

INDEX OF PLANS

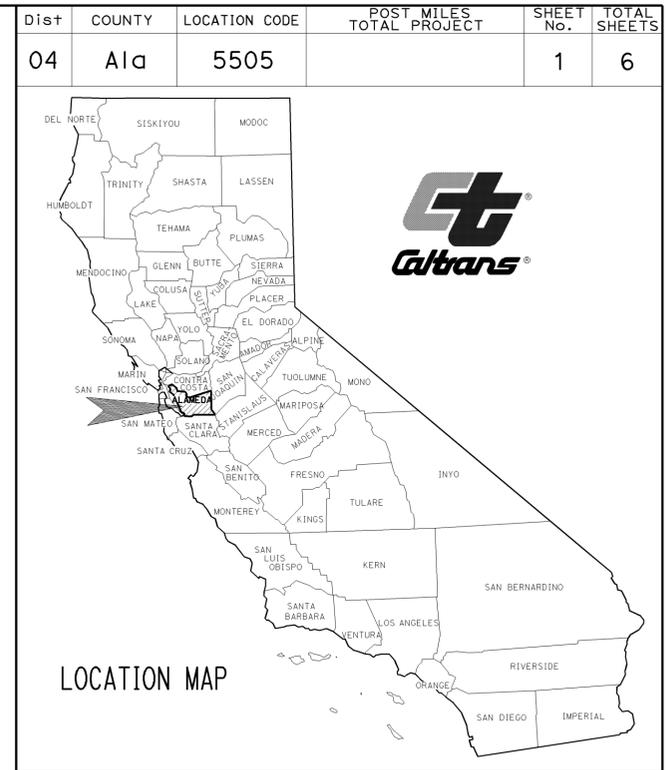
SHEET No.	DESCRIPTION
1	TITLE AND LOCATION MAP
STRUCTURE PLANS	
2	GENERAL PLAN AND LEGEND
3-6	ELECTRICAL PLANS

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO BIDDERS AND SPECIAL PROVISIONS BOOK.

STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR BUILDING CONSTRUCTION  
IN ALAMEDA COUNTY  
IN SAN LEANDRO  
AT THE SAN LEANDRO EQUIPMENT SHOP  
AT 1993 MARINA BOULEVARD

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006



LOCATION OF CONSTRUCTION  
SAN LEANDRO EQUIPMENT SHOP  
LOCATION CODE No. 5505

NO SCALE

CALIFORNIA STATE FIRE MARSHAL  
APPROVED

Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

Reviewed by: *Stephen Guarino*  
STEPHEN GUARINO  
Approval date: 11-23-09

PHOTOVOLTAIC SYSTEMS  
CSFM FILE # 15-01-11-0062

*Beatrice Bindu* 11-19-09  
PROJECT ENGINEER DATE  
REGISTERED ELECTRICAL ENGINEER

12-17-09

PLANS APPROVAL DATE

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CONTRACT No. **04-0AA014**

CU 04115 EA 0AA011

PROJECT MANAGER  
ROBERT NAVARRO  
DESIGN ENGINEER  
BEATRICE BINDU

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."



**INDEX OF SHEETS**

SHEET No.	DESCRIPTION
GP	GENERAL PLAN AND LEGEND
<b>ELECTRICAL</b>	
EE-1	PARTIAL SITE PLAN
EE-2	SINGLE LINE DIAGRAM GRID-TIED PV SYSTEM
EE-3	ROOF PLAN
EE-4	ELEVATION AND DETAILS

APPLICABLE CODES
2007 California Building Code (CBC) Title 24, Part 2 CCR
2007 California Electrical Code (CEC) Title 24, Part 3 CCR
2007 California Fire Code (CEC) Title 24, Part 9 CCR

**BUILDING DATA**

SHOP A/B BUILDING BUILT IN 1964

CONSTRUCTION TYPE : (BASED ON 2001 CBC) V-N

OCCUPANCY GROUP: H-4

ACTUAL BUILDING AREA: 26,764 SF

ALLOWABLE AREA: 26,774 SF

PROPOSED BUILDING AREA FOR PV PANELS:  
APPROXIMATE 15,801 SF

**ROOF DATA**  
NEW BUILT-UP ROOFING WITH AGGREGATE OVER INSULATION BOARD OVER METAL DECKING OVER STRUCTURAL STEEL BEAM AND GIRDER

**CALIFORNIA STATE FIRE MARSHAL APPROVED**

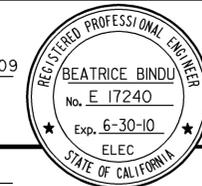
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STEPHEN GUARINO  
Approval date: 11-23-09

DIST.	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Ala	5505		2	6

12-17-09  
PLANS APPROVAL DATE

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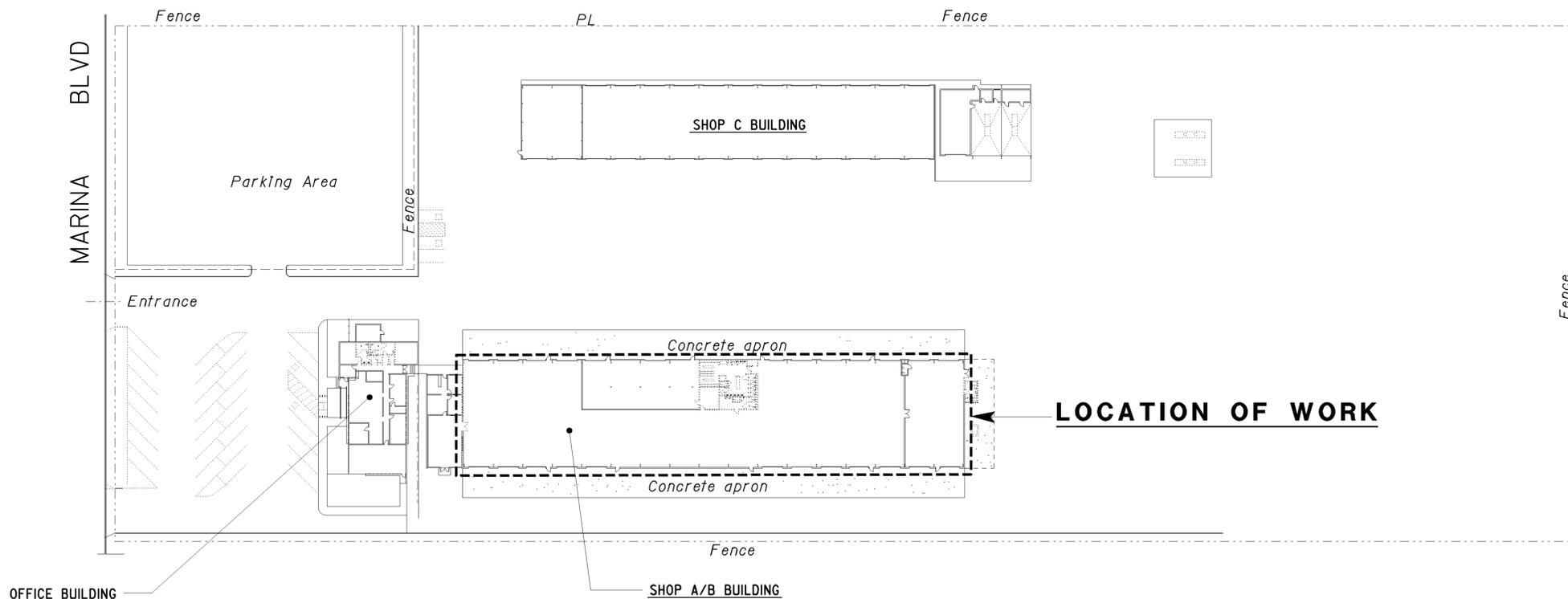


**LEGEND**

- x—x— CONDUIT EXPOSED
- MC— CONDUIT, METALLIC UNDERGROUND
- PVC— CONDUIT, POLYVINYL CHLORIDE, UNDERGROUND
- ~~~~~ CONDUIT, FLEXIBLE
- CONDUIT, TURN UP
- CONDUIT, TURN DOWN
- |— CIRCUIT BREAKER
- |— GROUNDING ELECTRODE
- |— ENCLOSURE BOND
- ▶— ADAPTER, ONE TYPE CONDUIT TO ANOTHER
- (J)— EXISTING JUNCTION BOX
- x---x--- EXISTING UNDERGROUND CONDUIT AND CONDUCTORS - REMOVE
- E-E-E- EXISTING CONDUIT AND CONDUCTORS-TO REMAIN UNLESS OTHERWISE NOTED
- ▲ A — SECTION/ELEVATION LETTER
- EE-2 — SHEET NUMBER
- 1 — DETAIL NUMBER
- EE-2 — SHEET NUMBER

**ABBREVIATIONS**

- ∅ PHASE
- A AMPERE
- AC ALTERNATING CURRENT
- Ah AMPERES - HOUR
- AL ALUMINUM
- BC BATTERY CHARGER
- BLDG BUILDING
- C CONDUIT
- CB CIRCUIT BREAKER
- CKT CIRCUIT
- DC DIRECT CURRENT
- DP DUPLEX RECEPTACLE
- (E) EXISTING
- EO ELECTRICALLY OPERATED
- G GROUND
- JB JUNCTION BOX
- KW KILOWATT
- MB MAIN BREAKER
- MC METALLIC CONDUIT
- MDP MAIN DISTRIBUTION PANEL
- MIN MINIMUM
- MT EMPTY CONDUIT
- (N) NEW
- P POLE
- PB PULL BOX
- PTC PV USA TEST CONDITIONS
- PV PHOTOVOLTAIC
- STC STANDARD TEST CONDITIONS
- TYP TYPICAL
- V VOLTS



THIS DRAWING ACCURATE FOR ELECTRICAL WORK ONLY.

DESIGN SUPERVISOR: *Paul Schreff*  
DESIGN ENGINEER: *Alan M. Jones*

DESIGN	BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>
DETAILS	BY <i>Linda Monson</i>	CHECKED <i>Beatrice Bindu</i>
QUANTITIES	BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>

STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES  
ELECTRICAL-MECHANICAL-WATER AND WASTEWATER DESIGN

BRIDGE NO.	33M5505
POST MILE	

**SAN LEANDRO EQUIPMENT SHOP PHOTOVOLTAIC SYSTEM**

GENERAL PLAN AND LEGEND

SHEET **GP** OF

DIST.	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Alameda	5505		3	6

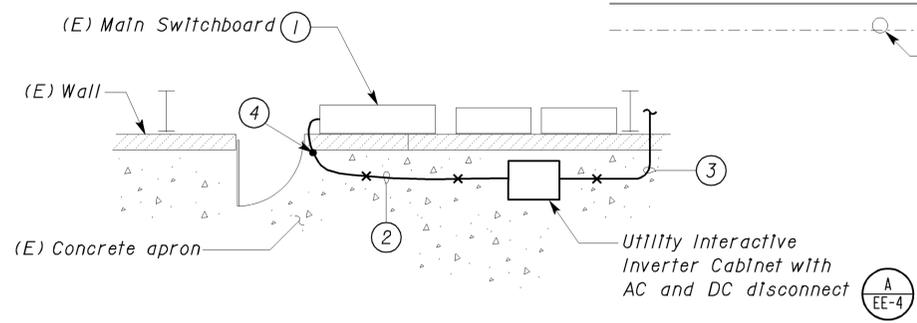
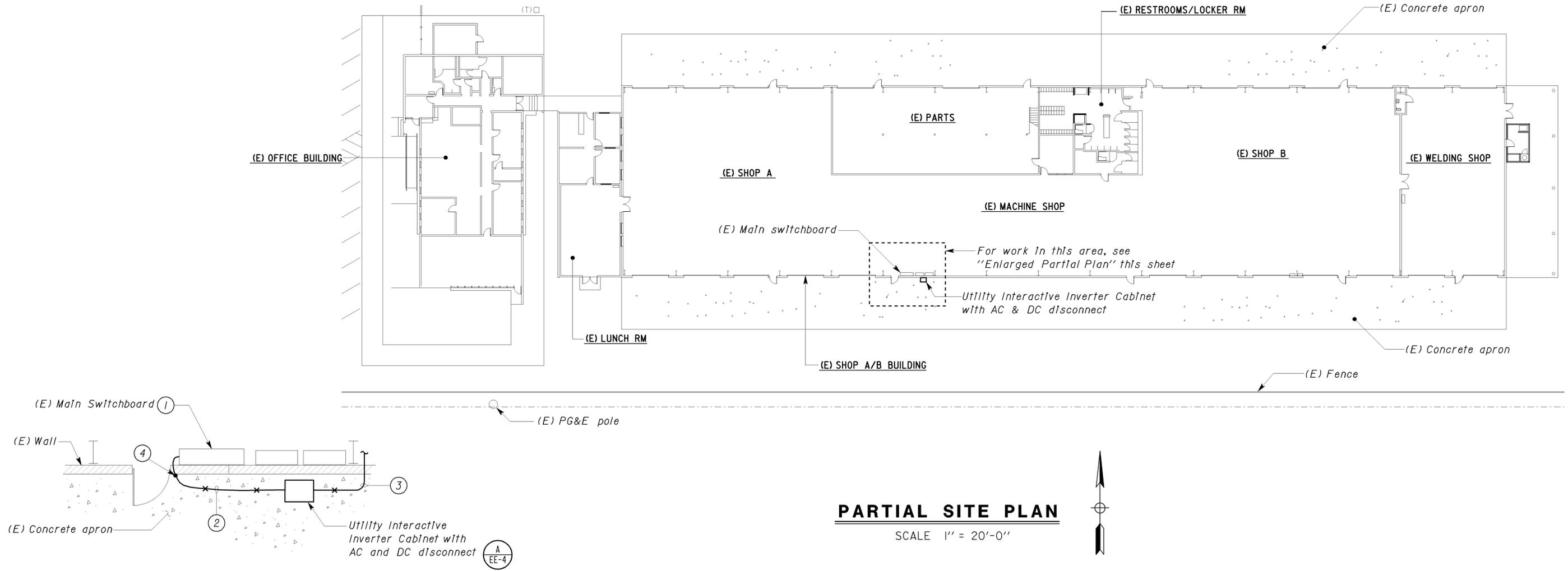
  

 REGISTERED ELECTRICAL ENGINEER	12-17-09 DATE
12-17-09 PLANS APPROVAL DATE	
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**CALIFORNIA STATE FIRE MARSHAL APPROVED**  
 Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.  
 Reviewed by: STEPHEN GUARINO  
 Approval date: 11-23-09

- General Notes:**
- The Contractor shall verify true north prior to installation of PV system.
  - All AC/DC feeder conductors and equipment grounding conductors shall be sized to meet or exceed the following:
    - Total net voltage drop of the PV electrical power generation system from PV source to the existing Main Switchboard shall not exceed 2%.
    - Upon occurrence of any kind of fault at any point in the system, over current protective devices shall trip within 1/2 cycle.
  - Not all existing electrical/mechanical equipment and conduit systems are shown.
  - Location of all existing equipment and conduit systems as shown are approximate only. Contractor shall verify the exact location of all equipment and conduit systems in the field where required.
  - For photovoltaic system single line diagram, see sheet EE-2.
  - For graphic symbols and abbreviations, see sheet GP.

- Notes:**
- Existing Main Switchboard is EATON Power R line, 480 volts, 3-phase, 3-wire, with 800-ampere main circuit breaker. Install 70-ampere, 3-pole molded case circuit breaker, in lowest available space, for connecting PV system. New circuit breaker shall have interrupting capacity (AIC) of 42,000 A symmetrical at 480 volts. Install nameplate, with letter height of 1/4", to read "PHOTOVOLTAIC SYSTEM" at the side of new 3-pole circuit breaker. Install screw-on type sign on existing Main Switchboard, with letter height of 1/2", to read "THIS PANEL FED FROM MULTIPLE SOURCES (UTILITY AND SOLAR)".
  - 2" MC, five conductors; three phase, one neutral and one equipment grounding conductors; to new 70-ampere, 3-pole circuit breaker for PV system inside the existing Main Switchboard.
  - (2) 2" MC, with DC conductors and equipment grounding conductor, from PV Array Circuit Combiner Boxes #1 and #2, on roof of Shop A/B Building, to Fused Sub-Array Combiner inside Utility Interactive Inverter Cabinet. For location of PV Array Circuit Combiner Boxes #1 and #2, see sheet EE-3.
  - Core drill through existing wall for conduit penetration. Use an LB conduit body for conduit transition into the inside of the building.



**ENLARGED PLAN**  
 SCALE 1/4" = 1'-0"

**PARTIAL SITE PLAN**  
 SCALE 1" = 20'-0"

THIS DRAWING ACCURATE FOR ELECTRICAL WORK ONLY.

DESIGN BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES ELECTRICAL-MECHANICAL-WATER AND WASTEWATER DESIGN	BRIDGE NO.	SAN LEANDRO EQUIPMENT SHOP PHOTOVOLTAIC SYSTEM	SHEET EE-1
				33M5505		
DETAILS BY <i>Linda Monson</i>	CHECKED <i>Beatrice Bindu</i>	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	CU 04115 EA 0AA011	POST MILE	PARTIAL SITE PLAN	SHEET OF
QUANTITIES BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>					
DOES SD Imperial Rev.10/09		0 1 2 3		DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES (PRELIMINARY STAGE ONLY)	
					9/24/09 9/25/09 10/5/09 11/18/09 12/17/09	

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DIST.	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Ala	5505		4	6

REGISTERED ELECTRICAL ENGINEER <i>Beatrice Bindu</i>	12-17-09 DATE
12-17-09 PLANS APPROVAL DATE	
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**Photovoltaic Module**

PV modules shall be polycrystalline silicon cell type module with interconnection connectors rated for 90°C. PV modules shall be UL 1703 listed, with a maximum system voltage of 600 VDC. PV module manufacturer shall be one of those manufacturers listed as an eligible California Solar Initiative (CSI) PV module manufacturer.

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**Photovoltaic Array Circuit Combiner Box**

PV array circuit combiner box shall be factory assembled, 600 VDC rated combiner box, with fused input circuits, two isolated DC bus bars, ground bus bar, all enclosed inside NEMA 3R lockable hinged cover enclosure. The combiner box shall be UL 1741 listed.

PV array circuit combiner box shall have the following components:

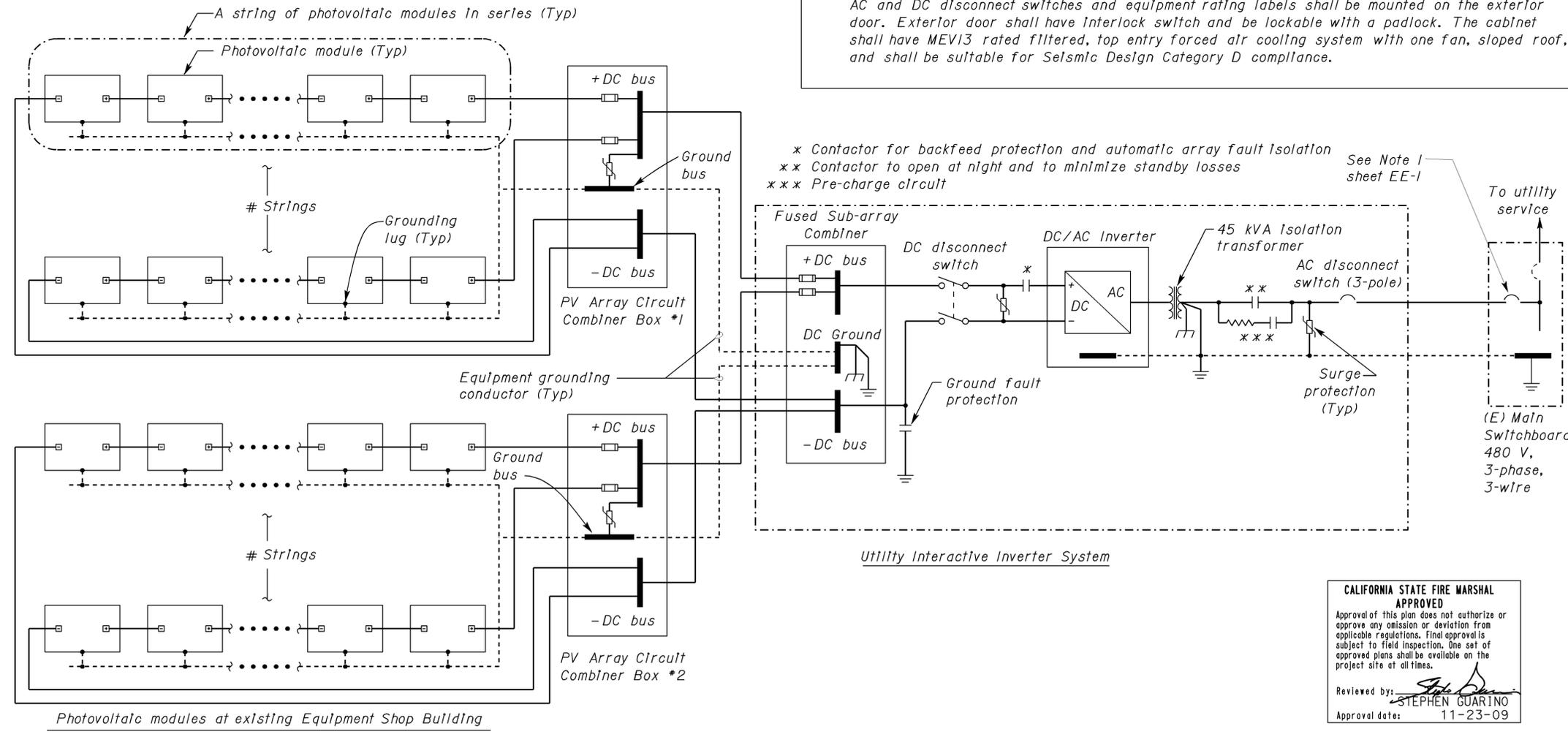
- DIN rail mounted touch safe fuse holders with fuse.
- Positive DC bus bar, negative DC bus bar and ground bus bar.
- DIN rail mounted Grid-Tie surge arrester. The surge arrester shall be rated to withstand 20 kA (8/20 micro second) induced transient surge type, and compatible to use with grounded PV arrays.

**Utility Interactive Inverter Cabinet**

Utility Interactive Inverter cabinet shall be outdoor type, factory assembled cabinet consisting of the following equipment:

- DC/AC Inverter:
  - DC/AC Inverter rated at maximum continuous output power of 45 kW, 480 VAC, 3-phase, 3-wire, at a power factor of 0.99 or greater, efficiency 95.5%, with input operating voltage range between 305 to 600 VDC.
  - Inverter shall be capable of operating at ambient temperature range (Full power) of -4°F to +122°F. DC/AC Inverter manufacturer shall be one of those manufacturers listed as an eligible California Solar Initiative (CSI) DC/AC Inverter manufacturer.
- Fused sub-array combiner, with minimum of 4 array inputs each for positive DC, negative DC, and DC ground bus bars. Positive array input fuse shall be sized to match loading.
- Built-in DC and AC disconnect switches, size to match loading.
- Integrated 45kVA, 480 V, 3-phase, 3-wire, output isolation type transformer.
- Ground fault protection.
- Integrated AC and DC surge protections.
- Integrated AC and DC contactors.
- Pre-charge circuit.
- Human Machine Interface (HMI):
  - AC/DC Inverter's HMI shall be equipped with LCD and keypad displaying main menu. HMI main menu shall display system monitoring, status and faults, and operation. Monitoring menu shall display system status, metering, daily, weekly and monthly energy production. Status and faults menu shall display status messages, system output, and number of faults. Operation menu shall display control and settings.
- Local and remote monitoring system capabilities.
- AC ground bus bars.
- NEMA 3R enclosure:
  - Enclosure shall be NEMA 3R, 14-gauge, and powder-coated standard factory finish steel enclosure. All screws, latches, hinge pins and similar hardware shall be stainless steel. HMI, AC and DC disconnect switches and equipment rating labels shall be mounted on the exterior door. Exterior door shall have interlock switch and be lockable with a padlock. The cabinet shall have MEV13 rated filtered, top entry forced air cooling system with one fan, sloped roof, and shall be suitable for Seismic Design Category D compliance.

- General Notes:**
- Provide and install all necessary warning labels/markings, per Article 690 of California Electrical Code (CEC), and the State Fire Marshal's guideline for solar PV installation.
  - Solar PV installation shall comply with the latest guideline from California Department of Forestry & Fire Protection, Office of the State Fire Marshal and latest Program Handbook from California Solar Initiative (CSI).



- Photovoltaic System Requirements**
- Photovoltaic system complete design and installation details, inclusive of all engineering calculations signed by an Professional Engineer in the State of California, shall be submitted for approval by the Contractor. The PV design shall meet or exceed the following requirements:
- Total designed capacity of photovoltaic system shall have CEC-AC rating of 45 kW. Number of PV modules per string shall be arranged in a manner to meet or exceed the following:
    - Maximum system voltage based on lowest expected ambient temperature at the site (Voc maximum on coldest day) shall be no less than 1% of the inverter's maximum input DC voltage range.
    - Maximum system voltage, based on highest continuous ambient temperature at the site (Vmp on warmest day), shall be 20% greater than the inverter's minimum input DC voltage range.
  - Photovoltaic system module row spacing shall be designed to prevent shading from adjacent module.
  - All wiring, except at module interconnection, shall be concealed inside conduit system.
  - Photovoltaic system modules structural support system shall be designed to withstand wind forces of 85-mile per hour.
  - Photovoltaic system wiring and protective devices shall meet or exceed the requirements of all applicable codes.
  - PV Array Circuit Combiner Boxes locations as shown are arbitrary only. Contractor shall install the combiner boxes at locations that best suit the photovoltaic system strings layout.

DOES SD Imperial Rev.10/09	DESIGN	BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES ELECTRICAL-MECHANICAL-WATER AND WASTEWATER DESIGN	BRIDGE NO.	SAN LEANDRO EQUIPMENT SHOP PHOTOVOLTAIC SYSTEM	SHEET	EE-2							
	DETAILS	BY <i>Linda Monson</i>	CHECKED <i>Beatrice Bindu</i>			33M5505		OF								
	QUANTITIES	BY <i>Beatrice Bindu</i>	CHECKED <i>Tech Ngov</i>			POST MILE		SINGLE LINE DIAGRAM GRID-TIED PV SYSTEM								
	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	0	1	2	3	CU 04115 EA 0AA011	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES (PRELIMINARY STAGE ONLY)	9/24/09	11/18/09	12/17/09					

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**General Notes:**

- A. Provide and install approved conduit support on top of the roof to support conduit system and junction boxes. Conduit support shall be one-piece and non-metallic type. For conduit support details, see Detail 1 on sheet EE-4.
- B. All exposed conduits shall be galvanized rigid steel, with minimum size 3/4".
- C. Size conduits to allow for 50% future capacity.
- D. No DC wiring except at the module connector shall be exposed.
- E. Use type CGB connectors at conduit terminations to exposed conductors.
- F. DC conduit/conductors between PV modules and PV Array Circuit Combiner Boxes are not shown.
- G. Existing Equipment Shop Building height is approximately 20'.
- H. For graphic symbols and abbreviations, see GP.
- I. For PV rack attachment detail, see Detail 2 on sheet EE-4.
- J. The location of roof mounted equipment shown are approximate only. Contractor shall field verify exact location.

**Note:**

- ① 2" C, MC, with DC conductors and equipment grounding conductor, to Utility Interactive Inverter Cabinet. For continuation, see sheet EE-1.

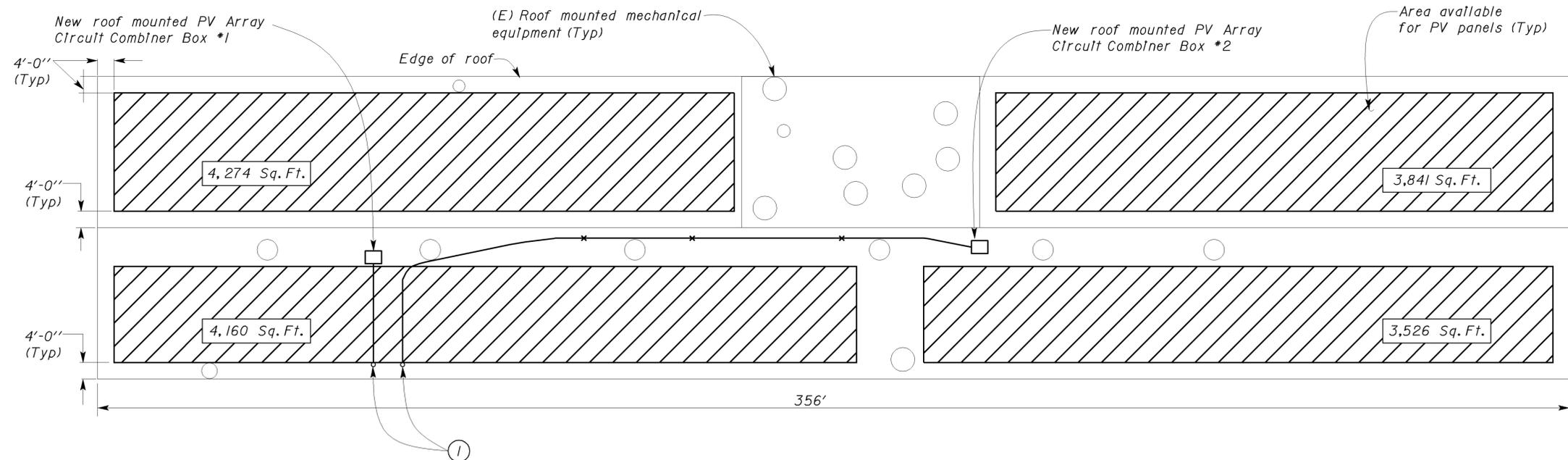
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04	Ala	5505		5	6

11-19-09  
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12-17-09  
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**ROOF PLAN**  
 SCALE 1/16" = 1'-0"

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			POST MILE			ROOF PLAN
			CU 04115 EA 0AA011			REVISION DATES (PRELIMINARY STAGE ONLY)
DETAILS BY <i>Linda Monson</i> CHECKED <i>Beatrice Bindu</i>	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	DISREGARD PRINTS BEARING EARLIER REVISION DATES	9/24/09 10/7/09 11/9/09 12/11/09	SHEET OF		
QUANTITIES BY <i>Beatrice Bindu</i> CHECKED <i>Tech Ngov</i>	0 1 2 3					

**Note:**

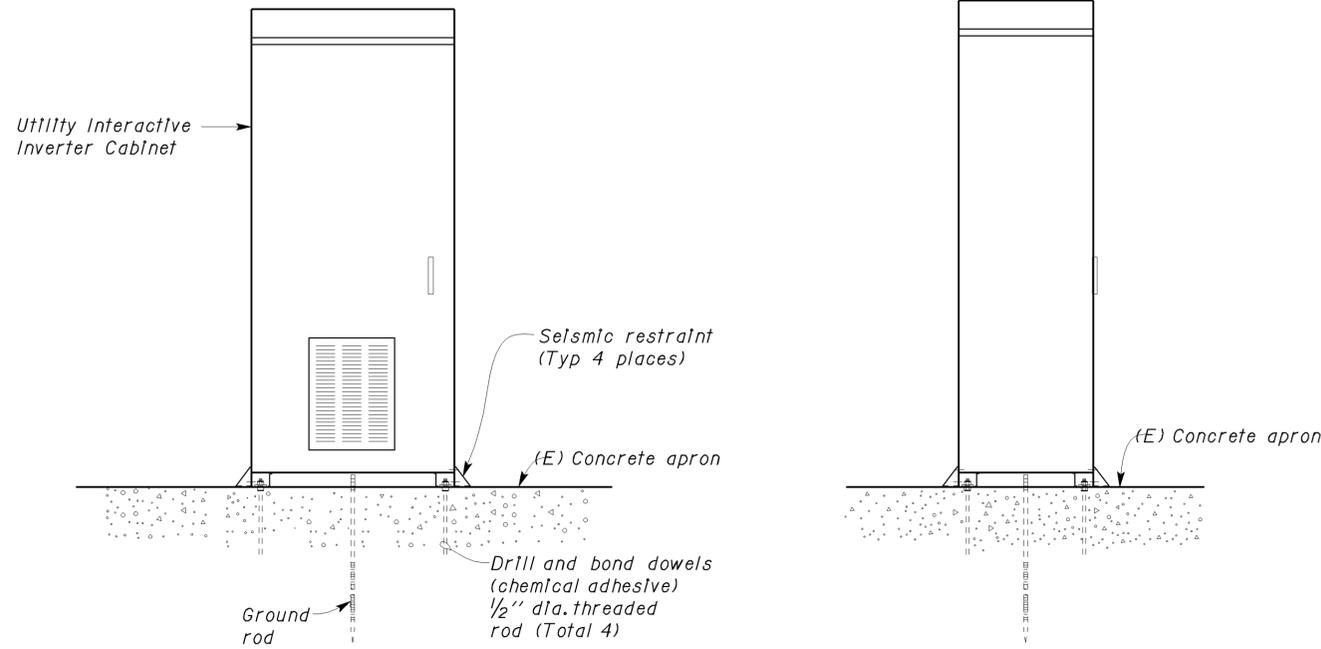
For conduit system to and from the Inverter cabinet, see sheet EE-1

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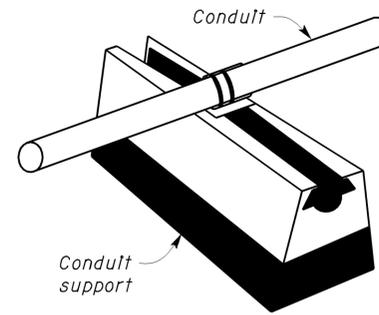
**FRONT VIEW**

**SIDE VIEW**

**ELEVATION**

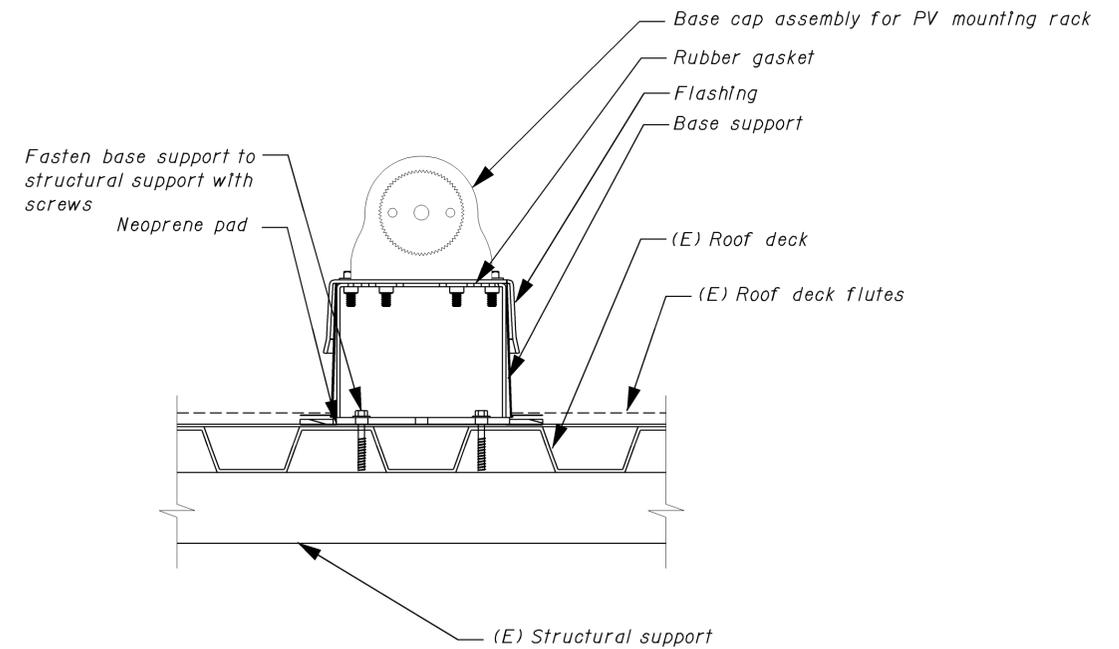
**A UTILITY INTERACTIVE INVERTER CABINET**

NO SCALE



**1 ROOF EXPOSED CONDUIT SUPPORT**

NO SCALE



**2 ROOF ATTACHMENT**

NO SCALE

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	DETAILS	BY	Linda Monson	CHECKED			Beatrice Bindu	POST MILE			-	EE-4		
	QUANTITIES	BY	Beatrice Bindu	CHECKED			Tech Ngov	DISREGARD PRINTS BEARING EARLIER REVISION DATES			REVISION DATES (PRELIMINARY STAGE ONLY)	9/24/09	9/25/09	11/19/09

DOES SD Imperial Rev.10/09 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 CU 04115 EA 0AA011