

Doe Residence - 5.64 kW DC Roof Mounted Photovoltaic System

EQUIPMENT SUMMARY

20 LG 300W SOLAR PANELS
 1 SMA SE6000A-US INVERTER
 EVEREST SOLAR SYSTEMS CROSS RAIL RACKING SYSTEM
 QUICKMOUNT PV QUICK HOOK – CURVED TILE MOUNT QMCTH

SHEET INDEX

T-01 COVER
 PV-01 SITE MAP & PV LAYOUT
 PV-02 ELECTRICAL 1-LINE DIAGRAM
 PV-03 SYSTEM LABELING DETAIL
 PV-04 MOUNTING DETAIL

GOVERNING CODES

ALL WORK TO COMPLY WITH THE FOLLOWING CODES:
 UNDERWRITERS LABORATORIES (UL) STANDARDS
 OSHA 29 CFR 1910.269
 2013 CALIFORNIA ELECTRICAL CODE
 2013 CALIFORNIA MECHANICAL CODE
 2013 CALIFORNIA BUILDING CODE
 2013 CALIFORNIA RESIDENTIAL CODE
 2013 CALIFORNIA PLUMBING CODE
 2013 CALIFORNIA FIRE CODE
 2010 CALIFORNIA ENERGY CODE WITH 2008 CA ENERGY EFFICIENCY STANDARDS.

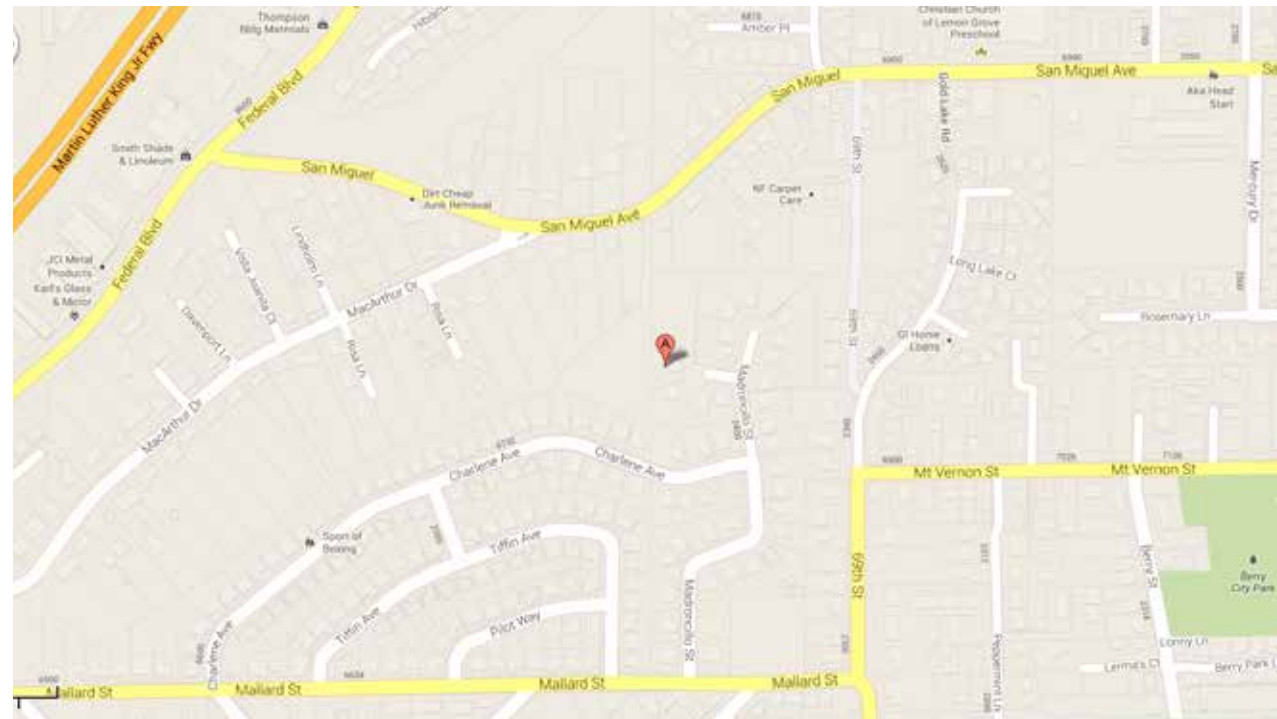
CUSTOMER:

John Doe
 1000 Sample St
 Sample City, CA 99999

CONTRACTOR:

Contractor
 1000 Sample St
 Sample City, CA 99999
 (999) 999-9999

Contractor Lic. #99999999



Vicinity Map

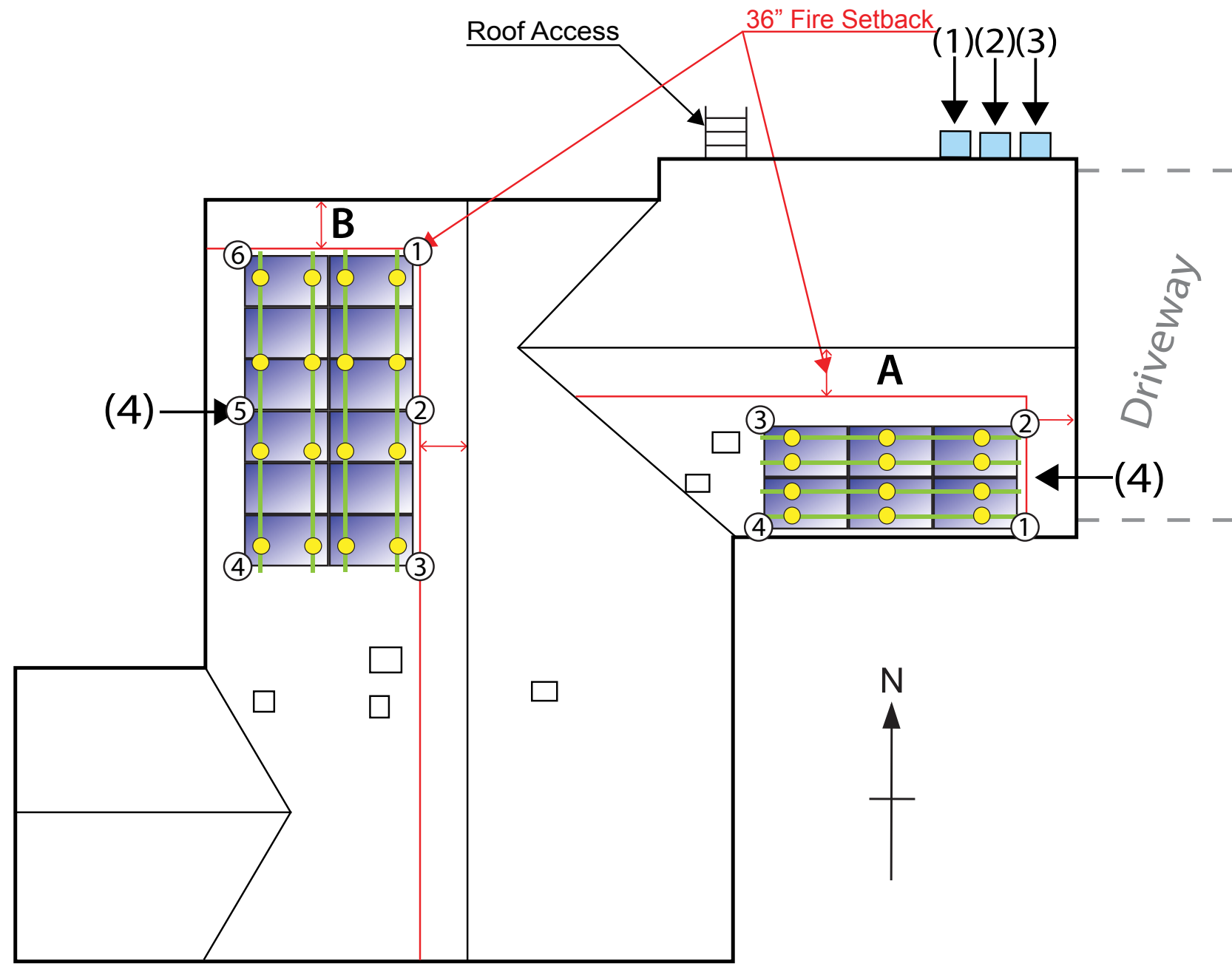
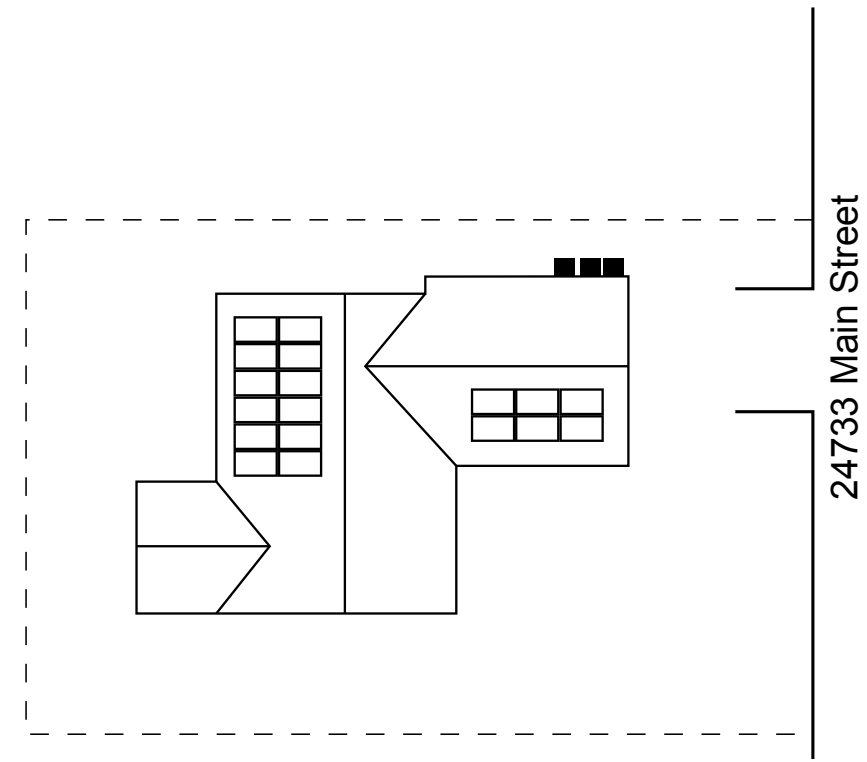


Single Family Residence

Installer	Contractor 1000 Sample St Sample City, CA 99999 (999) 999-9999 Contractor Lic. #999999 C-10 Electrical
Plans Prepared By	Electrician
Owner	John Doe 1000 Sample St Sample City, CA 99999 Existing Single Family Residence
Drawn By Peter Ruttkay	
T-01	

1. New Non-Centered Main Service Panel with 225A Bus Bar
2. PV Production Meter
3. SMA SE6000A-US Inverter
4. Location of 20 LG 300W Solar Modules

**Solar Modules Cover
Less than %50 of
Total Roof Area**



GENERAL NOTES:

This project has been designed in compliance with the CBC Section 11&09 to withstand a minimum 85mph wind load.

This system will not be interconnected until approval from the local jurisdiction and the utility is obtained.

This system is an utility interactive system with no storage batteries.

The solar photovoltaic installation shall not obstruct any plumbing, mechanical or building roof vents.

Roof access and ladder shall be located in area not requiring placement of ground ladder over openings such as doors or windows. Roof access shall be located in strong points of building construction in locations where access point does not conflict with overhead obstructions such as tree limbs, wires or signs.

Proper access and working clearance will be provided as per Section 110.21& CEC.

All equipment shall be identified on a warning placard clearly showing the location of all pertinent equipment and disconnects. Alternate power source placard shall meet the specifications of The San Diego Area Newsletter.

Provide load calculations at first inspection. All breaker spaces shall be used at distribution panel

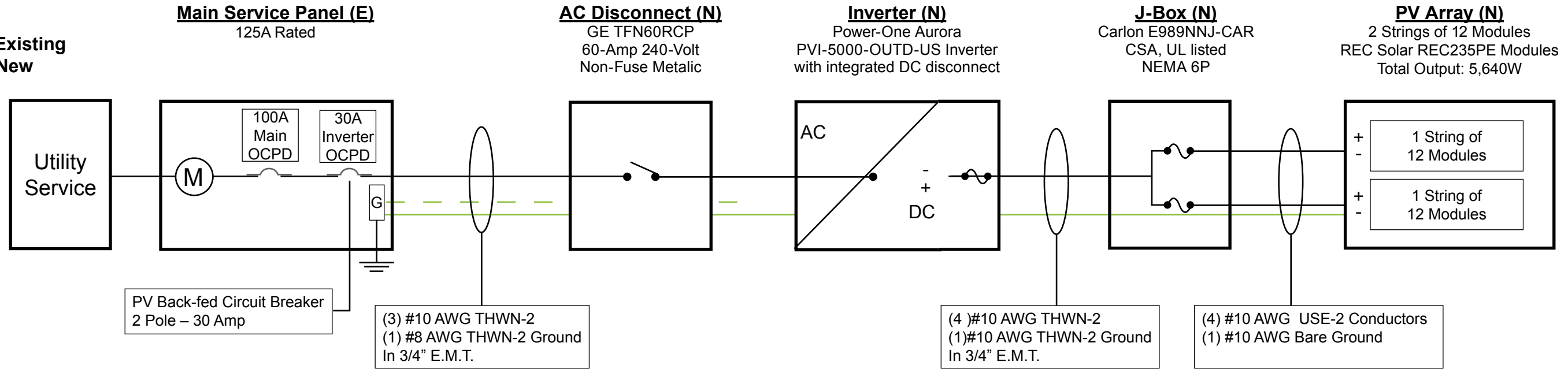
Azimuth: 135°
Tilt: 26°

LEGEND

- ⊙ - Suneye
- (1) - Main Service Panel
- (2) - PV Production Meter
- (3) - Inverter
- (4) - Solar Array(s)
- - Attachment
- - Rail
- - Fire Setback

Contractor	1000 Sample St Sample City, CA 99999 (999) 999-9999 Contractor Lic. #99999 C-10 Electrical
Installer	
Plans Prepared By	Electrician
Owner	John Doe 1000 Sample St Sample City, CA 99999 Existing Single Family Residence
Drawn By	Peter Ruttkay
PV-01	

(E) - Existing
(N) - New



1. Key Manufacturers

- Inverter
Power-One
740 Calle Plano
Camarillo, CA, 93012
- Solar Modules
REC Solar US LLC
835 Aerovista Place, Suite 230
San Luis Obispo, CA 93401
- Racking
SnapNrack PV Mounting
775 Fiero Lane Suite 200,
San Luis Obispo CA 93401

2. All Components are UL Listed and CEC Certified, where warranted.

Inverter Ratings:
Power-One Aurora
PVI-5000-OUTD-US Inverter
Input: 36A DC
Output: 240 VAC
I_{max} = 23A
I_{nc} = 28.75A (@ 125%)
Outdoor NEMA 4X Enclosure
UL1741/IEEE 1547

REC235PE BLK
235W Solar Module
Specs

P _{max} -	235W
V _{mp} -	29.5V
I _{mp} -	8.06A
V _{oc} -	36.6V
I _{sc} -	8.66A

System Configuration:	
Number of Strings	2
Modules per String	6 and 12
Number of Inverters	1
Module Model	Hanwha HSL60P6-PB-4-250TW
Power Optimizer Model	SolarEdge P300
Inverter Model	SolarEdge SE3800A-US
Service Bus Ampere Rating	200 A
Main Breaker Ampere Rating	200 A
PV Back-fed Breaker Ampere Rating	20 A
DC Watts STC	4.5 kW
Max AC Output Current	16 A
Operating AC Voltage	240 V

PV SYSTEM DC DISCONNECT

OPERATING CURRENT:	16.0A
OPERATING VOLTAGE:	350.0V
MAXIMUM SYSTEM VOLTAGE:	500.0V
SHORT CIRCUIT CURRENT:	22.0A

Label Located on Inverter / DC Disconnect

ELECTRICAL NOTES:

1. All modules will be grounded in accordance with code and the manufacturer's installation instructions. Each module shall be grounded using supplied connection point identified on the module and the manufacturer's instructions with direct burial laying lugs (gbl-4dbt or equal).
2. If the existing grounding electrode system can not be verified or is only metallic water piping, contractor shall install a supplemental grounding electrode.
3. Exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded in accordance with 250.13 or 250.136 (a) regardless of voltage.
4. Marking will be provided in accordance with Cal-Fire Solar Photovoltaic Installation Guideline
5. Utility will be notified prior to use and activation of any solar installation. System will be Commissioned by owner per utility interconnection Agreement.
6. All wires to be provided with strain relief at all entry to junction boxes as required by the box listing.
7. DC combiner box is UL listed with "Touch Safe" fuse holders.

Contractor	1000 Sample St Sample City, CA 99999 (999) 999-9999 Contractor Lic. #999999 C-10 Electrical
Installer	
Plans Prepared By	Electrician
Owner	John Doe 1000 Sample St Sample City, CA 99999 Existing Single Family Residence
Drawn By	Peter Ruttkay
PV-02	

SYSTEM LABELING DETAIL:

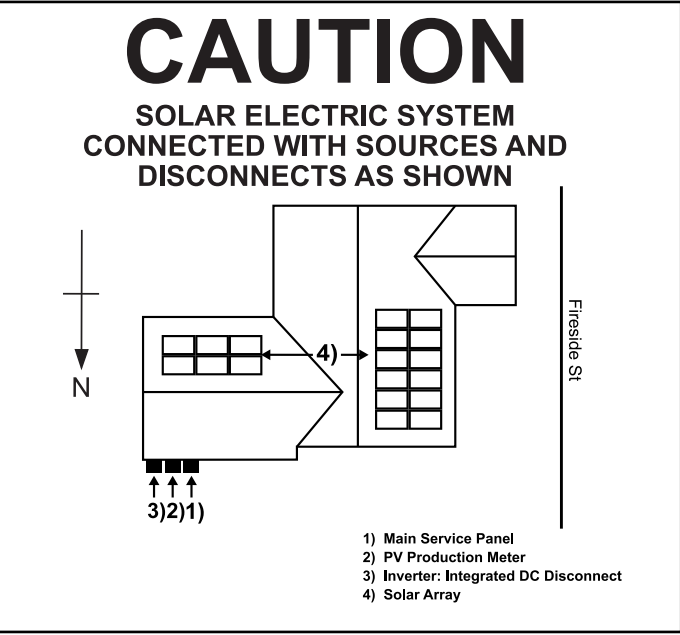
All Plaques and signage required by the 2013 edition of California Electrical Code, NEC and the San Diego Area Electrical Newsletter will be installed as required.

Placards consist of white lettering on red background with text written in capitol lettering a minimum of 3/8" in height on plastic Engraved placards.

Alternate Power Source Placard shall be metallic or plastic with engraved or machine printed letters in a contrasting color to the plaque, include the location of meter, disconnects, inverter, the array and a footprint of the entire building and site. This plaque will be attached by pop rivets, screws or other approved fasteners. If exposed to sunlight, it shall be UV resistant.

Photovoltaic DC conductors entering the building shall be installed in a metallic raceway and shall be identified every 5 feet -- and within 1 foot of turns or bends and within 1 foot above and below penetrations of roof/ceiling assemblies, walls, or barriers labeled "CAUTION SOLAR CIRCUIT" or equivalent.

Examples of all required warning labels per NEC and CEC 690 below:

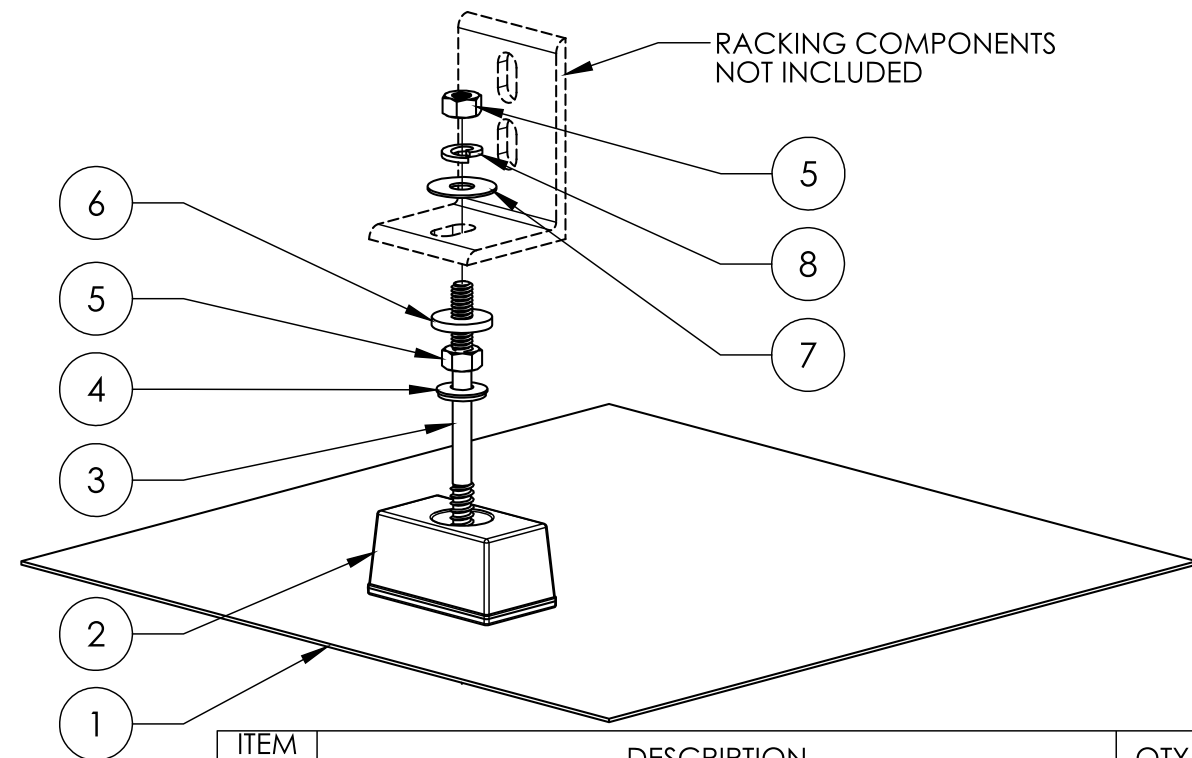
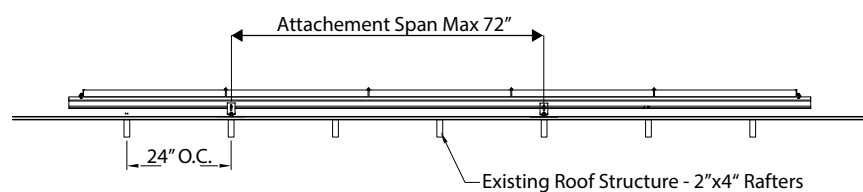
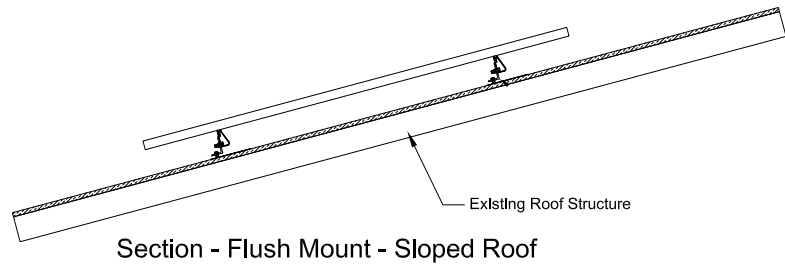
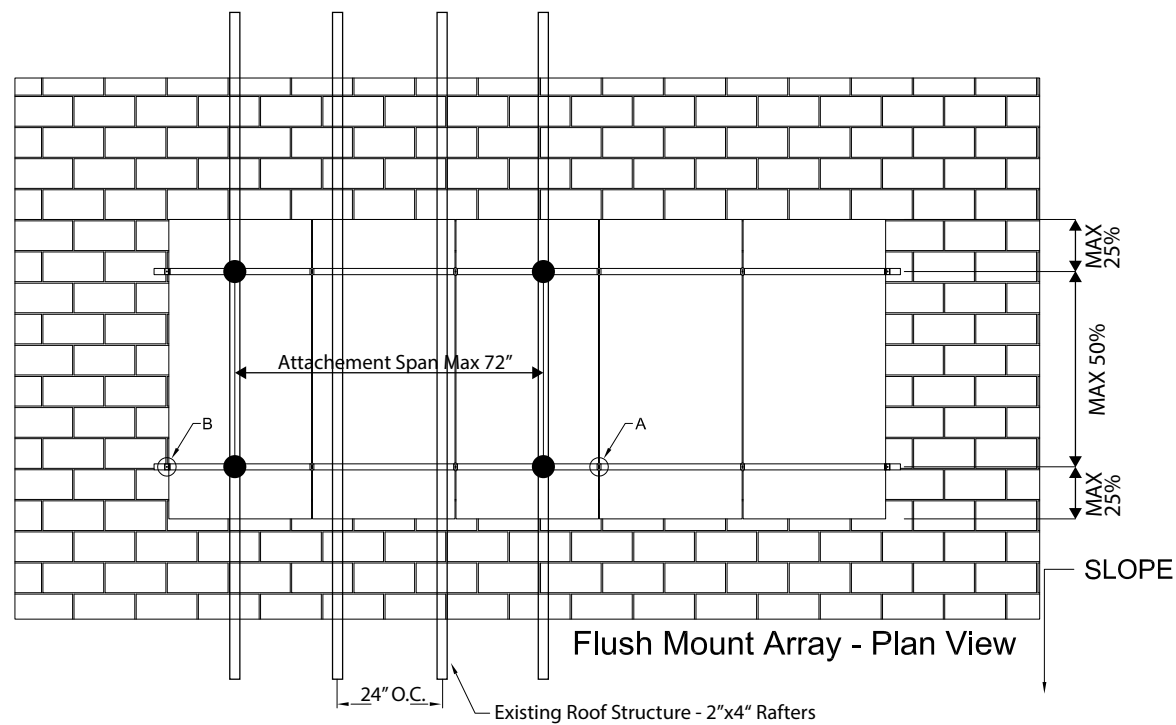
DC DISCONNECT WARNING	AC DISCONNECT WARNING	SERVICE PANEL		
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">PHOTOVOLTAIC SYSTEM DC DISCONNECT</p> <p>OPERATING VOLTAGE XXX VDC OPERATING CURRENT XXX ADC MAX SYSTEM VOLTAGE XXX VDC SHORT CIRCUIT CURRENT XXX ADC</p> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">ELECTRIC SHOCK HAZARD</p> <p style="text-align: center;">DO NOT TOUCH TERMINALS TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p style="text-align: center;"><small>per NEC 690.53 operating voltage, operating current, max system voltage, short circuit current and maximum output current of the charge controller if one is installed.</small></p> <p style="text-align: center;">PLACE ON: Main Solar Disconnect</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">PHOTOVOLTAIC SYSTEM DISCONNECT</p> <p style="text-align: center;"><small>"PV System Disconnect" label NEC 690.14(C)(2) Required Disconnect Markings</small></p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">PHOTOVOLTAIC SYSTEM AC DISCONNECT</p> <p>OPERATING CURRENT XXX AMPS OPERATING VOLTAGE 240 VOLTS</p> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">ELECTRIC SHOCK HAZARD</p> <p style="text-align: center;">DO NOT TOUCH TERMINALS TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p style="text-align: center;"><small>per NEC 690.54 operating voltage, operating current</small></p> <p style="text-align: center;">PLACE ON: Inverter Breaker Panel <small>if sum of breakers exceeds panels rating</small></p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">INVERTER OUTPUT CONNECTION</p> <p style="text-align: center;">DO NOT RELOCATE THIS OVERCURRENT DEVICE</p> <p style="text-align: center;"><small>"Inverter output connection" label NEC 705.12(7) Point of Connection</small></p> </div>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-size: 2em; font-weight: bold; margin: 0;">CAUTION</p> <p style="margin: 5px 0;">SOLAR ELECTRIC SYSTEM CONNECTED WITH SOURCES AND DISCONNECTS AS SHOWN</p>  <p style="margin: 5px 0;">1) Main Service Panel 2) PV Production Meter 3) Inverter: Integrated DC Disconnect 4) Solar Array</p> <p style="margin: 5px 0;"><small>must show drawing of the property and equipment layout. per NEC 690.56</small></p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">DUAL POWER SUPPLY</p> <p style="text-align: center;">SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM</p> <p style="text-align: center;"><small>"Dual Power Supply" label NEC 690.64, 705.12(4) Point of Connection</small></p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">ELECTRIC SHOCK HAZARD</p> <p style="text-align: center;">DO NOT TOUCH TERMINALS TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p style="text-align: center;"><small>"Do not touch terminals" label NEC 690.17(4) Switch or Circuit Breakers</small></p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">THIS ELECTRIC SYSTEM IS ALSO SERVED BY A PHOTOVOLTAIC SYSTEM</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;"> <p style="font-size: 1.5em; font-weight: bold;">CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED</p> </div>		<p style="text-align: center; font-weight: bold;">OTHER</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; width: 50%;"> <p style="text-align: center;">PLACE ON: All DC Source Markings and System Output Conductors Raceways</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p style="font-size: 1.5em; font-weight: bold;">CAUTION SOLAR CIRCUIT</p> <p style="text-align: center;"><small>"Caution Solar Circuit" label NEC 690.4(F), 690.31(E)(4) place on conduit every 10 feet IFC 605.11.1.1 & IFC 605.11.1.2 *MUST BE REFLECTIVE IF INDOORS OR IN ATTIC</small></p> </div> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; width: 30%;"> <p style="text-align: center;">PLACE ON: Next to Inverter Interconnection Breaker, Load Center, & Service Panel</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p style="font-weight: bold;">PV SOLAR BREAKER</p> <p style="font-weight: bold;">DO NOT RELOCATE THIS OVERCURRENT DEVICE</p> </div> </div> <div style="border: 1px solid black; padding: 5px; width: 30%;"> <p style="text-align: center;">PLACE ON: Near GFI Reset</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">ELECTRIC SHOCK HAZARD</p> <p style="text-align: center;">IF GROUND FAULT IS INDICATED ALL NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUND AND ENERGIZED</p> <p style="text-align: center;"><small>"Ground Fault Indicated" label NEC 690.5(C) Ground Fault Protection</small></p> </div> </div>
DC LABELS				
<p style="text-align: center;">PLACE ON: 1. DC Junction Boxes 2. DC Combiner Boxes</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p style="text-align: center;">⚠ WARNING ⚠</p> <p style="text-align: center;">ELECTRIC SHOCK HAZARD</p> <p style="text-align: center;">THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUND AND MAY BE ENERGIZED</p> <p style="text-align: center;"><small>"Electric Shock Hazard" label. NEC 690.35(F) Ungrounded PV Systems</small></p> </div> <p style="text-align: center;">PLACE ON: 1. DC Junction Boxes 2. DC Combiner Boxes</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p style="text-align: center;">PHOTOVOLTAIC POWER SOURCE</p> </div> <p style="text-align: center;"><small>"PV Power Source" label. NEC 690.31(E)(3) DC - PV Source Conductors</small></p>		<p style="text-align: center;">SIGNAGE REQUIREMENTS:</p> <p style="text-align: center;"><i>RED BACKGROUND. WHITE LETTERING. ("WARNING" - 3/8" LETTERS). ALL CAPITAL LETTERS. ARIAL OR SIMILAR FONT. WEATHER- RESISTANT MATERIAL, UL 969.</i></p>		

Contractor	1000 Sample St Sample City, CA 99999 (999) 999-9999 Contractor Lic. #99999 C-10 Electrical
Installer	1000 Sample St Sample City, CA 99999 (999) 999-9999 Contractor Lic. #99999 C-10 Electrical
Plans Prepared By	Electrician
Owner	John Doe 1000 Sample St Sample City, CA 99999 Existing Single Family Residence
Drawn By	Peter Ruttkay
PV-03	

MOUNTING DETAIL:

1. IronRidge XRS Rail Racking System with IronRidge Flash Foot Mount. Sized for 110 mph wind loads.
2. Racking loading calculations were performed for ASCE 7-10 wind speeds @ 110 mph for B and C exposure categories and ASCE 7-10 Seismic Design Category E.
3. Roof attachment hardware to be mounted to existing rafters; 72" rail spans or less.
4. Lag bolts are 5/16" X 4" stainless steel with 2.5" minimum penetration into the rafters.
5. Roof sheathed with 1/2" plywood and upper surface is faced with felt paper. Finished roof surface is composite shingle.
6. Lag screws shall be at least 6 inches from any truss joints.
7. L-foot base is sealed with Tremco Vulkem 116 Polyurethane Sealant or equivalent.

Flush Mount Detail



ITEM NO.	DESCRIPTION	QTY.
1	FLASHING, 12" X 12" X .050", 5052, MILL	1
2	QBLOCK, CLASSIC, A360.1 CAST AL, MILL	1
3	HANGER BOLT, PLAIN CENTER, 5/16" x 6", 18-8 SS	1
4	WASHER, SEALING, 5/16" ID X 3/4" OD, EPDM BONDED SS	1
5	NUT, HEX, 5/16-18, UNC-2B, 18-8 SS	2
6	WASHER, FLAT, 19/64" ID x 7/8" OD x 1/8" EPDM	1
7	WASHER, FENDER, 5/16" ID X 1" OD, 18-8 SS	1
8	WASHER, SPLIT-LOCK, 5/16" ID, 18-8 SS	1

Contractor
 1000 Sample St
 Sample City, CA 99999
 (999) 999-9999
 Contractor Lic. #99999
 C-10 Electrical

Installer

Plans Prepared By _____
 Electrician

Owner
 John Doe
 1000 Sample St
 Sample City, CA 99999
 Existing Single Family Residence

Drawn By
 Peter Ruttkay

PV-04