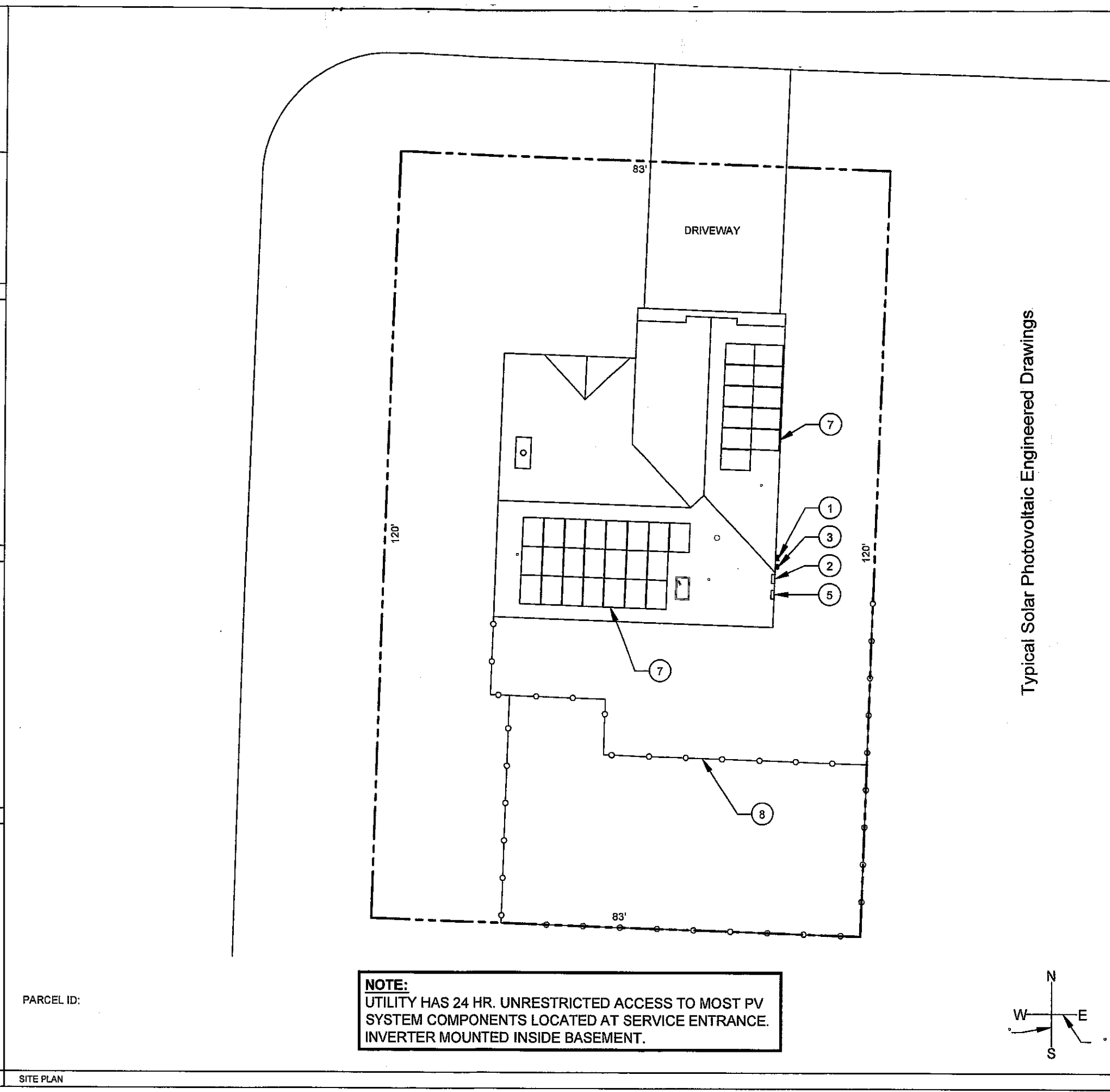


- NOTE:** EQUIPMENT LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE
- EQUIPMENT LOCATION ELEVATION**
- ① ELECTRICAL SERVICE ENTRANCE AND UTILITY REVENUE METER
 - ② EXISTING ELECTRICAL LOAD CENTER
 - ③ PHOTOVOLTAIC SYSTEM DISCONNECT FOR UTILITY OPERATION
 - ④ NOT USED
 - ⑤ INVERTER
 - ⑥ PV ARRAY DC DISCONNECTS
 - ⑦ PHOTOVOLTAIC PANEL ARRAY MOUNTED ON SHINGLE ROOF
 - ⑧ EXISTING FENCE

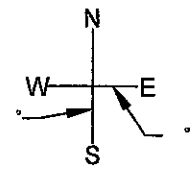
GENERAL NOTES



NOTE: UTILITY HAS 24 HR. UNRESTRICTED ACCESS TO MOST PV SYSTEM COMPONENTS LOCATED AT SERVICE ENTRANCE. INVERTER MOUNTED INSIDE BASEMENT.

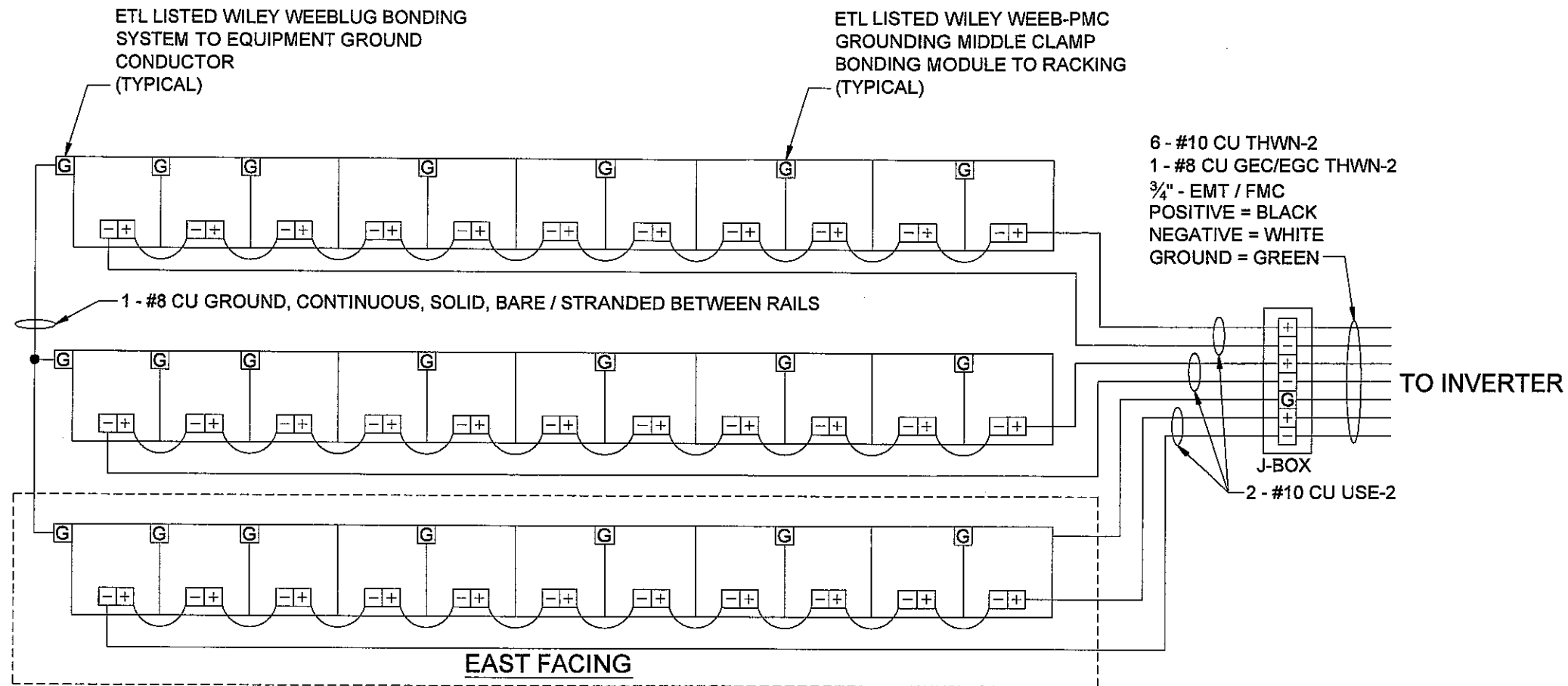
SITE PLAN

Typical Solar Photovoltaic Engineered Drawings



Prepared For:		NO.	REVISION	BY	DATE	APPR.
8.25 KW DC PV SYSTEM						
7.5 KW AC PV SYSTEM						
SITE PLAN						
RAYMORE, MO 64083						
Utility Company: KCP&L						
Drawn P:						
AS DC:						
Checked B:						
Date:						
Project:						
Scale:						
Sheet:						01

SOUTH AND EAST FACING ARRAYS



Sample Array and Wiring Diagram

NO.	REVISION	BY	DATE	APPR.

8.25 KW DC PV SYSTEM
7.5 KW AC PV SYSTEM

ARRAY & WIRING DIAGRAM

RAYMORE, MO 64083

Company: KCP&L

Drawn By: _____

Checked By: _____

Date: _____

Project: _____

Scale: _____ Sheet: 04

- ALL BACK COATED POLYCRYSTALLINE
- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE 2011 NEC AND ALL APPLICABLE REQUIREMENTS OF THE LOCAL AUTHORITY HAVING JURISDICTION.
 - GROUND WIRE MUST BE CONTINUOUS AND INSTALLED TO ALLOW FOR PANEL REMOVAL WITHOUT DISRUPTING CONTINUITY. ALL MODULE GROUND CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH NEC 690-4 (C).
 - FOLLOW MANUFACTURERS SUGGESTED INSTALLATION PRACTICES AND WIRING SPECIFICATIONS.
 - WIRES SHALL BE RATED AND LABELED "SUNLIGHT RESISTANT" WHERE EXPOSED TO AMBIENT TEMPERATURES.

MODEL NUMBER = CENTROSOLAR E250B
 NOMINAL POWER (P_{nom}) = 250 W
 OPEN CIRCUIT VOLTAGE (V_{oc}) = 37.47 V
 MAX POWER VOLTAGE (V_{mp}) = 30.34 V
 SHORT CIRCUIT CURRENT (I_{sc}) = 8.76 A
 MAX POWER CURRENT (I_{mp}) = 8.24 A
 SERIES FUSE RATING = 15 A

NUMBER OF STRINGS = 3
 NUMBER OF MODULES PER STRING = 11
 TOTAL NUMBER OF MODULES = 33
 SYSTEM POWER DC (STC) = 8250 W
 VOC = 412.17 V
 VMP = 333.74 V
 ISC = 8.76 A
 IMP = 8.24 A

NEC 690.7:
 VOC X 1.18 = 486.36 V

SOUTH AND EAST FACING
 VOC = 412.17 V
 VMP = 333.74 V
 ISC = 8.76 A
 IMP = 8.24 A
 NEC 690.7:
 VOC X 1.18 =
 486.36 V

8250 WATT
 PHOTO-VOLTAIC
 ARRAY(S)
 13

6 - #10 CU USE-2
 1 - #8 CU GROUND,
 CONTINUOUS, SOLID,
 BARE / STRANDED

17 J-BOX

9 6 - #10 CU THWN-2
 17 1 - #8 CU GEC/EGC THWN-2
 3/4" - EMT / FMC

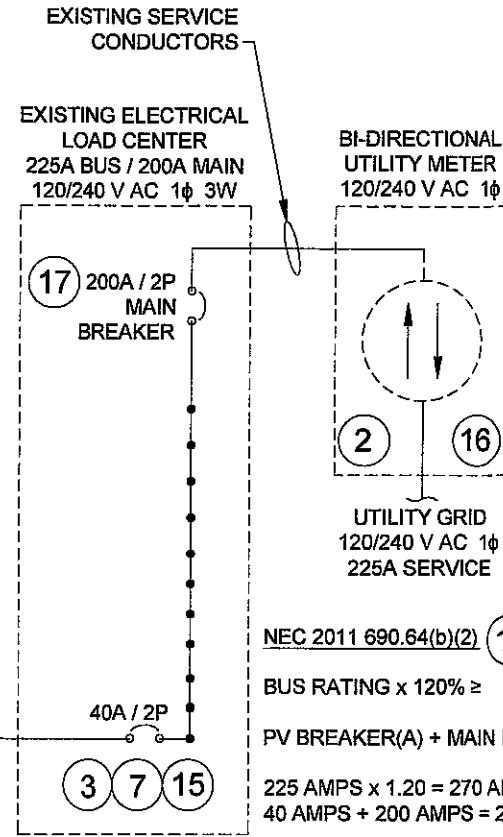
7500 WATT UTILITY INTERACTIVE INVERTER
 230 TO 600 V DC TO 120/240 V AC 1φ
 START UP VOLTAGE - 260 V DC
 RATED CURRENT OUTPUT AT 240 V AC, 31.3A
 FRONIUS INVERTER IG PLUS V 7.5-1 UNI
 WITH ATTACHED DC DISCONNECT
 NEGATIVE GROUNDING

AC
 DC
 5 7 8 13 14

PV SYSTEM DISCONNECT
 FOR UTILITY OPERATION
 CUTLER HAMMER DG222URB
 NON-FUSIBLE
 240 V AC 60A 2P NEMA-3R
 UL LISTED AND RATED
 FOR 75° C WIRE
 (OR EQUIVALENT)

4 7

9 3 - #8 CU THWN-2
 1 - #8 CU GEC/EGC THWN-2
 3/4" - EMT



NEC 2011 690.64(b)(2) 12

BUS RATING x 120% ≥
 PV BREAKER(A) + MAIN BREAKER(A)

225 AMPS x 1.20 = 270 AMPS ≥
 40 AMPS + 200 AMPS = 240 AMPS

Sample

- 1 EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC 2011 AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRICAL UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION.
- 2 BI-DIRECTIONAL UTILITY METER TO BE INSTALLED BY UTILITY COMPANY (WHEN REQUIRED).
- 3 PER NEC 690.54 LABEL OVERCURRENT DEVICE "PHOTOVOLTAIC ELECTRIC POWER SOURCE" WITH THE RATED AC OUTPUT OPERATING CURRENT AND THE OPERATING VOLTAGE. PER NEC 705.12(D)(7) LABEL DEVICE "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS DEVICE".
- 4 LABEL "PV SYSTEM DISCONNECT FOR UTILITY OPERATION". SWITCH COVER TO BE LOCKED AT ALL TIMES. SWITCH TO BE VISIBLE BLADE AND ACCESSIBLE PER UTILITY REQUIREMENTS AND CONFORM TO NEC 705.22 AND THE OPERATING VOLTAGE PER NEC 690.54.
- 5 LABEL "PHOTOVOLTAIC ARRAY DC DISCONNECT SWITCH" PER NEC 690.14(C)(2). LABEL WITH OPERATING CURRENT, OPERATING VOLTAGE, MAXIMUM SYSTEM VOLTAGE, AND SHORT CIRCUIT CURRENT PER NEC 690.53. SWITCH TO BE LOCKED PER NEC 690.7(D).
- 6 NOT USED.
- 7 PROVIDE WARNING SIGN PER NEC 690.17 READING "WARNING-ELECTRICAL SHOCK HAZARD- DO NOT TOUCH TERMINALS- TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OFF POSITION".
- 8 LISTED OR LABELED EQUIPMENT SHALL BE INSTALLED AND USED IN ACCORDANCE WITH ANY INSTRUCTIONS INCLUDED IN THE LISTING OR LABELING PER NEC 110.3(B).
- 9 METALLIC CONDUIT SHALL BE USED WITHIN BUILDING PER NEC 690.31(E).
- 10 NOT USED.

- 11 GEC TO BE INSTALLED AS REQUIRED BY MANUFACTURER INSTRUCTIONS AND NEC 690.47(C)(3).
- 12 PER NEC 690.64 B.2: THE SUM OF THE AMPERE RATINGS OF OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO THE BUS BAR SHALL NOT EXCEED 120% THE RATING OF THE BUS BAR OR CONDUCTOR FOR A DWELLING UNIT.
- 13 THE PV PANELS AND THE INVERTERS REQUIRE NEGATIVE GROUNDING PER MANUFACTURE'S INSTRUCTIONS.
- 14 ANTI-ISLANDING PROTECTION ENSURES THE SYSTEM WILL NOT EXPORT POWER INTO A BALANCED 60 Hz RESONANT LOAD WHILE THE UTILITY IS DISCONNECTED.
- 15 PER NEC 690.64(B)(7): UNLESS THE PANELBOARD IS RATED NOT LESS THAN THE SUM OF THE AMPERE RATINGS OF ALL OVERCURRENT DEVICES SUPPLYING IT, A CONNECTION IN A PANELBOARD SHALL BE POSITIONED AT THE OPPOSITE (LOAD) END FROM THE INPUT FEEDER LOCATION OR MAIN CIRCUIT LOCATION. THE BUS OR CONDUCTOR RATING SHALL BE SIZED FOR THE LOADS CONNECTED IN ACCORDANCE WITH ARTICLE 220. A PERMANENT WARNING LABEL SHALL BE APPLIED TO THE DISTRIBUTION EQUIPMENT WITH THE FOLLOWING OR EQUIVALENT MARKING: "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE".
- 16 PER NEC 705.10 "A PERMANENT PLAQUE OR DIRECTORY, DENOTING ALL ELECTRIC POWER SOURCES ON OR IN THE PREMISES, SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT LOCATIONS OF ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED".
- 17 LABEL "WARNING: PHOTOVOLTAIC POWER SOURCE". PER THE INTERNATIONAL FIRE CODE 2012 EDITION, SECTION 605.11. MARKING IS REQUIRED ON INTERIOR AND EXTERIOR DC CONDUIT, ENCLOSURES, RACEWAYS, CABLE ASSEMBLIES EVERY 10 FEET, WITHIN 1 FOOT OF TURNS OR BENDS AND WITHIN 1 FOOT ABOVE AND BELOW PENETRATIONS OF ROOF/CEILING ASSEMBLIES, WALLS OR BARRIERS, JUNCTION BOXES, COMBINER BOXES AND DISCONNECTS. THE MATERIALS USED FOR MARKING SHALL BE REFLECTIVE, WEATHER RESISTANT AND SUITABLE FOR THE ENVIRONMENT. THE MARKING SHALL ALSO BE PLACED ADJACENT TO THE MAIN SERVICE DISCONNECT IN A LOCATION CLEARLY VISIBLE FROM THE LOCATION WHERE THE DISCONNECT IS OPERATED.

CONDUCTOR SIZING PER NEC TABLES
 310.15(B)(16) AND 310.15(B)(2)(A) AND
 ADJUSTMENT FACTORS 0.67 (51-55°C) AND
 0.88 (35-40°C). OVERCURRENT DEVICE
 SIZING PER NEC 240.4(B) AND 240.6(A):

DC CALCS:

PER NEC 690.8(A)(1) AND (B)(1):
 $I_{sc} \times 1.25 \times 1.25$

CONDUCTOR SIZING PER NEC TABLES
 310.15(B)(3)(a) AND 310.15(B)(3)(c)

AC CALCS:

PER NEC 690.8(A)(3) AND (B)(1):
 $I \times 1.25$

CONDUCTOR COLORING:

DC:
 POSITIVE = BLACK
 NEGATIVE = WHITE
 GROUND = GREEN

AC:
 L1 = BLACK
 L2 = RED
 NEUTRAL = WHITE
 GROUND = GREEN

ALL SUPPLIED EQUIPMENT IS UL LISTED

EQUIPMENT TO BE INSTALLED PER LISTING
 AND / OR LABELING TO 2011 NEC
 REQUIREMENTS

GROUNDING CONDUCTORS CONNECTED TO
 EACH MODEL FRAME AND RACK ASSEMBLY

ALL SOLAR PANELS ARE UL LISTED TO UL1703
 AND HAVE A CLASS C FIRE RATING

MODULE INFORMATION:

MODEL NUMBER = CENTROSOLAR E250B
 NOMINAL POWER (P_{nom}) = 250 W
 OPEN CIRCUIT VOLTAGE (V_{oc}) = 37.47 V
 MAX POWER VOLTAGE (V_{mp}) = 30.34 V
 SHORT CIRCUIT CURRENT (I_{sc}) = 8.76 A
 MAX POWER CURRENT (I_{mp}) = 8.24 A
 SERIES FUSE RATING = 15 A

KEY NOTES

EQUIPMENT NOTES

Prepared For:

NO.	REVISION	BY	DATE	APPR.

8.25 KW DC PV SYSTEM
 7.5 KW AC PV SYSTEM
ONE LINE WIRING DIAGRAM

RAYMORE, MO 64083

Utility Company: KCP&L

Drawn by:

Checked by:

Date:

Project:

Scale:

SOUTH AND EAST FACING
8250 DC WATT
PHOTOVOLTAIC ARRAY(S)
SEE DRAWING 04 FOR
WIRING DETAIL (13)

6 - #10 CU USE-2
1 - #8 CU GROUND,
CONTINUOUS, SOLID,
BARE / STRANDED

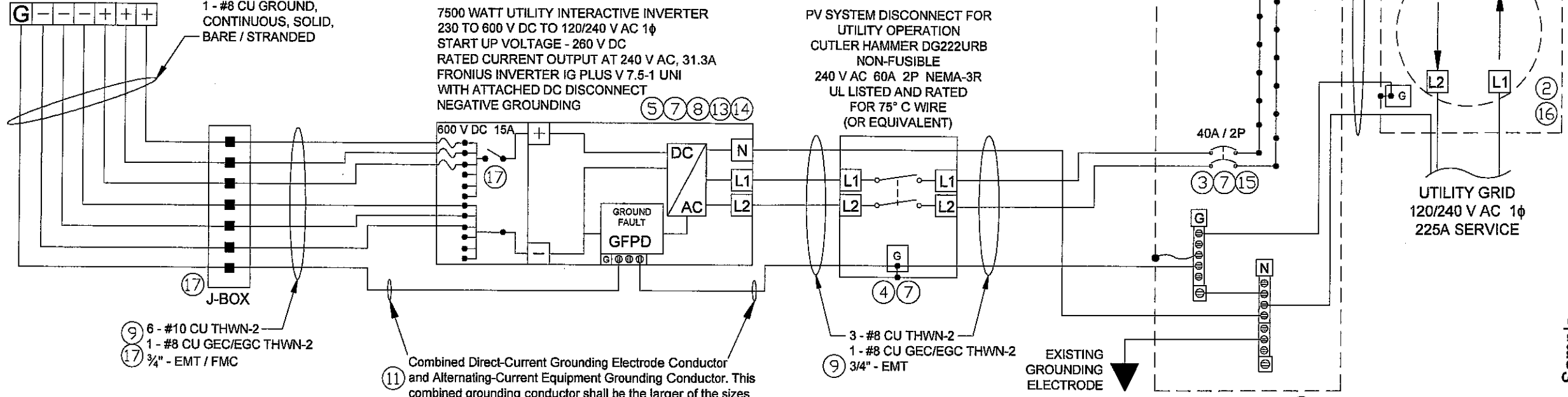
7500 WATT UTILITY INTERACTIVE INVERTER
230 TO 600 V DC TO 120/240 V AC 1φ
START UP VOLTAGE - 260 V DC
RATED CURRENT OUTPUT AT 240 V AC, 31.3A
FRONIUS INVERTER IG PLUS V 7.5-1 UNI
WITH ATTACHED DC DISCONNECT
NEGATIVE GROUNDING (5 7 8 13 14)

PV SYSTEM DISCONNECT FOR
UTILITY OPERATION
CUTLER HAMMER DG222URB
NON-FUSIBLE
240 V AC 60A 2P NEMA-3R
UL LISTED AND RATED
FOR 75° C WIRE
(OR EQUIVALENT)

EXISTING ELECTRICAL
LOAD CENTER
225A BUS / 200A MAIN
120/240 V AC 1φ 3W

BI-DIRECTIONAL
UTILITY METER
120/240 V AC 1φ

UTILITY GRID
120/240 V AC 1φ
225A SERVICE



(9) 6 - #10 CU THWN-2
(17) 1 - #8 CU GEC/EGC THWN-2
3/4" - EMT / FMC

(11) Combined Direct-Current Grounding Electrode Conductor and Alternating-Current Equipment Grounding Conductor. This combined grounding conductor shall be the larger of the sizes specified by NEC 2011 250.122 or 250.166(B) and shall be installed in accordance with 250.64(E).

(9) 3 - #8 CU THWN-2
1 - #8 CU GEC/EGC THWN-2
3/4" - EMT

EXISTING
GROUNDING
ELECTRODE

NEC 2011 690.64(b)(2) (12)

BUS RATING x 120% ≥
PV BREAKER(A) + MAIN BREAKER(A)
225 AMPS x 1.20 = 270 AMPS ≥
40 AMPS + 200 AMPS = 240 AMPS

Sample

- (1) EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC 2011 AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRICAL UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION.
- (2) BI-DIRECTIONAL UTILITY METER TO BE INSTALLED BY UTILITY COMPANY (WHEN REQUIRED).
- (3) PER NEC 690.54 LABEL OVERCURRENT DEVICE "PHOTOVOLTAIC ELECTRIC POWER SOURCE" WITH THE RATED AC OUTPUT OPERATING CURRENT AND THE OPERATING VOLTAGE. PER NEC 705.12(D)(7) LABEL DEVICE "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS DEVICE".
- (4) LABEL "PV SYSTEM DISCONNECT FOR UTILITY OPERATION". SWITCH COVER TO BE LOCKED AT ALL TIMES. SWITCH TO BE VISIBLE BLADE AND ACCESSIBLE PER UTILITY REQUIREMENTS AND CONFORM TO NEC 705.22 AND THE OPERATING VOLTAGE PER NEC 690.54.
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- (6) NOT USED.
- (7) PROVIDE WARNING SIGN PER NEC 690.17 READING "WARNING-ELECTRICAL SHOCK HAZARD- DO NOT TOUCH TERMINALS- TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OFF POSITION".
- (8) LISTED OR LABELED EQUIPMENT SHALL BE INSTALLED AND USED IN ACCORDANCE WITH ANY INSTRUCTIONS INCLUDED IN THE LISTING OR LABELING PER NEC 110.3(B).
- (9) METALLIC CONDUIT SHALL BE USED WITHIN BUILDING PER NEC 690.31(E).
- (10) NOT USED.

- (11) GEC TO BE INSTALLED AS REQUIRED BY MANUFACTURER INSTRUCTIONS AND NEC 690.47(C)(3).
- (12) PER NEC 690.64 B.2: THE SUM OF THE AMPERE RATINGS OF OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO THE BUS BAR SHALL NOT EXCEED 120% THE RATING OF THE BUS BAR OR CONDUCTOR FOR A DWELLING UNIT.
- (13) THE PV PANELS AND THE INVERTERS REQUIRE NEGATIVE GROUNDING PER MANUFACTURE'S INSTRUCTIONS.
- (14) ANTI-ISLANDING PROTECTION ENSURES THE SYSTEM WILL NOT EXPORT POWER INTO A BALANCED 60 Hz RESONANT LOAD WHILE THE UTILITY IS DISCONNECTED.
- (15) PER NEC 690.64(B)(7): UNLESS THE PANELBOARD IS RATED NOT LESS THAN THE SUM OF THE AMPERE RATINGS OF ALL OVERCURRENT DEVICES SUPPLYING IT, A CONNECTION IN A PANELBOARD SHALL BE POSITIONED AT THE OPPOSITE (LOAD) END FROM THE INPUT FEEDER LOCATION OR MAIN CIRCUIT LOCATION. THE BUS OR CONDUCTOR RATING SHALL BE SIZED FOR THE LOADS CONNECTED IN ACCORDANCE WITH ARTICLE 220. A PERMANENT WARNING LABEL SHALL BE APPLIED TO THE DISTRIBUTION EQUIPMENT WITH THE FOLLOWING OR EQUIVALENT MARKING: "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE".
- (16) PER NEC 705.10 "A PERMANENT PLAQUE OR DIRECTORY, DENOTING ALL ELECTRIC POWER SOURCES ON OR IN THE PREMISES, SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT LOCATIONS OF ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED".
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CONDUCTOR SIZING PER NEC TABLES 310.15(B)(16) AND 310.15(B)(2)(A) AND ADJUSTMENT FACTORS 0.67 (51-55°C) AND 0.88 (35-40°C). OVERCURRENT DEVICE SIZING PER NEC 240.4(B) AND 240.6(A):

DC CALCS:
PER NEC 690.8(A)(1) AND (B)(1):
 $I_{sc} \times 1.25 \times 1.25$
CONDUCTOR SIZING PER NEC TABLES 310.15(B)(3)(a) AND 310.15(B)(3)(c)

AC CALCS:
PER NEC 690.8(A)(3) AND (B)(1):
 $I \times 1.25$

CONDUCTOR COLORING:
DC:
POSITIVE = BLACK
NEGATIVE = WHITE
GROUND = GREEN
AC:
L1 = BLACK
L2 = RED
NEUTRAL = WHITE
GROUND = GREEN

ALL SUPPLIED EQUIPMENT IS UL LISTED
EQUIPMENT TO BE INSTALLED PER LISTING AND / OR LABELING TO 2011 NEC REQUIREMENTS
GROUNDING CONDUCTORS CONNECTED TO EACH MODEL FRAME AND RACK ASSEMBLY
ALL SOLAR PANELS ARE UL LISTED TO UL1703 AND HAVE A CLASS C FIRE RATING

MODULE INFORMATION:
MODEL NUMBER = CENTROSOLAR E250B
NOMINAL POWER (P_{nom}) = 250 W
OPEN CIRCUIT VOLTAGE (V_{oc}) = 37.47 V
MAX POWER VOLTAGE (V_{mp}) = 30.34 V
SHORT CIRCUIT CURRENT (I_{sc}) = 8.76 A
MAX POWER CURRENT (I_{mp}) = 8.24 A
SERIES FUSE RATING = 15 A

KEY NOTES

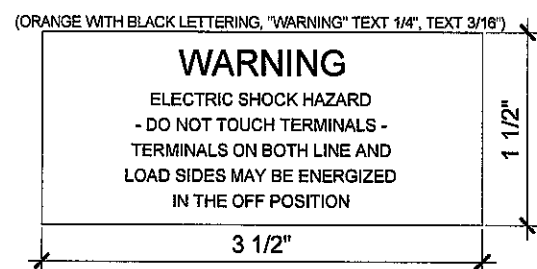
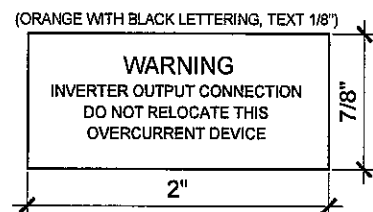
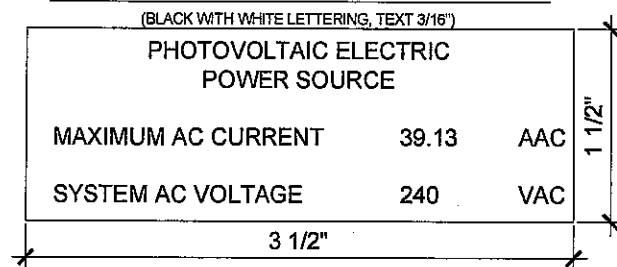
EQUIPMENT NOTES

Prepared For:	
NO.	
REVISION	
BY	
DATE	
APPR.	

8.25 KW DC PV SYSTEM
7.5 KW AC PV SYSTEM
THREE LINE WIRING DIAGRAM
RAYMORE, MO 64083

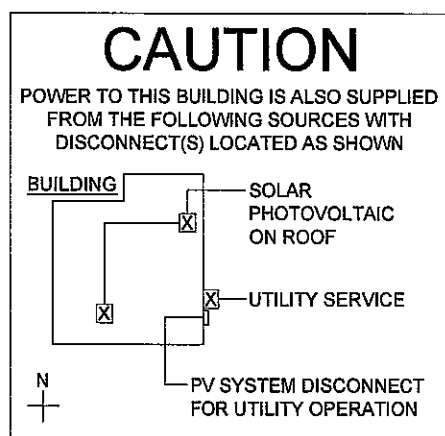
Utility Company:	KCP&L
Drawn By:	
Rev. No.:	
Checked By:	
Date:	
Project:	
Scale:	Sheet

MAIN SERVICE PANEL

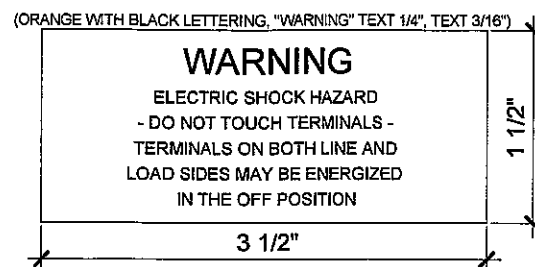
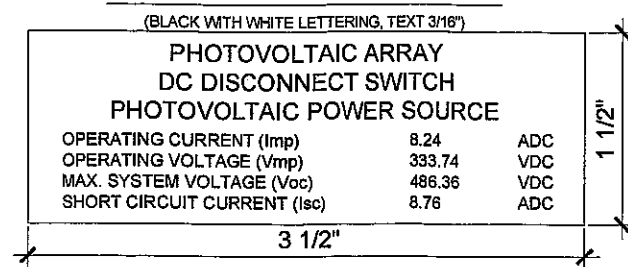


DIRECTORY

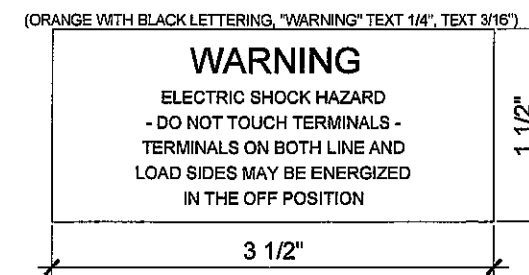
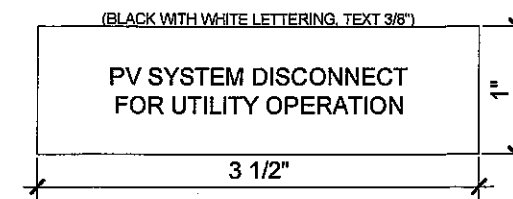
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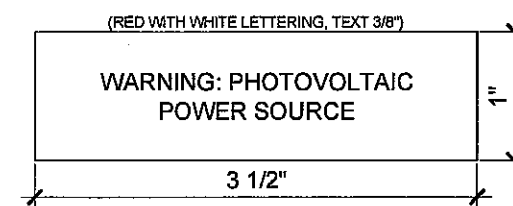
DC DISCONNECT



AC DISCONNECT



2012 IFC FIRE CODE MARKINGS



Labeling Requirements

Prepared For:			
		BY	DATE
		REVISION	APPR.
		NO.	
8.25 KW DC PV SYSTEM 7.5 KW AC PV SYSTEM EQUIPMENT LABELING RAYMORE, MO 64083			
Utility Company: KCP&L			
Drawn By:			
By DC:			
Checked By:			
Date:			
Project:			
Scale:			

ALL LABELS TO BE ENGRAVED AND MECHANICALLY BONDED UNLESS OTHERWISE STATED

