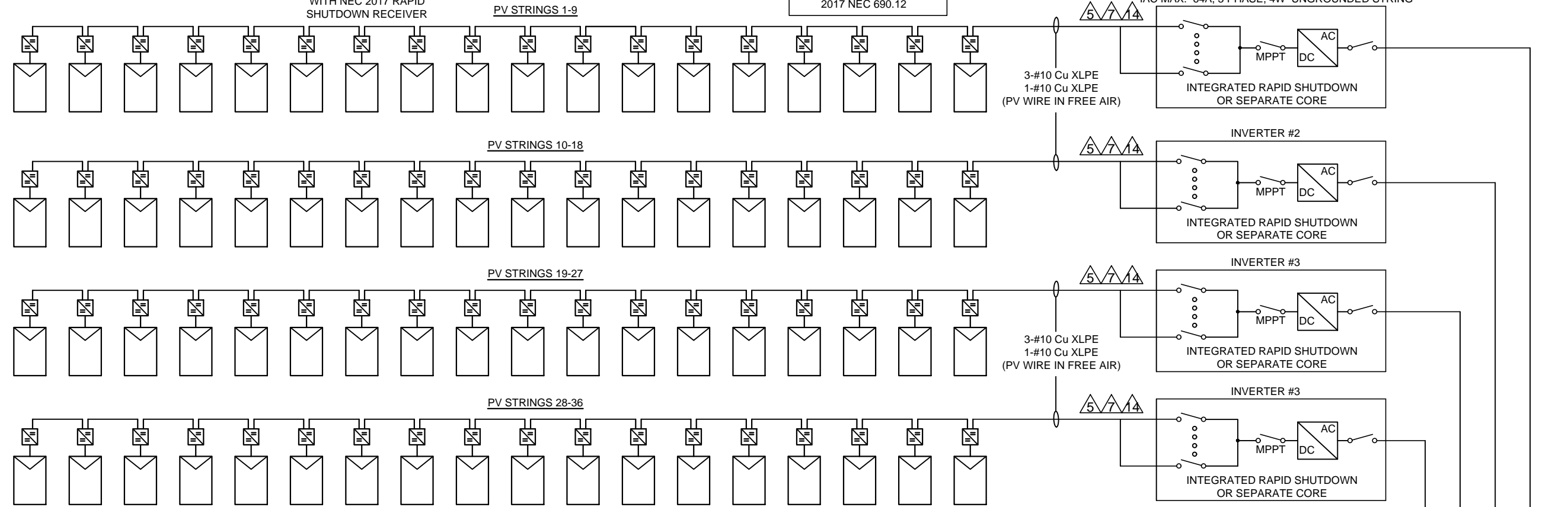


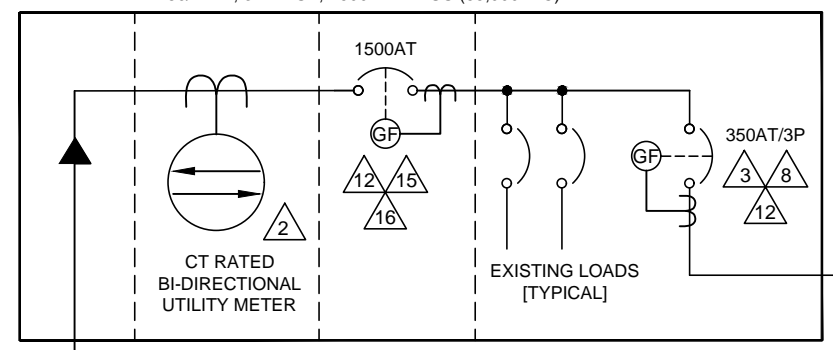
REV.	DESCRIPTION	DATE
A	PRELIMINARY DRAWING SET	08-18-10
B	REVISED PER 2011 NEC REQUIREMENTS	04-30-13
C	REVISED PER APS REQUIREMENTS	02-07-18
D	REVISED PER 2017 NEC REQUIREMENTS	03-27-20

Voc=896.4VDC,
Isc=10.36AMPS
Vmp=750.6VDC, Imp=9.6AMPS
7200 WATT
PHOTO-VOLTAIC STRINGS
WITH NEC 2017 RAPID
SHUTDOWN RECEIVER

THESE RAPID SHUTDOWN
COMPONENTS SHALL BE
LISTED OR FIELD LABELED
AS AN ASSEMBLY IN
ACCORDANCE WITH
2017 NEC 690.12



ELECTRICAL SERVICE ENTRANCE AND LOAD CENTER
480/277V, 3 PHASE, 1600 AMP BUS (65,000 AIC)



UTILITY GRID 480/277V,
3 Phase, 4 Wire
MAX ISC PER APS ESRM
800.2 IS 32,990A

3-#500 Cu THWN-2
1-#4/0 Cu THWN-2 NEUTRAL
1-#4/0 Cu THWN-2 GROUND
3" RMC CONDUIT
[25 FEET OR LESS]

PHOTOVOLTAIC SYSTEM
DISCONNECT SWITCH
[SPECIFY MAKE AND MODEL
#] 3-POLE, 400 A, 600 VAC
350 A, 600 VAC FUSES
(R1-TYPE)

3-#500 Cu THWN-2
1-#3 Cu THWN-2 NEUTRAL
1-#3 Cu THWN-2 GROUND
3" EMT COND JIT

PHOTOVOLTAIC SYSTEM
UTILITY DISCONNECT
SWITCH
[SPECIFY MAKE & MODEL #]
3 POLE, 400A, 600VAC

LINE SIDE (TOP) TERMINALS.
CONNECT PHASE "A" TO THE
LEFT ELEMENT (TERMINAL)
[LOOKING AT THE FRONT OF
THE METER]

PHOTOVOLTAIC SYSTEM
METER
[SPECIFY MAKE AND MODEL #]
480/277V, 400A, FORM 9S
(42,000 AIC)
(RING TYPE)

3-#4 Cu THWN-2
1-#4 Cu THWN-2 NEUTRAL
1-#8 Cu THWN-2 GROUND
1 1/2" EMT CONDUIT

PHOTOVOLTAIC SYSTEM
METER DISCONNECT
SWITCH
[SPECIFY MAKE & MODEL #]
3 POLE, 400A, 600VAC

DEDICATED PHOTOVOLTAIC
SYSTEM COMBINER PANEL
[SPECIFY MAKE, MODEL #,
VOLTAGE AND AMP RATING]
(35KAIC)

NOTE: FOR COMBINER BOX
TO BE RATED PROPERLY
FOR THE AVAILABLE FAULT
CURRENT, TAKE F4 ISC AND
ADD TO THE FULL LOAD
INVERTER FAULT AT 120%.
IN THIS CASE SINCE WE
HAVE FOUR INVERTERS, THE
FAULT CONTRIBUTION FROM
THE PV SYSTEM WILL BE THE
TOTAL FAULT CONTRIBUTION
FROM INVERTERS.

I.E. $4 \times (64A \times 120\%) = 307A + 27,163A = 27,470A$

FAULT CALCS:

F1: AVAIL = 32,990 AIC d = 10 feet f = 0.0537 m = 0.949 Isc = 31,309 AIC	F2: AVAIL = 31,309 AIC d = 10 feet f = 0.0509 m = 0.9515 Isc = 29,790 AIC
F3: AVAIL = 29,790 AIC d = 10 feet f = 0.0485 m = 0.954 Isc = 28,419 AIC	F4: AVAIL = 28,419 AIC d = 10 feet f = 0.0462 m = 0.9558 Isc = 27,163 AIC
F5: AVAIL = 27,163 AIC d = 200 feet f = 5.146 m = 0.163 Isc = 4,420 AIC	

* SOURCE: COOPER
BUSSMAN SPD MANUAL, REV
2009. CALCULATIONS IN
ACCORDANCE WITH NEC
ART 110.9 & 110.10.

NOTE: SYSTEM DESIGNED IN
ACCORDANCE WITH THE
2017 N.E.C.

SAMPLE LOAD SIDE CONNECTION ONE-LINE DIAGRAM

1234 South Main Street
Any City, Arizona 85123
Tel: 602-555-5555

ABC SOLAR COMPANY INC.

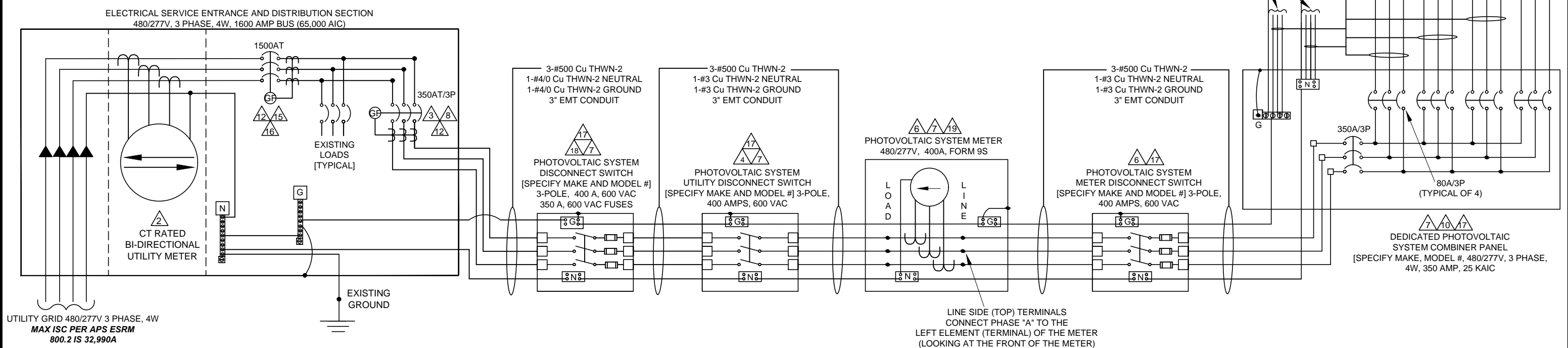
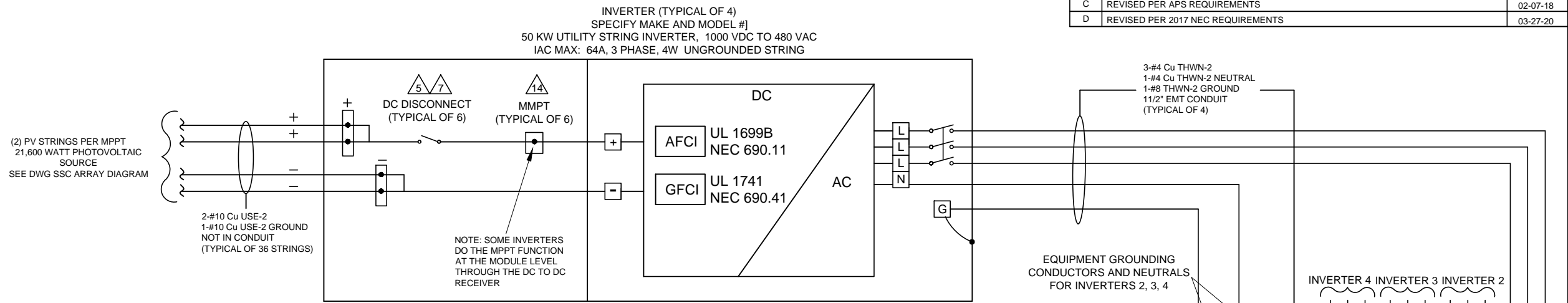
ONE-LINE ELECTRICAL DIAGRAM
200 KW AC PHOTOVOLTAIC SYSTEM
999 N. CACTUS BIRD RD.
ANY CITY, AZ 85123

APPROVALS	DATE
DRAWN ABC	09-10-10
CHECKED	
ENGINEER	
REV. D	03-27-20

ABC PROJECT #1111-9999	SIZE B	CODE INTENT NO.	DRAWING NO. LSC ONE-LINE
SCALE NA	REV. D	SHEET 1 OF 5	

This Sample Drawing is for
illustration purposes only and is
not to be used for design or
construction. This drawing and
its suitability for end use is not
implied. The intent is to only
illustrate typical minimum
information required at time of
application to APS. Additional
information may be required.

REV.	DESCRIPTION:	DATE
A	PRELIMINARY DRAWING SET	08-18-10
B	REVISED PER 2011 NEC REQUIREMENTS	04-30-13
C	REVISED PER APS REQUIREMENTS	02-07-18
D	REVISED PER 2017 NEC REQUIREMENTS	03-27-20



NOTES:

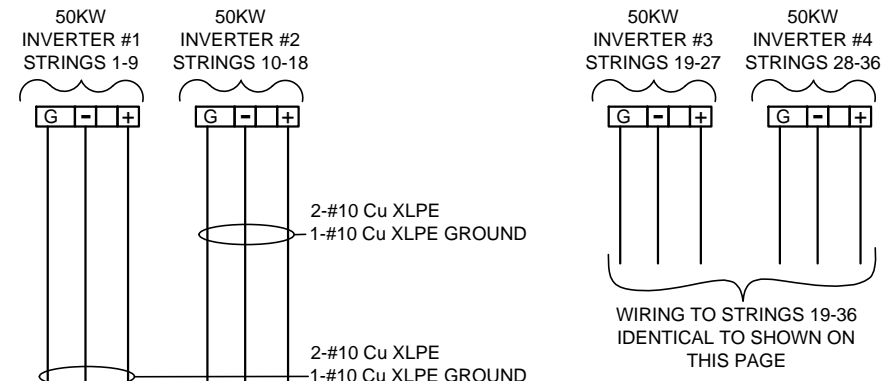
- 1 ALL EQUIPMENT SHALL BE INSTALLED AND LABELED IN ACCORDANCE WITH THE NEC AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRIC UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION.
- 2 CT-RATED BI-DIRECTIONAL UTILITY METER INSTALLED BY UTILITY COMPANY.
- 3 LABEL BREAKER "PHOTOVOLTAIC ELECTRIC POWER SOURCE" PER NEC 705.12(B)(3), AND BREAKERS ARE SUITABLE FOR BACKFEED" PER NEC 705.12(B)(4). LABEL WITH THE MAXIMUM AC OUTPUT OPERATING CURRENT AND THE OPERATING VOLTAGE PER NEC 690.54.
- 4 LABEL "PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SWITCH". SWITCH COVER TO BE LOCKED AT ALL TIMES. SWITCH TO BE VISUAL OPEN, ACCESSIBLE PER UTILITY REQUIREMENTS, CONFORM TO NEC 705.22.
- 5 LABEL "PHOTOVOLTAIC SYSTEM DC DISCONNECT" PER NEC 690.13(B). LABEL WITH OPERATING CURRENT, OPERATING VOLTAGE, MAXIMUM SYSTEM VOLTAGE, AND SHORT CIRCUIT CURRENT PER NEC 690.53. SWITCH TO BE LOCKED. [SWITCH IS INTERNAL TO INVERTER]
- 6 LABEL "PHOTOVOLTAIC SYSTEM METER". METER ENCLOSURE AND SOCKET PROVIDED AND INSTALLED BY CUSTOMER PER APS ESRM. METER, CTs AND TEST SWITCHES PROVIDED BY UTILITY COMPANY WHEN REQUIRED. **NOTE: CUSTOMER TO SUBMIT SHOP DRAWINGS OF METERING CABINET TO APS METERSHOP FOR APPROVAL.**
- 7 PROVIDE WARNING SIGN PER NEC 690.13(B) READING "WARNING-ELECTRIC SHOCK HAZARD-DO NOT TOUCH TERMINALS-TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION".
- 8 LABEL "WARNING INVERTER OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE" AND LOCATE BREAKER AT OPPOSITE END OF BUS FROM MAIN BREAKER LOCATION PER NEC 705.12(B)(2)(3)(b).
- 9 METALLIC CONDUIT SHALL BE USED WITHIN BUILDING PER NEC 690.31(G).
- 10 LABEL "DEDICATED PHOTOVOLTAIC SYSTEM COMBINER PANEL" AND "DO NOT ADD LOADS TO THIS PANEL".
- 11 LABEL "PHOTOVOLTAIC SYSTEM METER DISCONNECT SWITCH". SWITCH COVER TO BE LOCKED AT ALL TIMES. SWITCH TO BE ACCESSIBLE PER UTILITY REQUIREMENTS, CONFORM TO NEC 705.22, AND RATED FOR THE AVAILABLE FAULT CURRENT.
- 12 BREAKER WITH GROUND FAULT PROTECTION HAS BEEN IDENTIFIED AND LISTED AS SUITABLE FOR BACKFEED PER NEC 705.32
- 13 IF DC FUSES ARE ADDED, LABEL: "WARNING, DO NOT OPEN FUSES UNDER LOAD."
- 14 THE STRING INVERTERS DEPICTED HAVE A MAXIMUM OF TWO STRINGS PER MPPT; THEREFORE, THE STRINGS DO NOT REQUIRE OVERCURRENT DEVICES. FOR STRING INVERTERS WITH THREE STRINGS OR MORE IN PARALLEL EACH SERIES STRING REQUIRES OVERCURRENT DEVICES.
- 15 LABEL "BREAKER HAS BEEN DE-RATED TO 1500A PER NEC 705.12(B)(2)(3)(b).
- 16 -----
- 17 EQUIPMENT SHALL BE TESTED, LISTED AND MARKED TO WITHSTAND THE AVAILABLE SHORT CIRCUIT CURRENT.
- 18 INSTALL AS REQUIRED TO ENSURE PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SWITCH AND PRODUCTION METER FAULT WITHSTAND RATINGS ARE NOT EXCEEDED. LABEL "PHOTOVOLTAIC SYSTEM DISCONNECT SWITCH". SWITCH TO BE LOCKED AT ALL TIMES AND COMPLY WITH NEC 705.22.

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SAMPLE LOAD SIDE CONNECTION 3-LINE DIAGRAM

1234 South Main Street Any City, Arizona 85123 Tel: 602-555-5555		ABC SOLAR COMPANY INC.	
APPROVALS		DATE	
DRAWN ABC		09-10-10	
CHECKED			
ENGINEER			
REV. D		03-27-20	
ABC PROJECT #1111-9999		SIZE B	CODE INTENT NO. NA
		LSC THREE-LINE	
		SCALE NA	REV. D
		SHEET 2 OF 5	

REV.	DESCRIPTION	DATE
A	PRELIMINARY DRAWING SET	08-18-10
B	REVISED PER 2011 NEC REQUIREMENTS	04-30-13
C	REVISED PER 2017 NEC REQUIREMENTS	03-27-20



PHOTOVOLTAIC MODULE SPECIFICATIONS

[SPECIFY MAKE & MODEL]
 400 WATTS
 $V_{oc}=49.8$ VDC, $I_{sc}=10.36$ AMPS
 $V_{mp}=41.7$ VDC, $I_{mp}=9.6$ AMPS
 T_{coeff} of $V_{oc}=-0.28$ %/°C
 T_{coeff} of $P_{max}=-0.36$ %/°C

ONE PHOTOVOLTAIC STRING

7,200 WATTS
 18 MODULES IN SERIES PER STRING
 $V_{oc}=896.4$ VDC, $I_{sc}=10.36$ AMPS
 $V_{mp}=750.6$ VDC, $I_{mp}=9.6$ AMPS
 TYPICAL OF 36 STRINGS
 (9 STRINGS PER INVERTER)

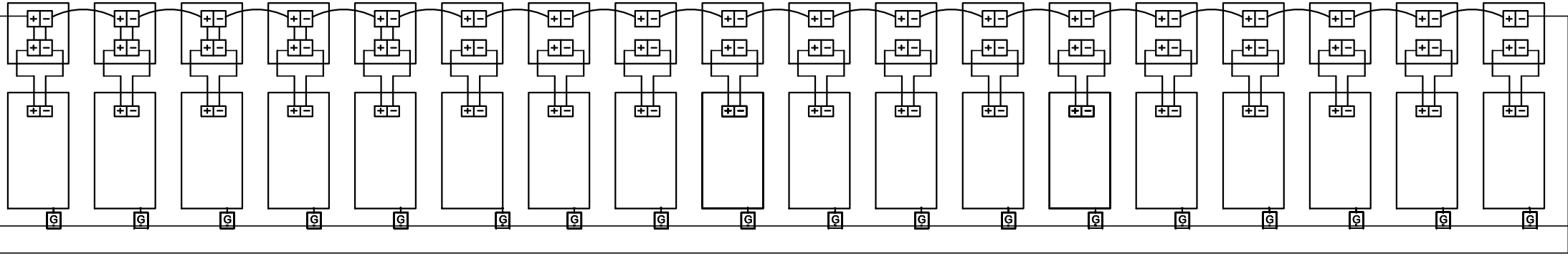
COMPLETE PHOTOVOLTAIC ARRAY

259,200 WATTS
 $V_{oc} = 896.4$ VDC, $I_{sc} = 372.96$ AMPS
 $V_{mp} = 750.6$ VDC, $I_{mp} = 345.6$ AMPS

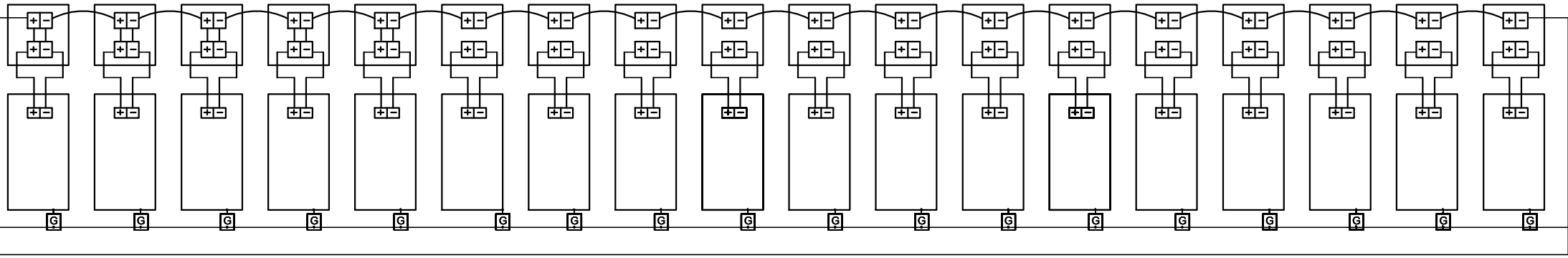
RAPID SHUTDOWN TRANSMITTER AND RECEIVER COMPONENTS SHALL BE LISTED OR FIELD LABELED AS AN ASSEMBLY IN ACCORDANCE WITH 2017 NEC 690.12

TS4-F FIRE SAFETY RAPID SHUTDOWN RECEIVERS

PV STRING OF 18 MODULES (TYPICAL OF 9)



PV STRING OF 18 MODULES (TYPICAL OF 9)



NOTES:

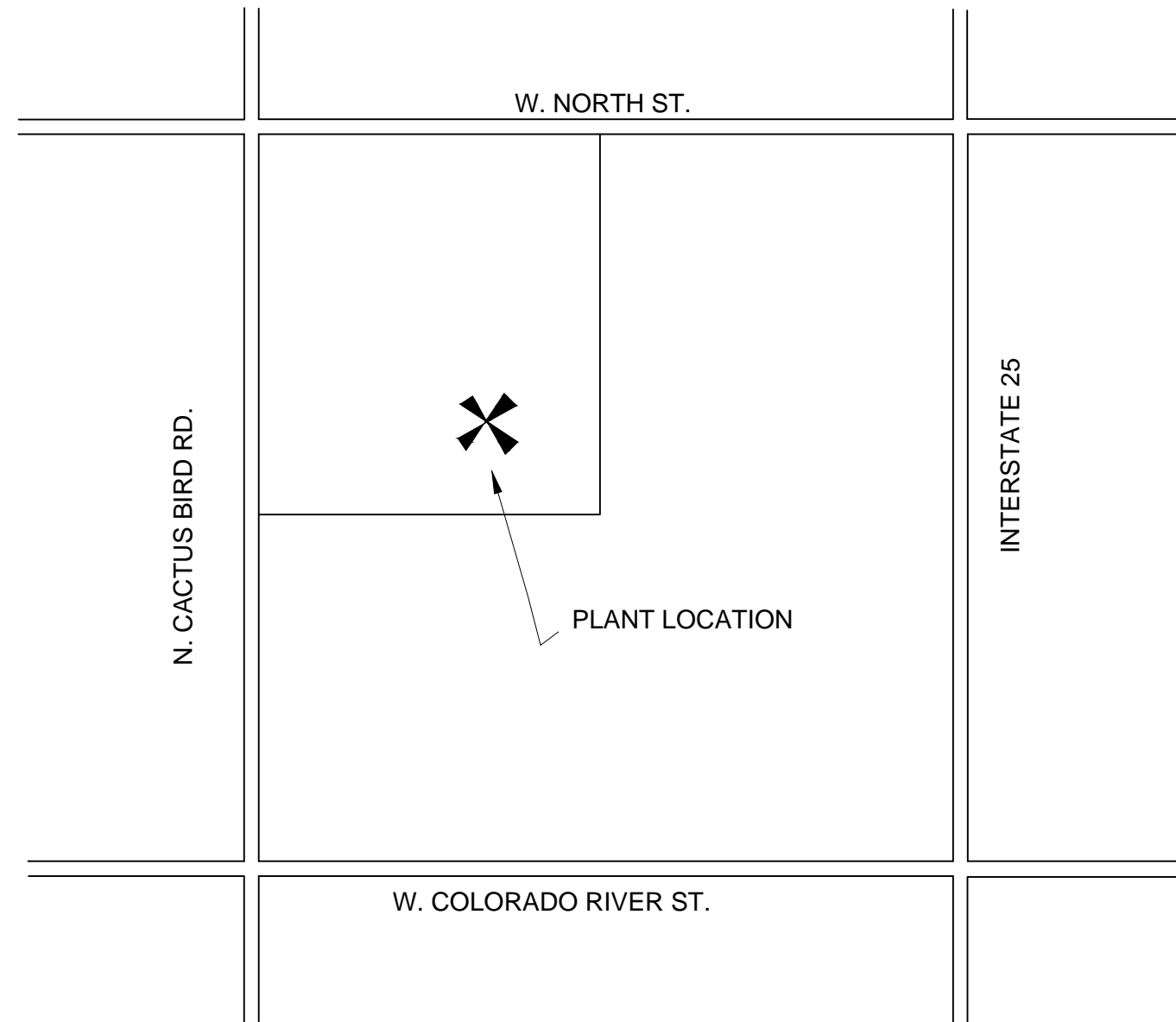
- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC AND ALL APPLICABLE REQUIREMENTS OF THE LOCAL AUTHORITY HAVING JURISDICTION.
- FOLLOW MANUFACTURERS SUGGESTED INSTALLATION PRACTICES AND WIRING SPECIFICATIONS.
- WIRES SHALL BE RATED AND LABELED "SUNLIGHT RESISTANT" WHERE EXPOSED TO AMBIENT CONDITIONS.

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SAMPLE LOAD SIDE CONNECTION ARRAY DRAWING

1234 South Main Street Any City, Arizona 85123 Tel: 602-555-5555		ABC SOLAR COMPANY INC.	
THREE-LINE ELECTRICAL ARRAY DIAGRAM 200 KW AC PHOTOVOLTAIC SYSTEM 999 N. CACTUS BIRD RD. ANY CITY, AZ 85123		SIZE B	CODE INTENT NO.
APPROVALS	DATE	DRAWING NO.	
DRAWN ABC	09-10-10	LSC ARRAY DIAGRAM	
CHECKED		SCALE NA	REV. C
ENGINEER		SHEET 3 OF 5	
REV. C	03-27-20		
ABC PROJECT #1111-9999			

REV.	DESCRIPTION:	DATE
A	PRELIMINARY DRAWING SET	08/18/10
B	UPDATED DRAWING TITLE	03/27/20

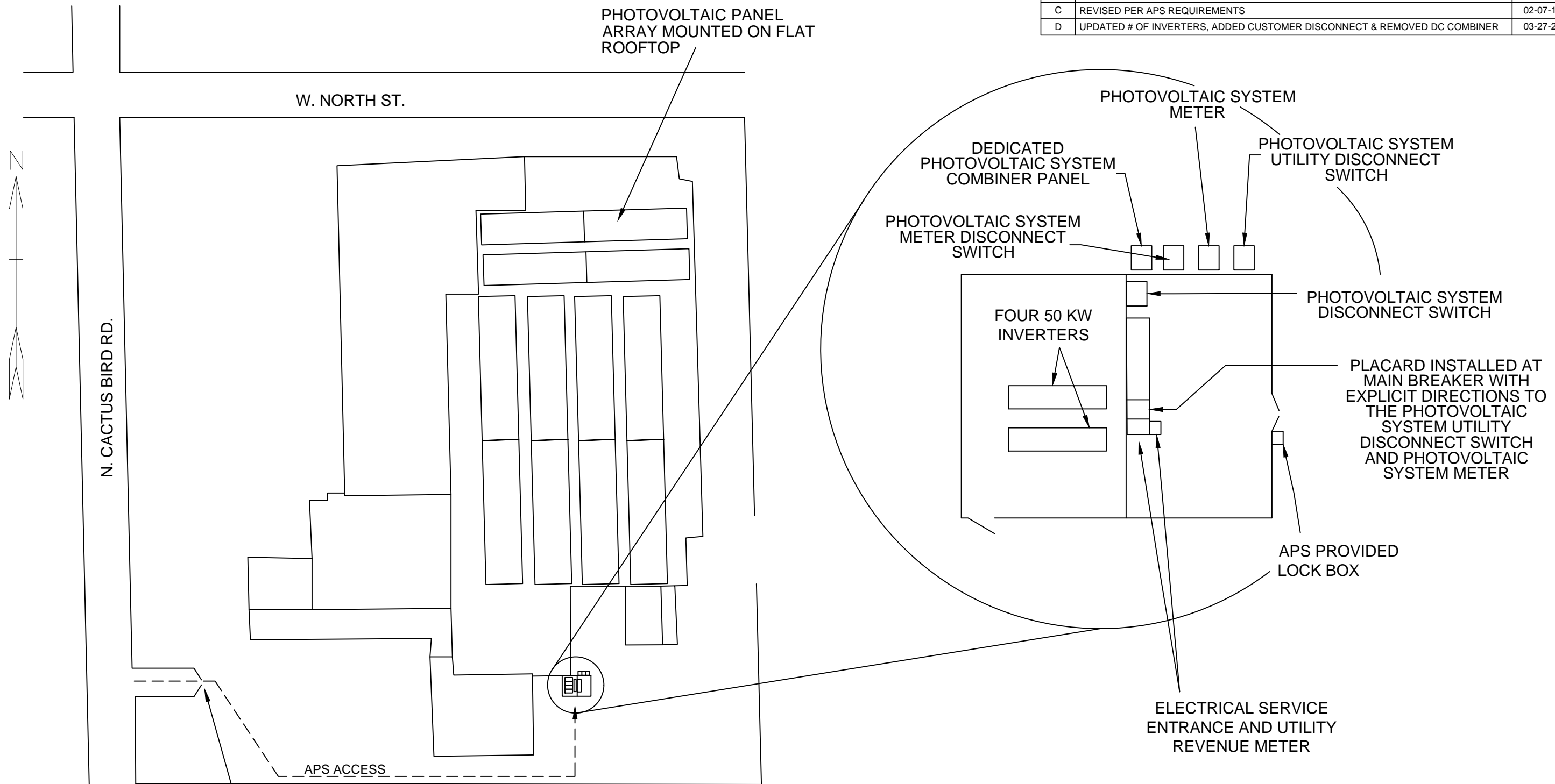


SAMPLE LOAD SIDE CONNECTION PLANT LOCATION

1234 South Main Street Any City, Arizona 85123 Tel: 602-555-5555		ABC SOLAR COMPANY INC.	
APPROVALS		DATE	
DRAWN	ABC	09-10-10	
CHECKED			
ENGINEER			
REV. B	03-27-20		
ABC PROJECT #1111-9999		SIZE B	CODE INTENT NO. DRAWING NO. LSC PLANT LOCATION
		SCALE NA	REV. A SHEET 4 OF 5

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REV.	DESCRIPTION:	DATE
A	PRELIMINARY DRAWING SET	08-18-10
B	WORKSPACE NOTE	04-30-13
C	REVISED PER APS REQUIREMENTS	02-07-18
D	UPDATED # OF INVERTERS, ADDED CUSTOMER DISCONNECT & REMOVED DC COMBINER	03-27-20



DRIVEWAY WITH GATE & KEY CODE SECURITY IN APS PROVIDED LOCKBOX
ACCESS CODE: 12345#

NOTE: UTILITY HAS 24-HR UNRESTRICTED ACCESS TO THE PHOTOVOLTAIC SYSTEM METER AND PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SWITCH THROUGH THE SECURITY GATE

SAMPLE LOAD SIDE TAP SITE PLAN

1234 South Main Street Any City, Arizona 85123 Tel: 602-555-5555		ABC SOLAR COMPANY INC.	
APPROVALS		DATE	
DRAWN	ABC	09-10-10	
CHECKED			
ENGINEER			
REV. D		03-24-20	
ABC PROJECT #1111-9999		SIZE B	CODE INTENT NO. DRAWING NO. LST SITE PLAN
		SCALE NA	REV. D SHEET 5 OF 5

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