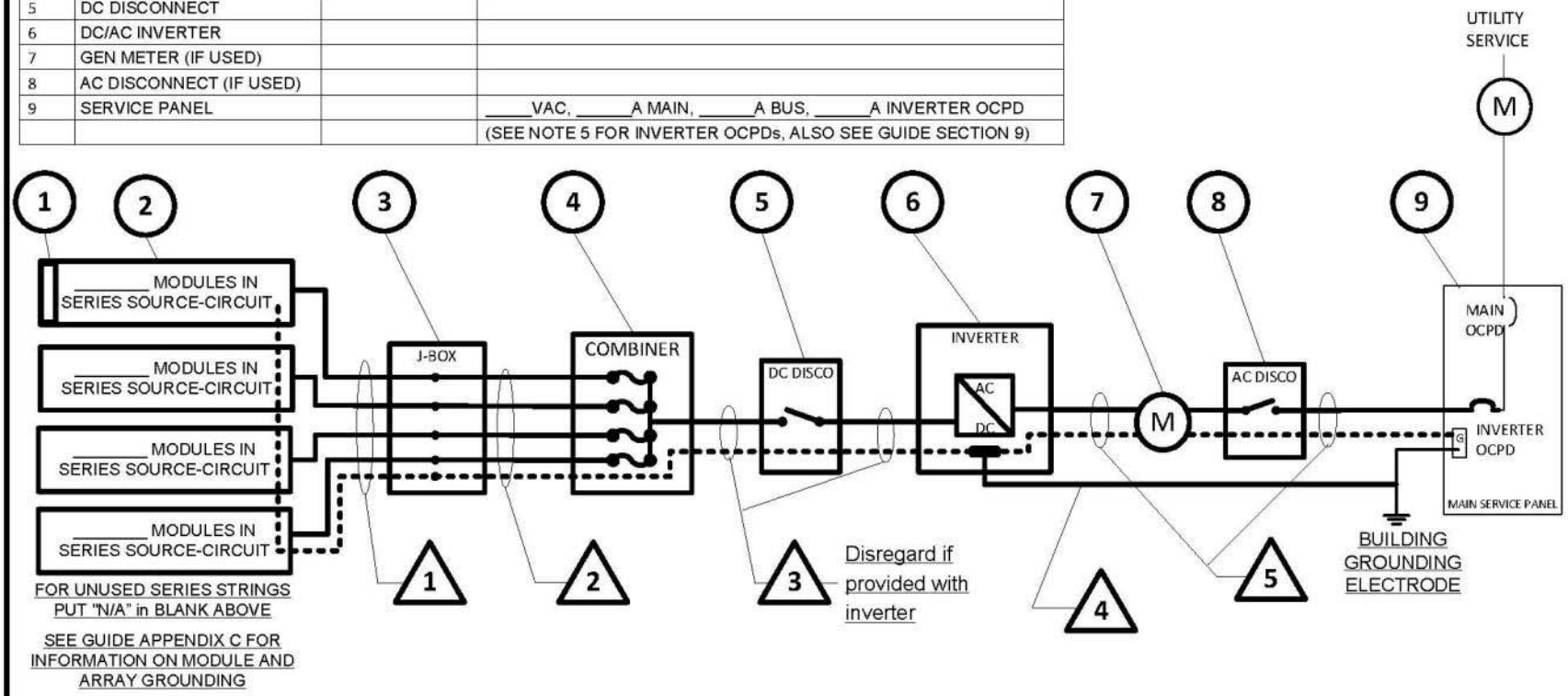
Standard Electrical Diagram

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 ☐ or PV WIRE ☐			N/A	N/A
	BARE COPPER EQ. GRD. COND. (EGC)			N/A	N/A
2	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
3	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				
4	DC GROUNDING ELECTRODE COND.				
5	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				

Contractor Name, Address and Phone:

_____
_____
_____
_____

One-Line Standard Electrical Diagram for Small-Scale, Single-Phase PV Systems

Site Name: _____
Site Address: _____
System AC Size: _____

Drawn By:	SIZE	FSCM NO	DWG NO	REV
			E1.1	
Checked By:	SCALE NTS	Date:	SHEET	

Notes for Standard 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_{DC})	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 FUNDEMENTALS 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 Isc 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 Isc 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

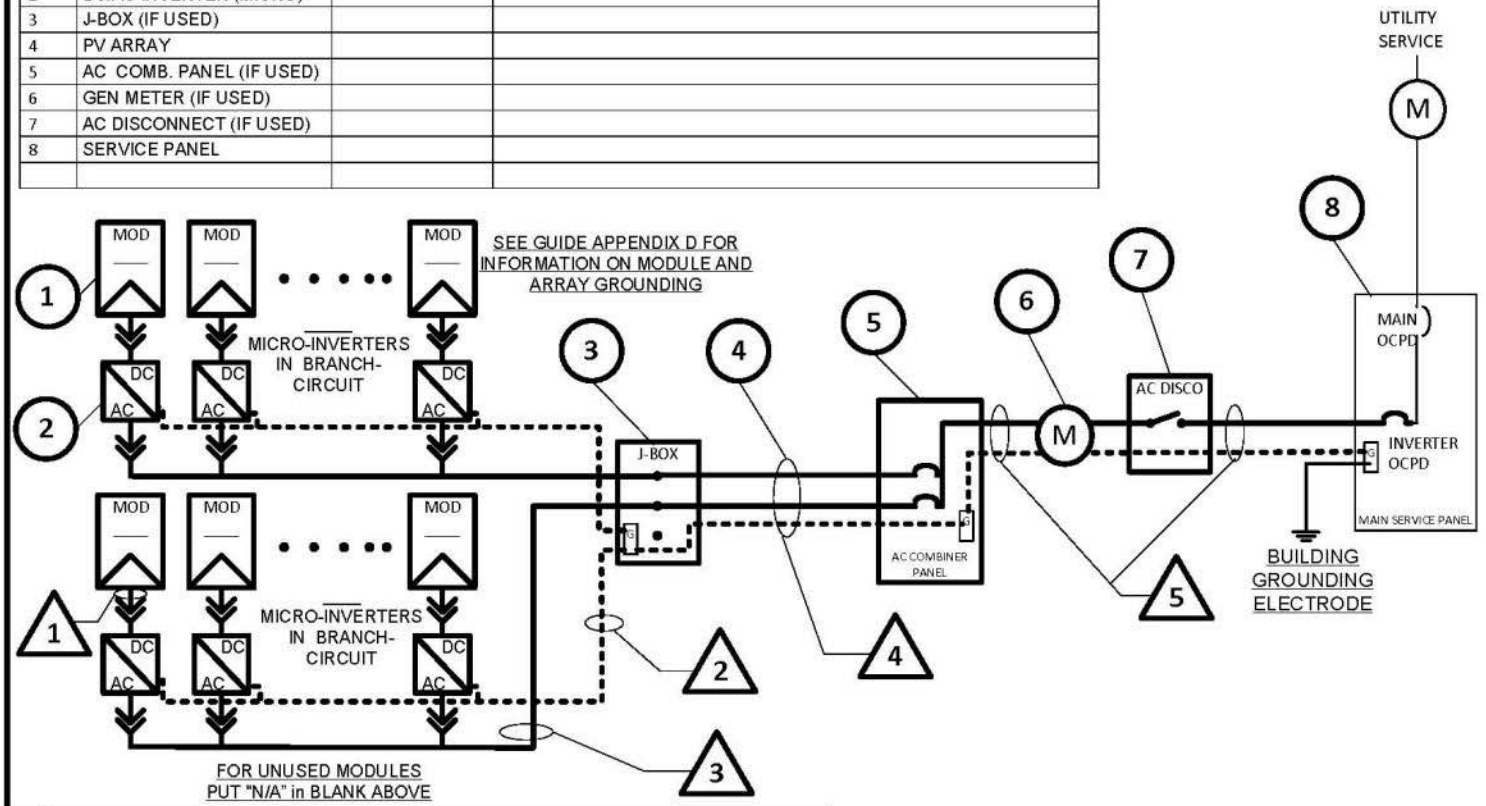
4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)

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: _____ _____ _____ _____	Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems Site Name: _____ Site Address: _____ System AC Size: _____			
Drawn By:	SIZE	FSCM NO	DWG NO E1.2	REV
Checked By:	SCALE NTS	Date:	SHEET	

Micro-Inverter Electrical Diagram

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	PV DC or AC MODULE		
2	DC/AC INVERTER (MICRO)		
3	J-BOX (IF USED)		
4	PV ARRAY		
5	AC COMB. PANEL (IF USED)		
6	GEN METER (IF USED)		
7	AC DISCONNECT (IF USED)		
8	SERVICE PANEL		



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 ☐ or PV WIRE ☐	MFG	MFG Cable	N/A	N/A
2	GEC ☐ EGC ☐ X ALL THAT APPLY			N/A	N/A
3	EXTERIOR CABLE LISTED W/ INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	GEC ☐ EGC ☐ X ALL THAT APPLY			SAME	SAME
	NO DC GEC IF 690.35 SYSTEM				
5	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	GEC ☐ EGC ☐ X ALL THAT APPLY			SAME	SAME

Contractor Name, Address and Phone:	One-Line Standard Electrical Diagram for Micro-Inverter PV Systems			
	Site Name:			
	Site Address:			
	System AC Size:			
Drawn By:	SIZE	FSCM NO	DWG NO	REV
			E1.1a	0
Checked By:	SCALE NTS	Date:	SHEET	

Notes for Micro-Inverter Electrical Diagram

PV MODULE RATINGS @ STC (Guide Section 5)

MODULE MAKE	
MODULE MODEL	
MAX POWER-POINT CURRENT (I_{MP})	
MAX POWER-POINT VOLTAGE (V_{MP})	
OPEN-CIRCUIT VOLTAGE (V_{OC})	
SHORT-CIRCUIT CURRENT (I_{SC})	
MAX SERIES FUSE (OCPD)	
MAXIMUM POWER (P_{MAX})	
MAX VOLTAGE (TYP 600V_{DC})	
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	
MAX POWER @ 40°C	
NOMINAL AC VOLTAGE	
MAX AC CURRENT	
MAX OCPD RATING	

SIGNS–SEE GUIDE SECTION 7

SIGN FOR DC DISCONNECT

No sign necessary since 690.51 marking on PV module covers needed information

SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

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

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

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.) 2009 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 Isc 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 Isc 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

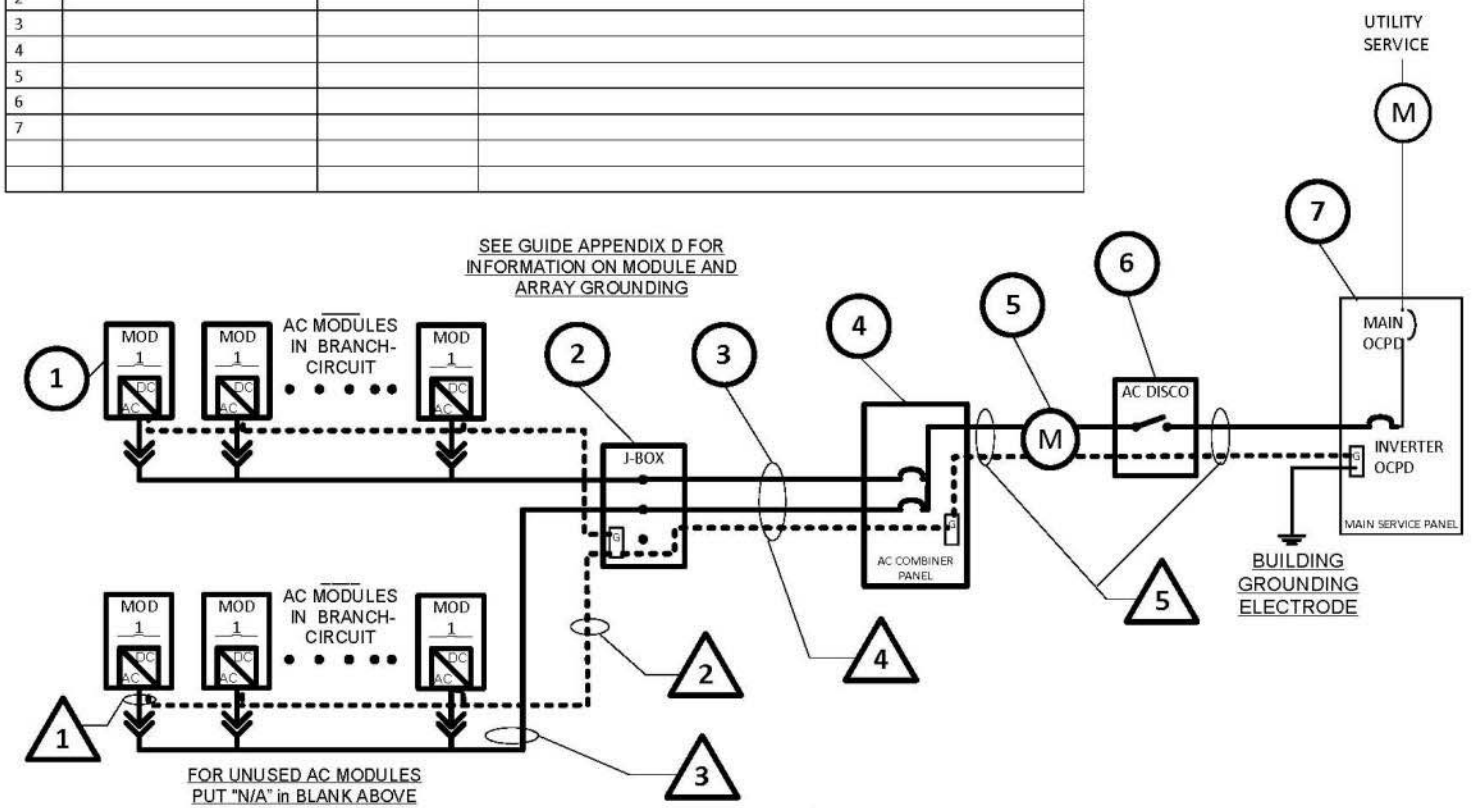
4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)

5) TOTAL OF _____ INVERTER OUTPUT CIRCUIT OCPD(s), ONE FOR EACH MICRO-INVERTER CIRCUIT. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES☐ NO☐

Contractor Name, Address and Phone:	Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems Site Name: Site Address: System AC Size:			
Drawn By:	SIZE	FSCM NO	DWG NO E1.2a	REV
Checked By:	SCALE NTS	Date:	SHEET	

AC Module Electrical Diagram

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1			
2			
3			
4			
5			
6			
7			



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 ☐ or PV WIRE ☐	MFG	MFG Cable	N/A	N/A
2	GEC ☐ EGC ☐ X ALL THAT APPLY			N/A	N/A
3	EXTERIOR CABLE LISTED W/ INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	GEC ☐ EGC ☐ X ALL THAT APPLY				
	NO DC GEC IF 690.35 SYSTEM				
5	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	GEC ☐ EGC ☐ X ALL THAT APPLY				

Contractor Name, Address and Phone:	One-Line Standard Electrical Diagram for AC Module PV Systems		
	Site Name:		
	Site Address:		
	System AC Size:		
Drawn By:	SIZE	FSCM NO	DWG NO: E1.1b / REV
Checked By:	SCALE: NTS	Date:	SHEET

NOTES FOR AC MODULE ELECTRICAL DIAGRAM

NOTES FOR ALL DRAWINGS:

OCPD = OVERCURRENT PROTECTION DEVICE

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

AC MODULE RATINGS (Guide Appendix C)

AC MODULE MAKE	
AC MODULE MODEL	
NOMINAL OPERATING AC VOLTAGE	
NOMINAL OPERATING AC FREQUENCY	
MAXIMUM AC POWER	
MAXIMUM AC CURRENT	
MAXIMUM OCPD RATING	

SIGNS–SEE GUIDE SECTION 7

SIGN FOR DC DISCONNECT

N/A since no dc wiring

SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

SOLAR PV SYSTEM AC POINT OF CONNECTION	
AC OUTPUT CURRENT	
NOMINAL AC VOLTAGE	

THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)

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

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.) 2009 ASHRAE FUNDAMENTALS 2% DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE UNITED STATES (PALM SPRINGS, CA IS 44.1°C). FOR 6 OR LESS 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 AC MODULES INVERTER OUTPUT CIRCUITS WITH 12 AMPS OR LESS WHEN PROTECTED BY A 15-AMP OR SMALLER OCPD.

b) 10 AWG, 90°C CONDUCTORS ARE GENERALLY ACCEPTABLE FOR AC MODULES INVERTER OUTPUT CIRCUITS WITH 16 AMPS OR LESS WHEN PROTECTED BY A 20-AMP OR SMALLER OCPD.

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 (N/A)

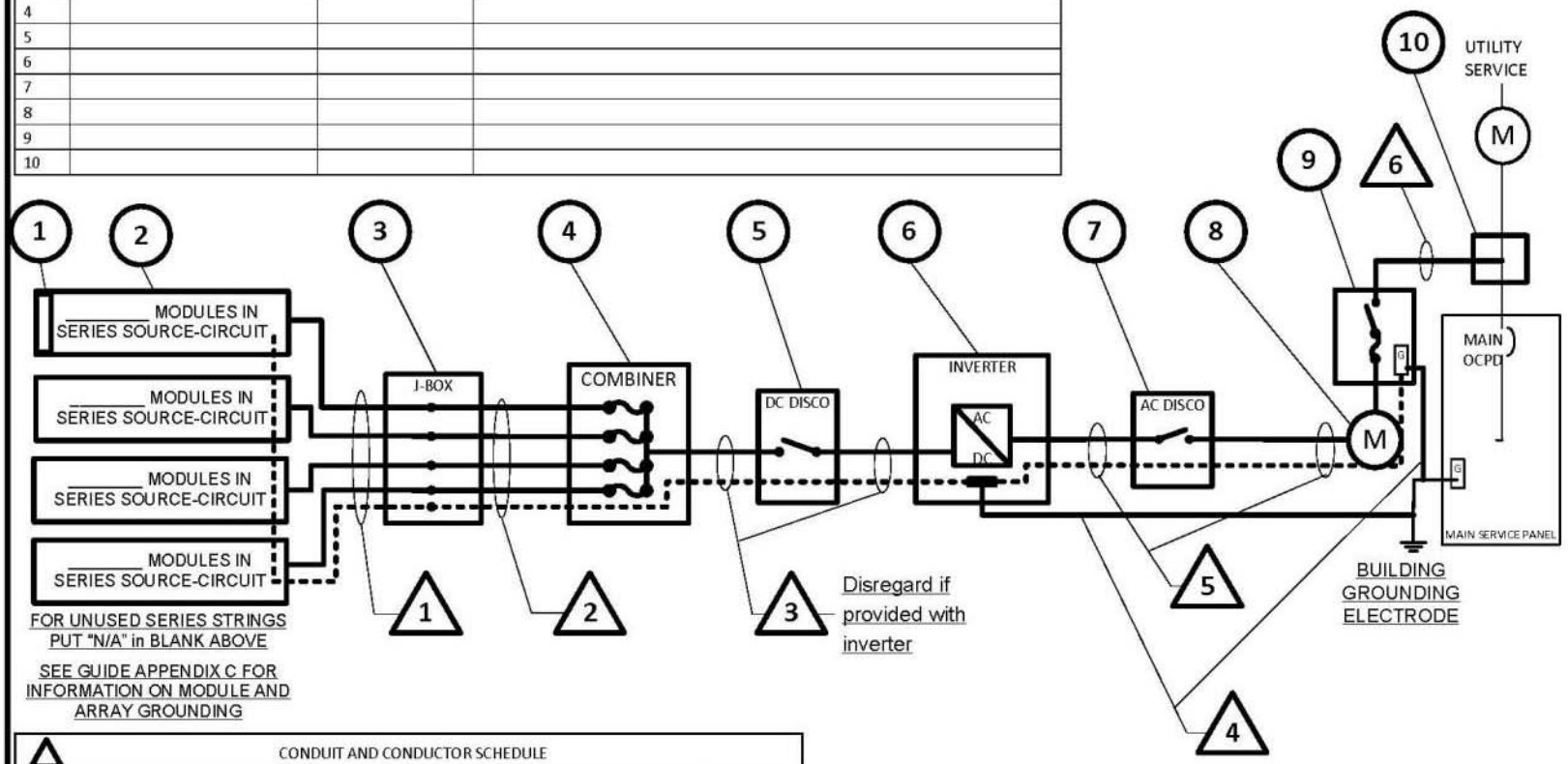
4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)

5) TOTAL OF _____ INVERTER OUTPUT CIRCUIT OCPD(s), ONE FOR EACH AC MODULE CIRCUIT. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES ☐ NO ☐

Contractor Name, Address and Phone:	Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems Site Name: Site Address: System AC Size:			
Drawn By: Bill	SIZE	FSCM NO	DWG NO: E1.2b	REV: 0
Checked By: Ted	SCALE: NTS	Date:	SHEET	

Supply-Side Connected Electrical Diagram

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 ☐ or PV WIRE ☐				
	BARE COPPER EQ. GRD. COND. (EGC)				
2	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
3	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				
4	GROUNDING ELECTRODE COND.				
5	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				
	INSULATED EGC				
6	THWN-2 ☐ or XHHW-2 ☐ or RHW-2 ☐				

Contractor Name, Address and Phone:	One-Line Electrical Diagram for Supply-Side Connected Single-Phase PV Systems			
	Site Name:			
	Site Address:			
	System AC Size:			
Drawn By:	SIZE	FSCM NO	DWG NO: E1.1c	REV: 0
Checked By:	SCALE: NTS	Date:	SHEET	

iii) MAXIMUM SYSTEM VOLTAGE [NEC 690.7]

Explanation: Maximum system voltage is calculated by multiplying the value of Voc on the listing label by the appropriate value on Table 690.7 in the NEC, and then multiplying that value by the number of modules in a series string. The table in the NEC is based on crystalline silicon modules and uses lowest expected ambient temperature at a site to derive the correction factor. Some modules do not have the same temperature characteristics as crystalline silicon so the manufacturer's instructions must be consulted to determine the proper way to correct voltage based on lowest expected ambient temperature. As of the 2008 NEC, the manufacturer's temperature correction factor must be used for all modules, regardless of construction, if the information is supplied. All known listed modules currently provide this information.

From the example in Appendix A:

Module V_{OC} = 37.0 Volts

Rating temperature = 25°C

Number of Modules in Series = 11

Lowest expected ambient temperature (ASHRAE) = 1°C (Ontario, California)

Maximum System Voltage = V_{MAX} = V_{OC} x # of Modules in Series x Temperature Correction Factor

Method 1— Module Manufacturer's Temperature Correction Factor—Percentage Method

Temperature Coefficient for V_{OC} = αV_{OC} = -0.37%/C = -0.0037/C

Temperature Correction Factor = 1 + α VOC (%) x (TempLOW - TempRATING)

= 1 + (-0.0037/C) x (-1°C - 25°C)

= 1 + 0.0962 = 1.0962

V_{MAX} = 37V x 11 x 1.0962 = 446 Volts < 500Volts (compliant for a 500V_{MAX} inverter)

Method 2— Module Manufacturer's Temperature Correction Factor—Voltage Method

Temperature Coefficient for V_{OC} = αV_{OC} = 137mV/C = 0.137 V/C

Temperature Correction Factor = 1 + [αVOC (V) x (TempLOW - TempRATED) ÷ VOC]

= 1 + [0.137 V/C x (-1°C - 25°C) ÷ 37V]

= 1 + [5.206V ÷ 37V] = 1.0963

V_{MAX} = 37V x 11 x 1.0963 = 446 Volts < 500Volts (compliant for a 500V_{MAX} inverter)

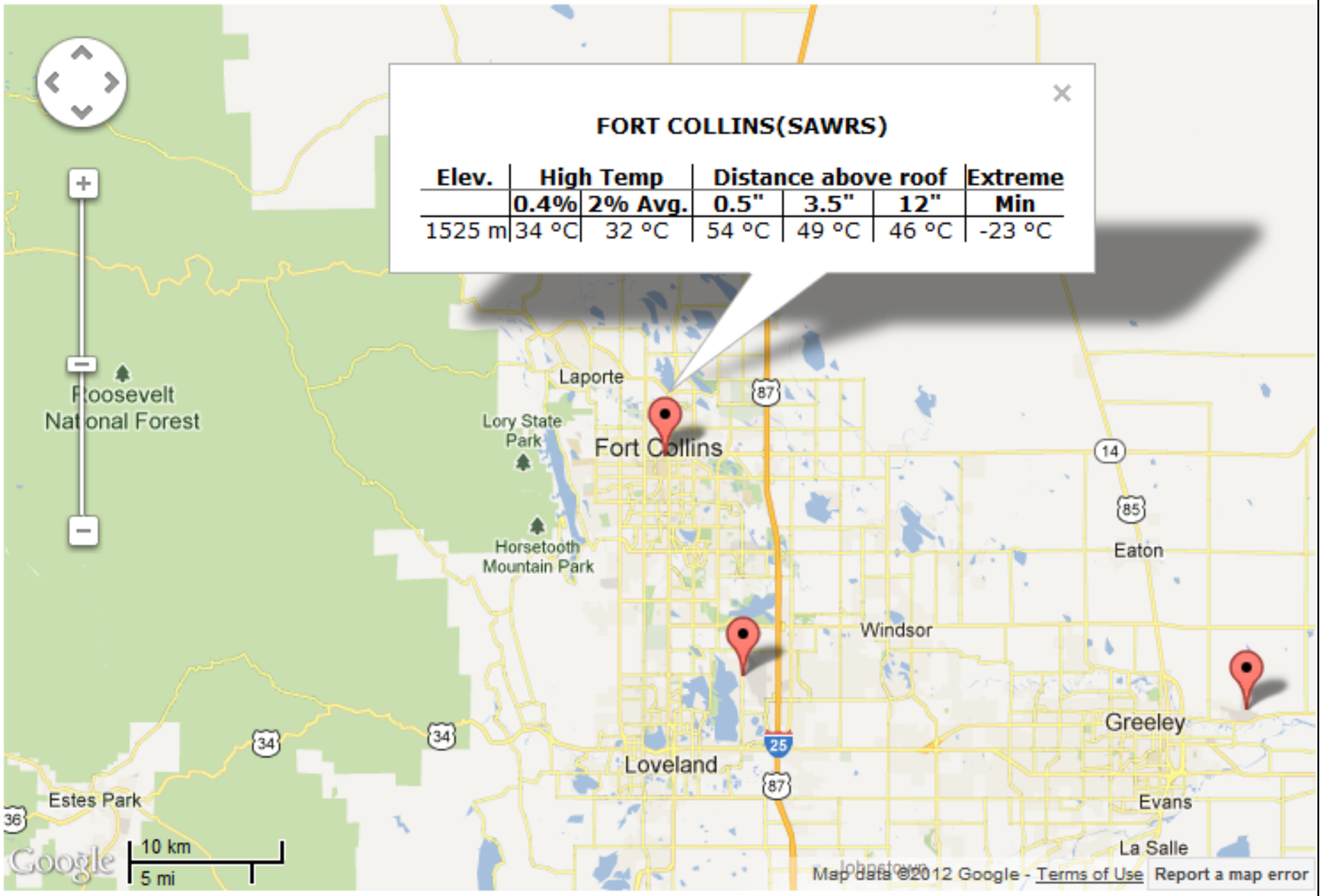
Method 3—Table 690.7 Temperature Correction Factor

From row for ambient temperature = -1°C to -5°C 1.12

V_{MAX} = 37V x 11 x 1.12 = 456 Volts < 500Volts (compliant for a 500V_{MAX} inverter)

CA	SAN LUIS CO RGNL	66	32	28	50	46	42	-2
CA	SANDBERG	1379	35	32	54	49	46	-5
CA	SANTA BARBARA MUNICIPAL AP	6	29	26	48	43	40	-1
CA	SANTA MARIA PUBLIC ARPT	73	29	25	47	42	39	-3
CA	SANTA ROSA (AWOS)	45	38	34	56	51	48	-3
CA	STOCKTON METROPOLITAN ARPT	8	41	38	60	56	52	-3
CA	TRAVIS AFB/FAIRFLD	18	40	36	58	53	50	-3
CA	TRUCKEE-TAHOE	1798	34	30	52	47	44	N/A
CA	TUSTIN MCAF	17	34	31	53	48	45	2
CA	UKIAH MUNICIPAL AP	191	41	37	59	54	51	-3
CA	VISALIA MUNI (AWOS)	89	39	37	59	54	51	-3
CO	AKRON WASHINGTON CO AP	1409	38	34	56	51	48	-23
CO	ALAMOSA SAN LUIS VALLEY RGNL	2299	32	29	51	46	43	-30
CO	ASPEN PITKIN CO SAR	2444	32	28	50	45	42	-24
CO	BUCKLEY ANGB/DENVER	1726	36	33	55	50	47	-22
CO	COLORADO SPRINGS MUNI AP	1881	35	32	54	49	46	-23
CO	CORTEZ/MONTEZUMA CO	1803	37	34	56	51	48	-19
CO	CRAIG-MOFFAT	1915	35	31	53	48	45	-31
CO	DENVER INTL AP	1655	37	34	56	51	48	-23
CO	DENVER STAPLETON INTL ARPT	1611	36	34	56	51	48	-25
CO	DENVER/CENTENNIAL	1793	36	33	55	50	47	-23
CO	DURANGO/LA PLATA CO	2038	34	32	54	49	46	-21
CO	EAGLE COUNTY AP	1992	33	30	52	47	44	-28
CO	FORT COLLINS (AWOS)	1529	38	34	56	51	48	-23
CO	FORT COLLINS(SAWRS)	1525	34	32	54	49	46	-23
CO	GRAND JUNCTION WALKER FIELD	1475	39	36	58	53	50	-17
CO	GREELEY/WELD (AWOS)	1420	38	35	57	52	49	-27

Search near (City, State): Fort Collins, CO Submit



Conductor Sizing Chart for Hottest U.S. Climate

For Sunlit Raceway 0.5"-3.5" from Roof and Max 2% Design Temp - 47°C

80% Duty Fuses		100% Duty Fuses		Minimum Conductor Size in Raceway		
Fuse Size	Max Rated ISC	Fuse Size	Max Rated ISC	Based on # of Cond. in Raceway (AWG)		
Amps	Amps	Amps	Amps	8 conductors	4-6 cond.	2 cond.
10	6.4	10	8	14	14	14
12	7.68	12	9.6	12	14	14
15	9.6	15	12	10	10	14
20	12.8	20	16	10	10	12
25	16	25	20	8	8	10
30	19.2	30	24	6	8	8
35	22.4	35	28	6	68	
40	25.6	40	32	4	4	6
45	28.8	45	36	3	4	6
50	32	50	40	2	3	4
60	38.4	60	48	2	3	4
70	44.8	70	56	1	2	3
80	51.2	80	64	2/O	1/O	2
90	57.6	90	72	3/O	2/O	1
100	64	100	80	3/O	2/O	1/O
110	70.4	110	88	4/O	3/O	2/O
125	80	125	100	250MCM	4/O	2/O
150	96	150	120	300MCM	250MCM	3/O
175	112	175	140	400MCM	350MCM	4/O
200	128	200	160	2-3/O	400MCM	300MCM
225	144	225	180	2-4/O	500MCM	350MCM
250	160	250	200	2-250MCM	2-4/O	500MCM
300	192	300	240	2-300MCM	2-250MCM	600MCM
350	224	350	280	2-400MCM	2-350MCM	700MCM
400	256	400	320	2-500MCM	2-400MCM	1000MCM

BROOKS ENGINEERING

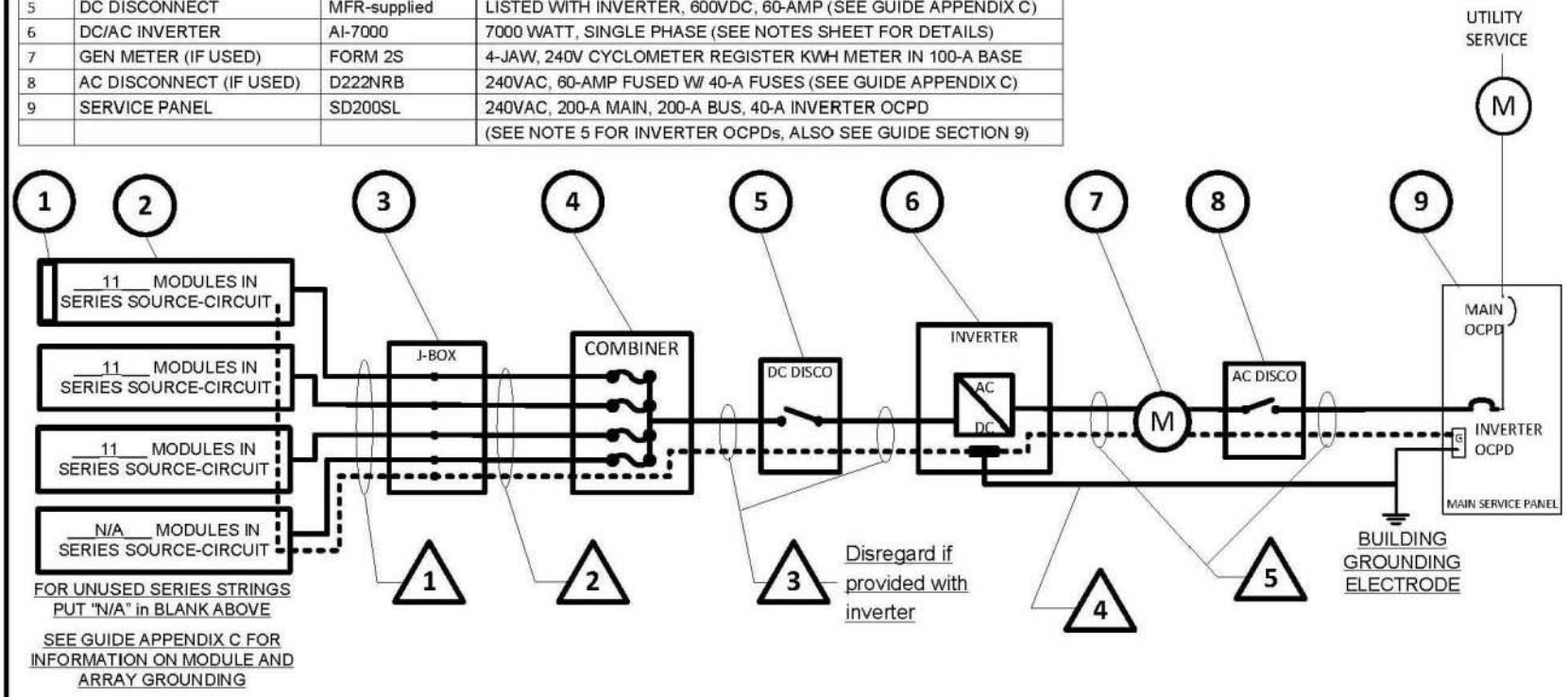
Table of NEC 690.64(B) AC Interconnection Options

Maximum Inverter Current	Required Inverter OCPD Size	Minimum Conductor Size in Conduit	Minimum Busbar/Main Breaker Combinations (Busbar Amps/Main Amps)
64 Amps	80 Amps	4 AWG	400/400; 200/150
56 Amps	70 Amps	4 AWG	225/200; 250/225
48 Amps	60 Amps	6 AWG	300/300; 200/175
40 Amps	50 Amps	8 AWG	125/100; 150/125
36 Amps	45 Amps	8 AWG	225/225
32 Amps	40 Amps	8 AWG	200/200
24 Amps	30 Amps	10 AWG	150/150
16 Amps	20 Amps	12 AWG	100/100; 70/60
12 Amps	15 Amps	14 AWG	80/80

BROOKS ENGINEERING

Diagram for Example 1 - Standard String Inverter System

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	SOLAR PV MODULE	AS 230	AMERICAN SOLAR, QUANTITY - 33 (SEE NOTES SHEET FOR DETAILS)
2	PV ARRAY	N/A	ARRAY IS 3 STRINGS WITH 11 MODULES PER SERIES STRING
3	J-BOX (IF USED)		6"x6"x4" NEMA 4, PVC JUNCTION BOX
4	COMBINER (IF USED)	MFR-supplied	15-A MAX FUSE W/15-A FUSES, 600VDC, 4-STRING MAX
5	DC DISCONNECT	MFR-supplied	LISTED WITH INVERTER, 600VDC, 60-AMP (SEE GUIDE APPENDIX C)
6	DC/AC INVERTER	AI-7000	7000 WATT, SINGLE PHASE (SEE NOTES SHEET FOR DETAILS)
7	GEN METER (IF USED)	FORM 2S	4-JAW, 240V CYCLOMETER REGISTER KWH METER IN 100-A BASE
8	AC DISCONNECT (IF USED)	D222NRB	240VAC, 60-AMP FUSED W/ 40-A FUSES (SEE GUIDE APPENDIX C)
9	SERVICE PANEL	SD200SL	240VAC, 200-A MAIN, 200-A BUS, 40-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 ☒ or PV WIRE ☐	10 AWG	8 BLACK	N/A	N/A
	BARE COPPER EQ. GRD. COND. (EGC)	10 AWG	1 BARE CU	N/A	N/A
2	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	10 AWG	4-R, 4-W, 1-G	EMT	¾"
3	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	N/A	N/A	N/A	N/A
	INSULATED EGC	N/A	N/A		
4	DC GROUNDING ELECTRODE COND.	6 AWG	1 BARE CU	N/A	N/A
5	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	8 AWG	1-R, 1-B, 1-W	EMT	¾"
	INSULATED EGC	10 AWG	1 GREEN		

Contractor Name, Address and Phone:

Bill and Ted's Solar
456 Excellent Drive
San Dimas, CA
800-555-1212

One-Line Standard Electrical Diagram for Small-Scale, Single-Phase PV Systems

Site Name: Joe and Jane Homeowner
Site Address: 123 Sunnyside St., Fontana, CA
System AC Size: 6.1 kW Solar Array

Drawn By:	Bill	SIZE	FSCM NO	DWG NO	REV
Checked By:	Ted			E1.1	0
		SCALE: NTS	Date:	SHEET	

Notes for Electrical Diagram for Example 1 - Standard String Inverter System

PV MODULE RATINGS @ STC (Guide Section 5)

MODULE MAKE	AMERICAN SOLAR
MODULE MODEL	AS 230
MAX POWER-POINT CURRENT (I_{MP})	7.80 A
MAX POWER-POINT VOLTAGE (V_{MP})	29.5 V
OPEN-CIRCUIT VOLTAGE (V_{OC})	37.0 V
SHORT-CIRCUIT CURRENT (I_{SC})	8.40 A
MAX SERIES FUSE (OCPD)	15 A
MAXIMUM POWER (P_{MAX})	230 W
MAX VOLTAGE (TYP 600V_{DC})	600 V
VOC TEMP COEFF (mV/°C ☐ or %/°C ☒)	-0.37
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	AMERICAN INVERTER
INVERTER MODEL	AI-7000
MAX DC VOLT RATING	500 V
MAX POWER @ 40°C	7000 W
NOMINAL AC VOLTAGE	240 V
MAX AC CURRENT	29 A
MAX OCPD RATING	50 A

SIGNS–SEE GUIDE SECTION 7

SIGN FOR DC DISCONNECT

PHOTOVOLTAIC POWER SOURCE	
RATED MPP CURRENT	19.6 A
RATED MPP VOLTAGE	430 V
MAX SYSTEM VOLTAGE	577 V
MAX CIRCUIT CURRENT	26.5 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	29 A
NOMINAL AC VOLTAGE	240 V

THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)

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

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 ___-1_°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 __37_°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 Isc 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 Isc 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)

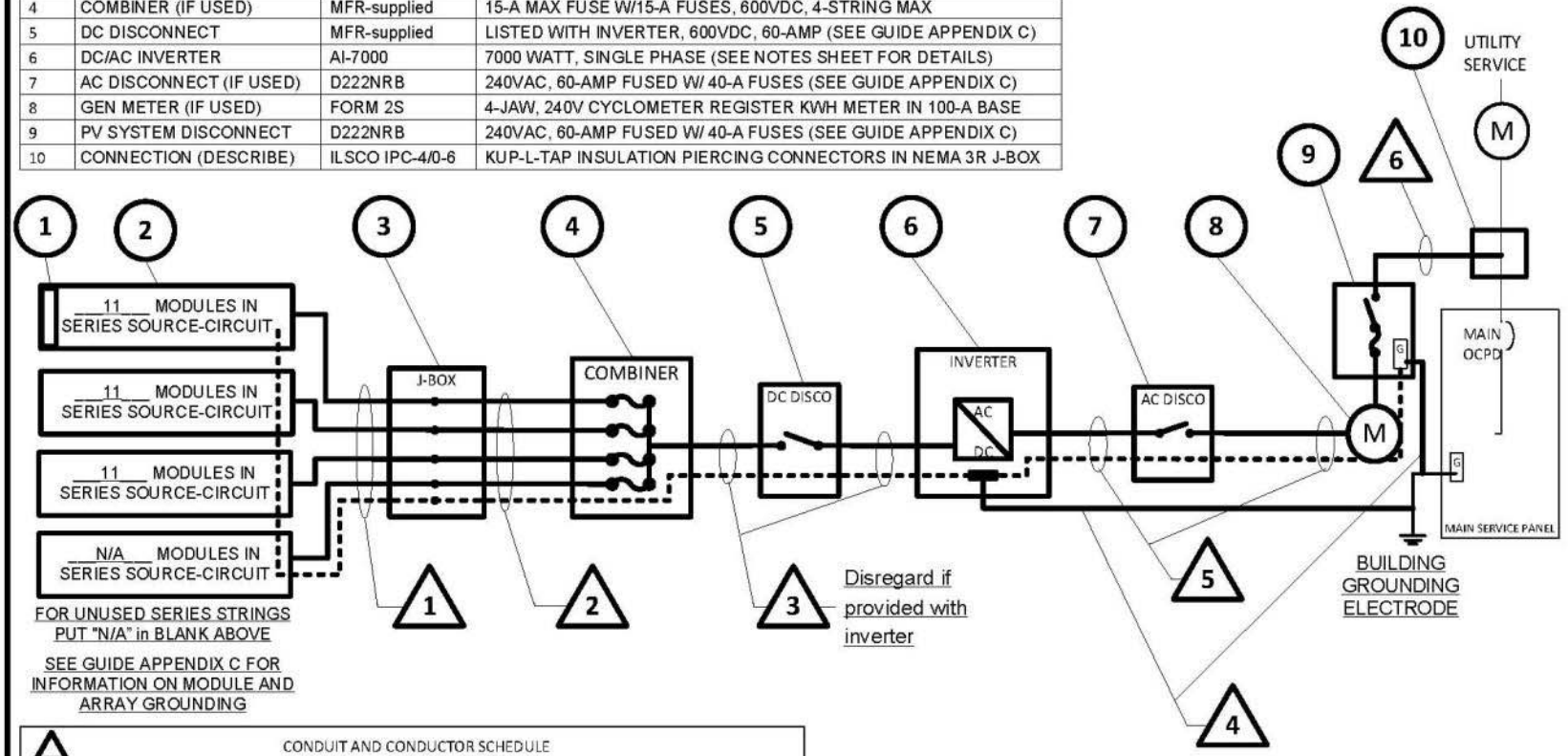
5) TOTAL OF 1 INVERTER OCPD(s), ONE FOR EACH INVERTER. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES ☒ NO ☐

Contractor Name, Address and Phone	Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems
Bill and Ted's Solar 456 Excellent Drive San Dima, CA 800-555-1212	Site Name: Joe and Jane Homeowner Site Address: 123 Sunnyside St., Fontana, CA System AC Size: 6.0 kW Solar Array

Drawn By: Bill	SIZE	FSCM NO	DWG NO	REV
			E1.2	0
Checked By: Ted	SCALE NTS	Date:	SHEET	

DIAGRAM FOR EXAMPLE 1

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	SOLAR PV MODULE	AS 230	AMERICAN SOLAR, QUANTITY - 33 (SEE NOTES SHEET FOR DETAILS)
2	PV ARRAY	N/A	ARRAY IS 3 STRINGS WITH 11 MODULES PER SERIES STRING
3	J-BOX (IF USED)		6"x6"x4" NEMA 4, PVC JUNCTION BOX
4	COMBINER (IF USED)	MFR-supplied	15-A MAX FUSE W/15-A FUSES, 600VDC, 4-STRING MAX
5	DC DISCONNECT	MFR-supplied	LISTED WITH INVERTER, 600VDC, 60-AMP (SEE GUIDE APPENDIX C)
6	DC/AC INVERTER	AI-7000	7000 WATT, SINGLE PHASE (SEE NOTES SHEET FOR DETAILS)
7	AC DISCONNECT (IF USED)	D222NRB	240VAC, 60-AMP FUSED W/ 40-A FUSES (SEE GUIDE APPENDIX C)
8	GEN METER (IF USED)	FORM 2S	4-JAW, 240V CYCLOMETER REGISTER KWH METER IN 100-A BASE
9	PV SYSTEM DISCONNECT	D222NRB	240VAC, 60-AMP FUSED W/ 40-A FUSES (SEE GUIDE APPENDIX C)
10	CONNECTION (DESCRIBE)	ILSCO IPC-4/0-6	KUP-L-TAP INSULATION PIERCING CONNECTORS IN NEMA 3R J-BOX



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 ☒ or PV WIRE ☐	10 AWG	8 BLACK	N/A	N/A
	BARE COPPER EQ. GRD. COND. (EGC)	10 AWG	1 BARE CU	N/A	N/A
2	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	10 AWG	4-R, 4-W, 1-G	EMT	¾"
3	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	N/A	N/A	N/A	N/A
	INSULATED EGC	N/A	N/A		
4	GROUNDING ELECTRODE COND.	6 AWG	1 BARE CU	N/A	N/A
5	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	8 AWG	1-R, 1-B, 1-W	EMT	¾"
	INSULATED EGC	10 AWG	1 GREEN		
6	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	6 AWG	1-R, 1-B, 1-W	EMT	¾"

Contractor Name, Address and Phone:
Bill and Ted's Solar
456 Excellent Drive
San Dimas, CA
800-555-1212

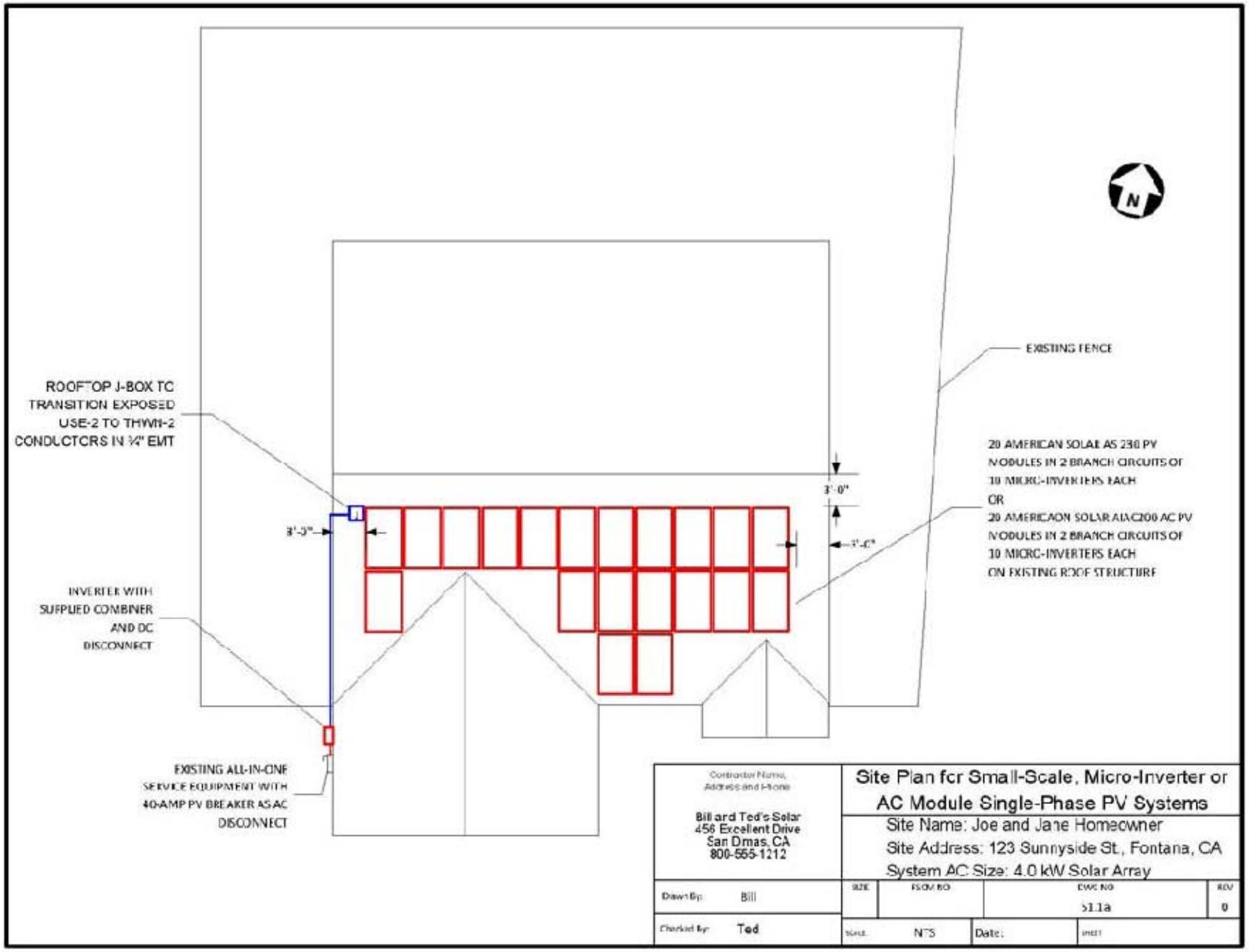
Drawn By: Bill
Checked By: Ted

One-Line Electrical Diagram for Supply-Side Connected Single-Phase PV Systems

Site Name: Joe and Jane Homeowner
Site Address: 123 Sunnyside St., Fontana, CA
System AC Size: 6.1 kW Solar Array

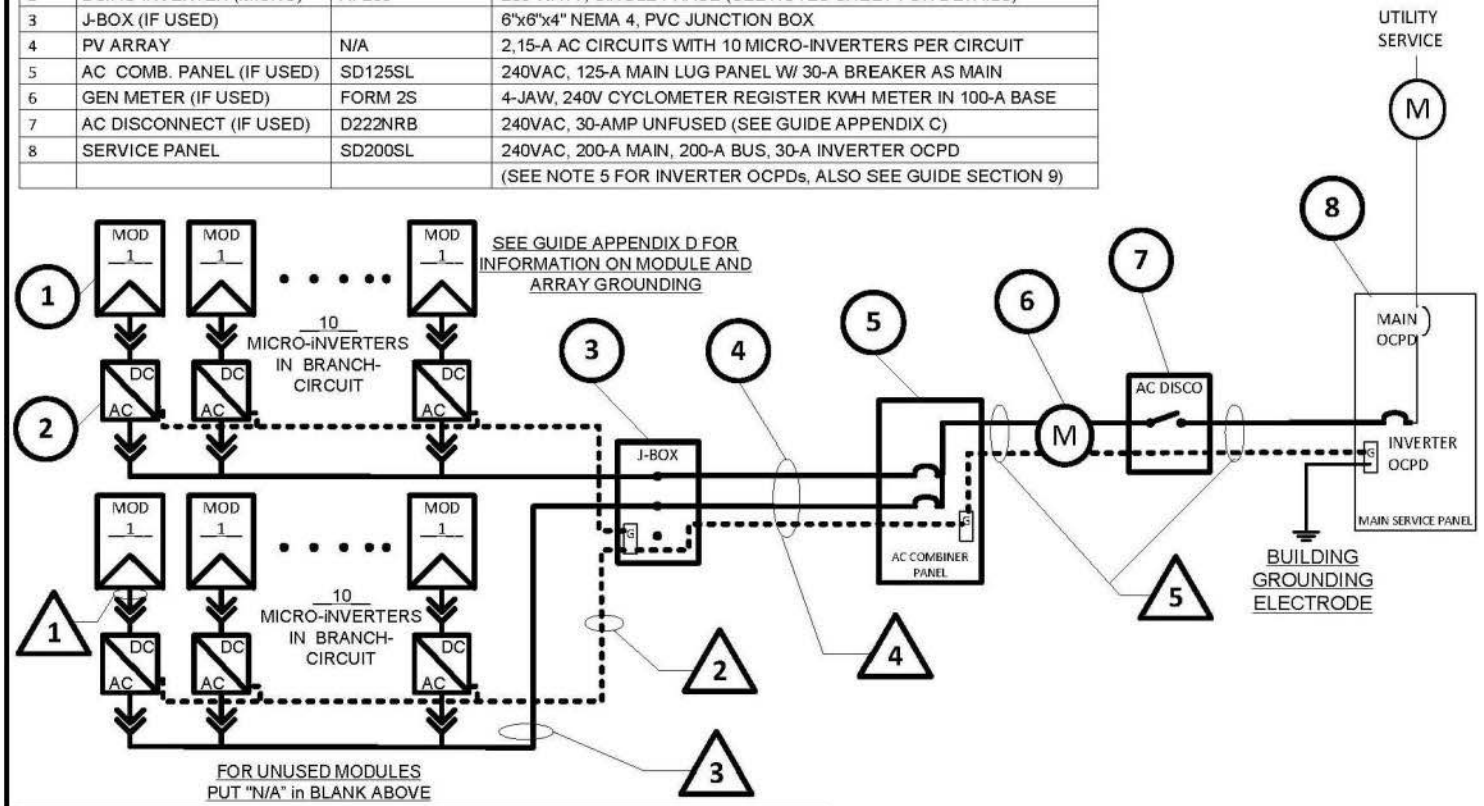
SIZE	FSCM NO	DWG NO	REV
		E1.1c	0
SCALE: NTS	Date:	SHEET	

Site plan for example 2 - Micro-Inverter



Electrical Diagram for Example 2 - Micro-Inverter

O	EQUIPMENT SCHEDULE		
TAG	DESCRIPTION	PART NUMBER	NOTES
1	PV DC or AC MODULE	AS 230	AMERICAN SOLAR, QUANTITY - 20 (SEE NOTES SHEET FOR DETAILS)
2	DC/AC INVERTER (MICRO)	AI-200	200 WATT, SINGLE PHASE (SEE NOTES SHEET FOR DETAILS)
3	J-BOX (IF USED)		6"x6"x4" NEMA 4, PVC JUNCTION BOX
4	PV ARRAY	N/A	2,15-A AC CIRCUITS WITH 10 MICRO-INVERTERS PER CIRCUIT
5	AC COMB. PANEL (IF USED)	SD125SL	240VAC, 125-A MAIN LUG PANEL W/ 30-A BREAKER AS MAIN
6	GEN METER (IF USED)	FORM 2S	4-JAW, 240V CYCLOMETER REGISTER KWH METER IN 100-A BASE
7	AC DISCONNECT (IF USED)	D222NRB	240VAC, 30-AMP UNFUSED (SEE GUIDE APPENDIX C)
8	SERVICE PANEL	SD200SL	240VAC, 200-A MAIN, 200-A BUS, 30-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 ☐ or PV WIRE ☐	MFG	MFG Cable	N/A	N/A
2	GEC ☒ EGC ☒ X ALL THAT APPLY	6 AWG	1 BARE CU	N/A	N/A
3	EXTERIOR CABLE LISTED W/ INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	12 AWG	2-B, 2-R, 2-W	EMT	¾"
	GEC ☒ EGC ☒ X ALL THAT APPLY	8 AWG	1 GREEN	SAME	SAME
	NO DC GEC IF 690.35 SYSTEM				
5	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	10 AWG	1-R, 1-B, 1-W	EMT	¾"
	GEC ☒ EGC ☒ X ALL THAT APPLY	8 AWG	1 GREEN	SAME	SAME

Contractor Name, Address and Phone:

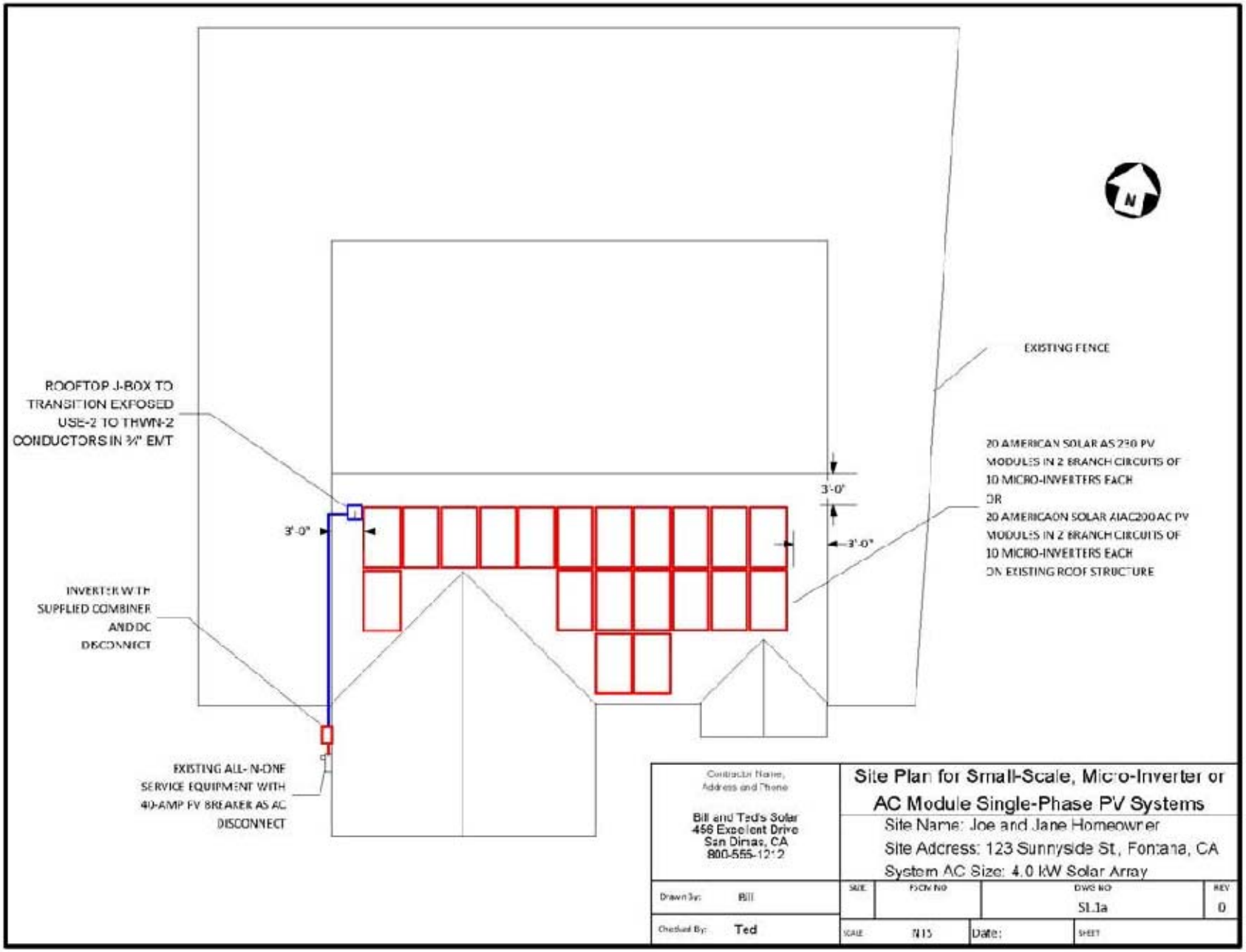
Bill and Ted's Solar
456 Excellent Drive
San Dimas, CA
800-555-1212

One-Line Standard Electrical Diagram for Micro-Inverter or AC Module PV Systems

Site Name: John and Jane Homeowner
Site Address: 123 Sunnyside St., Fontana, CA
System AC Size: 4.0 KW

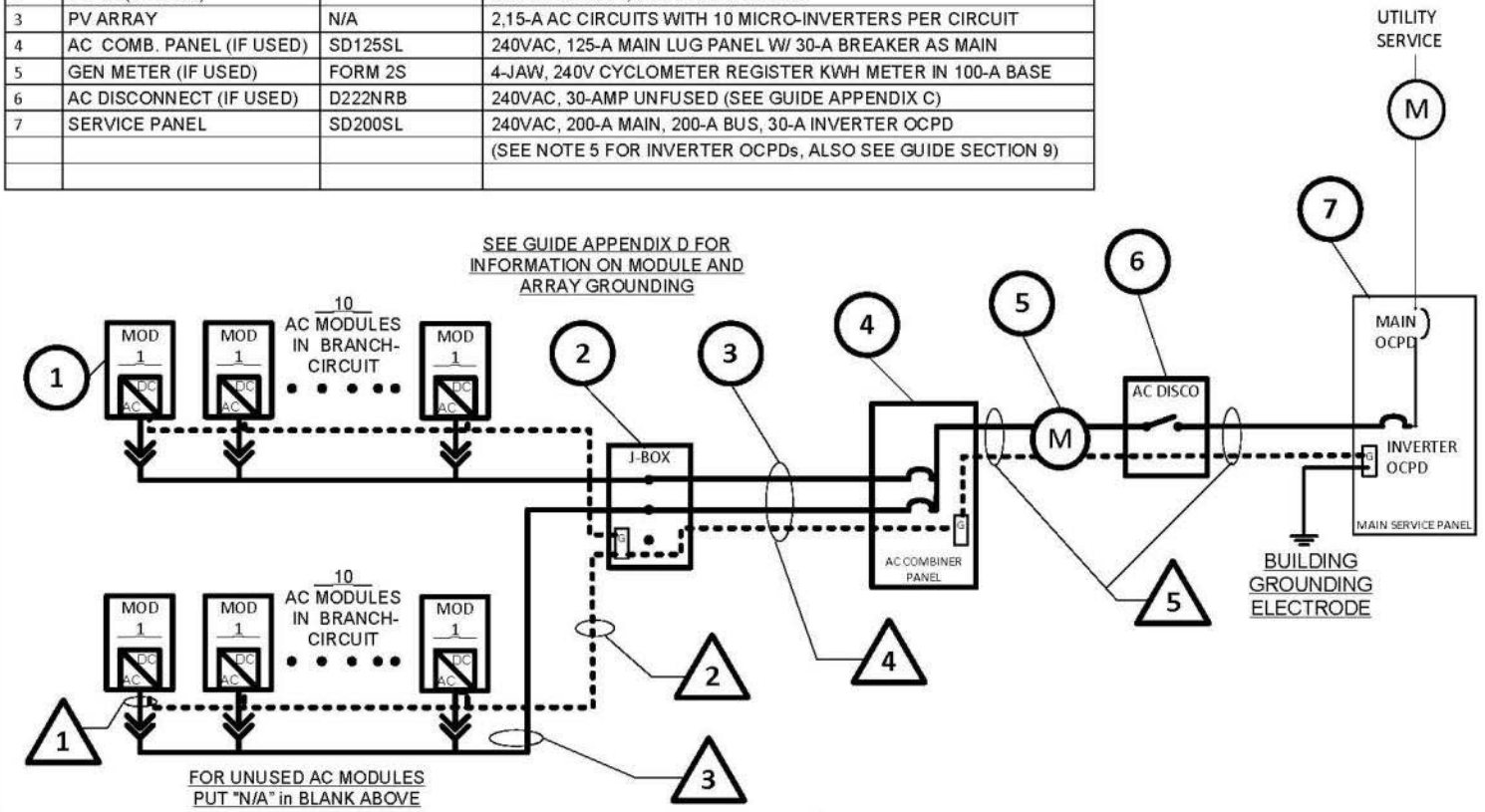
Drawn By:	Bill	SIZE	FSCM NO	DWG NO	REV
Checked By:	Ted			E1.1a	0
		SCALE	NTS	Date:	SHEET

Site plan for example 3 - AC Module



ELECTRICAL DIAGRAM FOR EXAMPLE 3 - AC MODULE

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	AC MODULE	ASAC 200	AMERICAN SOLAR, QUANTITY - 20 (SEE NOTES SHEET FOR DETAILS)
2	J-BOX (IF USED)		6"x6"x4" NEMA 4, PVC JUNCTION BOX
3	PV ARRAY	N/A	2,15-A AC CIRCUITS WITH 10 MICRO-INVERTERS PER CIRCUIT
4	AC COMB. PANEL (IF USED)	SD125SL	240VAC, 125-A MAIN LUG PANEL W/ 30-A BREAKER AS MAIN
5	GEN METER (IF USED)	FORM 2S	4-JAW, 240V CYCLOMETER REGISTER KWH METER IN 100-A BASE
6	AC DISCONNECT (IF USED)	D222NRB	240VAC, 30-AMP UNFUSED (SEE GUIDE APPENDIX C)
7	SERVICE PANEL	SD200SL	240VAC, 200-A MAIN, 200-A BUS, 30-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 ☐ or PV WIRE ☐	MFG	MFG Cable	N/A	N/A
2	GEC ☒ EGC ☒ X ALL THAT APPLY	6 AWG	1 BARE CU	N/A	N/A
3	EXTERIOR CABLE LISTED W/ INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	12 AWG	2-B, 2-R, 2-W	EMT	¾"
	GEC ☒ EGC ☒ X ALL THAT APPLY	8 AWG	1 GREEN	SAME	SAME
	NO DC GEC IF 690.35 SYSTEM				
5	THWN-2 ☒ or XHHW-2 ☐ or RHW-2 ☐	10 AWG	1-R, 1-B, 1-W	EMT	¾"
	GEC ☒ EGC ☒ X ALL THAT APPLY	8 AWG	1 GREEN	SAME	SAME

Contractor Name, Address and Phone:
Bill and Ted's Solar
456 Excellent Drive
San Dimas, CA
800-555-1212

Drawn By: Bill
Checked By: Ted

One-Line Standard Electrical Diagram for AC Module PV Systems

Site Name: John and Jane Homeowner
Site Address: 123 Sunnyside St., Fontana, CA
System AC Size: 4.0 KW

SIZE	FSCM NO	DWG NO	REV
		E1.1b	0

SCALE: NTS | Date: | SHEET