



STAFF REPORT

CITY COUNCIL OF THE CITY OF SAUSALITO

AGENDA TITLE:

Note and File Regarding Invitations to Bid for Photovoltaic Installation at the Public Safety Facilities Project

RECOMMENDED MOTION:

None

SUMMARY

The approved plans for the Public Safety Facilities (PSF) include provision of conduits and space in the electrical room at the Fire Station for future photovoltaic (PV) installation. Following Council approval of SolarCity's contract for installation of PV at City Hall, Staff provided copies of the approved building plans and requested a proposal for installation from SolarCity. Because of the small size of the system that the Fire Station can accommodate, SolarCity indicated that the financing structures available to them would not support such a proposal.

Recognizing that the contractors working onsite under Alten Construction are in a position to construct such facilities in conjunction with completion of the PSF project, and based on concurrence from Dana Armanino, Marin Energy Management Team, Marin County Community Development Agency that outright purchase of such systems offer the best possible return on investment, Staff requested that Glass Architects provide a proposal for design of such a system. The proposal from Glass was approved and the design work authorized. Glass estimates that the construction cost for the specified system will total approximately \$190,000.

The plans and specifications produced by Glass are attached. Once finalized, Staff will issue formal invitations to bid in conformance with Sausalito Municipal Code (SMC) Section 3.30.310.C. It is anticipated that, assuming the bids are received from responsive and responsible bidders and that budget permits, recommendations for award will be made to Council in January 2010. It is expected that if the PV installation can be accomplished as part of the PSF project, LEED Gold certification would be achieved.

ISSUES

No outstanding issues not discussed above have been identified.

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Meeting Date: December 8, 2009
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FISCAL IMPACT

No impact associated with inviting bids.

STAFF RECOMMENDATIONS

None. Note and file only.

ATTACHMENTS

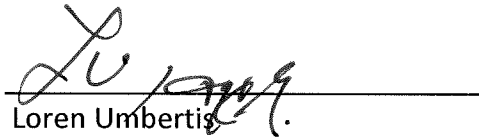
Glass Architects Specification Section 16630 - PHOTOVOLTAIC SYSTEM with Plans

PREPARED BY:
Director of Public Works



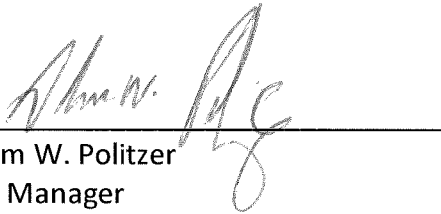
Jonathon Goldman

REVIEWED BY:
SMC Project Manager



Loren Umbertis

SUBMITTED BY:



Adam W. Politzer
City Manager

16630 - PHOTOVOLTAIC SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install a complete Photovoltaic (PV) System as shown on the drawings and as specified hereinafter, including but not limited to the work listed below.
- B. The Drawings and Specifications shall be used as the performance criteria for the design and installation of a complete operational PV system. The Contractor shall include in their bid all additional design and engineering costs associated with the PV system design to be submitted, operation, installation, and testing.
- C. The system shall be utility grid connected with no storage batteries. The contractor shall be responsible for all required utility company coordination, approval, and applications for the complete interconnection of the PV system with the utility company grid, including bi-directional utility meter.
- D. Refer to the PV roof plan, for the panel layout to be provided. Refer to the Architectural and Structural drawings for all roof types and details, including panel mounting.

1.2 SCOPE

- A. The system shall consist of an array of framed photovoltaic modules, all mounting hardware, terminal boxes and combiner panels, quick-connect electrical connectors, DC wiring, DC disconnect, utility interactive inverter, AC disconnect, AC feeder, main PV system disconnect, and a complete data acquisition and monitoring system to allow the City to monitor and utilize the collected data over the City network.
- B. The work shall include furnishing all labor, materials, and equipment necessary to form a complete installation, ready for operation to produce solar power at the site.
- C. The array shall be located on the roof area as indicated on the plans. Refer to the drawings for the required system output.
- D. The installing contractor shall be responsible for adequate clearance and equipment space within the allotted area as shown on the drawings. Alternate equipment sizes or requirements due to alternate designs are the responsibility of the contractor. Additional floor area within the buildings will not be made available for PV system equipment beyond that shown in these documents.
- E. System installer shall submit for and pay for the required plan check permits and inspections with the local Fire Department, AHJ and utility company.
- F. The installer shall complete all of the required paper work for the utility interconnection agreement contract in conjunction with the City's input and approval, including rate schedule (i.e. TOU or other) designations. In order for the Installer to act on behalf of the City, the Installer (in conjunction with the City) shall submit to the utility company the proper authorization forms.
- G. The installer shall also be responsible for and submit for, and pay filing fees for any relevant buy-down incentive rebates available for the system. This shall include application (and payment) of all required "reservation" applications as well as system applications and system

certification and testing with the utility company to receive the final rebates. The contractor's bid shall not include any potential buy-down incentive rebates.

- H. System installation shall include the programming, set-up, and commissioning of a web based data acquisition system and interactive data application to allow public viewing of the real-time system performance and past historical performance.

1.3 RELATED SECTIONS

- A. General Commissioning Requirements.

1.4 WARRANTIES

- A. The system shall be warranted by for a period of five (5) years from system start-up and acceptance by the City.
- B. The photovoltaic panels shall be covered by the manufacturer's warranty for a minimum of 20 years.
- C. The inverters shall be covered by the manufacturers warranty of 5 years.
- D. System installation shall be such that it does not affect the roof warranty.

1.5 APPLICABLE GUIDELINES / REGULATIONS / STANDARDS

- A. CPUC approved Electric Rule 21 – Generating Facility Interconnections
- B. UL1741 (Inverters, Converters, and Controllers for Independent Power Systems)
- C. UL1703 (Standard for Flat-Plate Photovoltaic Modules and Panels).
- D. IEEE 929 (2000) – Recommended Practice for Utility Interface of Photovoltaic (PV) Systems.
- E. IEEE 1262 (1995) – Recommended Practice for Qualifications of Photovoltaic (PV) Modules.
- F. NEC Articles 690 and 702.
- G. California Department of Forestry and Fire Protection office of the state Fire Marshal – Solar Photovoltaic Installation Guidelines.

1.6 QUALITY ASSURANCE

- A. Underwriters' Laboratories shall certify the system.
- B. Contractor Qualification – The contractor shall be approved by the PV Manufacturer to install the PV System.

1.7 SUBMITTALS

- A. Comply with the provisions of Section 16010 – Submittals.
- B. Submit the following for approval:
 - 1. Roof plans with the PV System layout (based on submitted panel).
 - 2. Single line Diagrams indicating all required connections and utility tie-in.

3. Array calculations including string design, string amperage, array amperage (including short circuit currents), and DC voltage (maximum and minimum based on coldest record low and average high ambient temperatures).
4. DC combiner box with fusing.
5. DC/AC Inverter.
6. KWH Meter and Logger.
7. Data Acquisition System.
8. PV System weights.
9. PV cells / tiles.
10. Installation Manuals.
11. Web based data acquisition system application software.
12. Mounting hardware.
13. Wiring (AC and DC).
14. Disconnects.
15. Placards (with all code and utility required designations).
16. Testing and certification / commissioning results (upon completion).

1.8 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.
- B. Appropriate protective clothing shall be worn when handling the equipment. Such clothing shall include hard hats and steel-toe boots when lifting materials to roof, and insulated gloves when working on an active system.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable system manufacturers/vendors shall have been in the business of producing and/or installing similar commercial grade solar photovoltaic systems for the last 5 years minimum (20KW systems or higher). Manufacturers shall provide their latest line of equipment, meeting all current industry standards.
- B. The basis of design is a high efficiency Suntech STP210-18/Ub-1 module with characteristics as outlined below:

2.2 MATERIALS

- A. The PV modules shall have the following physical properties as a minimum.

1. Module Weight - 37 lbs. max. each
 2. Module Dimensions – 58" x 37" x 2" max.
 3. Installed Wind Uplift Resistance - 140 mph; Test Standard - ASCE 7-95
 4. Corrosive Atmosphere (Salt Spray); Test Standard - UL 1703
 5. Impact Resistance - Safely withstand 2" diameter steel sphere dropped 51"; Test Standard - UL 1703.
 6. Mechanical Loading - 45 lb/ft², 30 minutes; Test Standard - UL 1703
 7. Humidity - -40 C to 85 C, 85%RH, 10 cycles; Test Standard - UL 1703
- B. The following Electrical Module characteristic shall be used as a minimum standard.
1. Power Output (Pmax) - 210 Watts; Test – STC
 2. Open Circuit Voltage (Voc) – 33.6 Volts; Test – STC
 3. Maximum Power Voltage (Vmp) – 26.4 Volts; Test – STC
 4. Short Circuit Current (Isc) – 8.33 Amps; Test – STC
 5. Maximum Power Current (Imp) – 7.95 Amps STC
- C. Inverter to distribution system interface shall be as follows:
1. 208 VAC 1-Phase, 3 wire, 60Hz. (3) 1-Phase inverters shall be arranged for 3-phase configuration.
- D. All AC interconnecting feeders sized to NEC Table 316 (75 degree column) based on associated disconnect amperage. Conduit fill to 40% max. Provide equipment-grounding conductor in each conduit.
- E. All AC circuits to be 4-wire + ground. All grounding per nec 690-45.
- F. All DC circuits and feeders sized to NEC table 316 (90 degree column) based on associated disconnect amperage. Conduit fill to 40% max. Provide equipment-grounding conductor in each conduit.
- G. All DC circuits to be 2-wire + ground.
- H. All AC and DC wiring in conduit to be RHW-2, THWN-2, or XHHW-2 (90 degree) wet rated for use with 90 degree listed terminals on PV equipment.
- I. All exposed DC wiring to be USE-2 or SE (90 degree) wet rated and sunlight resistant.
- J. All PV modules to be UL 1703 listed.
- K. All above ground-exposed conduit shall be rigid galvanized steel with threaded fittings or painted EMT with watertight compression fittings. All interior conduit to be EMT with steel setscrew fittings (no cast fittings).

2.3 ARRAY MOUNTING

- A. Modules shall be roof mounted, flat to the roof surface, with appropriate racking hardware and structural attachments, mounted in the patterns shown on the PV System Roof Plan. The roof shall not be penetrated for the installation of the modules. The electrical wiring transition to the building shall use the existing conduits stubbed out at the roof from the electrical room.
- B. Utilize Unirac Sunframe and S5U Clamps for mounting.

2.4 WIND LOADING

- A. The system shall minimize wind loading by mounting the modules flat on the roof.

2.5 MISC. SYSTEM REQUIREMENTS

- A. All exterior equipment to be sunlight and UV resistant as well as rated for elevated temperatures at which they are expected to operate (on roofs in hot sunlight).
- B. Heavy duty urethane sealants shall be used for all non-flashed roof penetrations
- C. No dissimilar metals allowed to contact (use plastic or rubber washers)
- D. No aluminum in contact with concrete or masonry materials
- E. Use high quality stainless steel fasteners only.
- F. Structural members for PV supports should be corrosion resistant aluminum (6061 or 6063), hot dipped galvanized steel (per ASTM A 123), coated or painted steel (in non-corrosive environments only), or stainless steel (in corrosive environments).
- G. All PV modules to be installed such that they are 100% free from shade between 8am and 5pm daily.

2.6 SYSTEM ELECTRICAL

- A. The modules shall be interconnected using cable assemblies. The pigtails shall be quick-connect electrical wiring connections rated for the application.
- B. The array shall have at least one gathering box, providing a watertight entry to the conduit leading to the combiner box.
- C. The array shall have a DC combiner box, containing fuses and a bus to combine the outputs of the strings as indicated on the drawings.
- D. The system shall have (4) inverters. Full specifications of the inverter shall be supplied as part of the system submittal.
- E. The inverters shall be by SMA America, or equal, sized as noted on the drawings, together with all other components as follows. All inverters shall be CEC approved and shall be utility interactive type:
 - 1. Nominal AC Voltage delivered to MSB (Three-phase, + 10%)
 - a. 208 VAC
 - 2. Nominal AC Frequency (+ 0.5 Hz)

- a. 60 Hz
3. Line Power Factor (Above 20% rated power)
 - a. >0.99
4. AC Current Distortion (At rated power)
 - a. <5% THD
5. Maximum Open Circuit Voltage
 - a. 600 VDC
6. Power Tracking Window Range
 - a. 300 to 600 VDC
7. Maximum Ripple Current (% of rated current)
 - a. <5%
8. Peak Inverter Efficiency
 - a. >95%
9. Standby Tare Losses
 - a. <30 watts
10. Temperature Range Ambient
 - a. -4° F to 122° F (-20° C to 50° C)
11. Enclosure Environmental Rating
 - a. NEMA 1
12. Enclosure Environmental Rating
 - a. Galvaneal folded steel enclosure
13. Relative Humidity (non-condensing)
 - a. 0-95%
14. Array Configuration
 - a. Monopole, positive grounded
15. Cooling Method
 - a. Forced convection cooling
16. Protective Functions

4/25/08

- a. Standard wakeup voltage, wakeup time delay, shutdown power, shutdown time delay, AC over / under voltage and time delays, AC over / under frequency and time delays, ground over current, over-temperature, AC and DC over current, DC over voltage
- 17. User Display
 - a. Standard-LCD, four-line, twenty characters, with on/off toggle switch
- 18. AC Disconnect
 - a. NEMA 1 wall mount enclosure, load break rated
- 19. DC Disconnect
 - a. NEMA 1 wall mount enclosure, 600 VDC load break rated
- 20. Communications Software
 - a. Serial communications and control software
- F. All major components of the systems and the installation procedures shall meet National Electrical Code requirements, including Article 690.
- G. The inverters shall automatically drop-off-line when normal utility power is lost to avoid unintentional islanding effects. Drop-off to be activated by over-voltage (110%) and under-voltage (88%), and shall be adjustable. Frequency drifts outside 59.3 to 60.5 Hz for more than 10 cycles shall also activate automatic drop-off. Automatic reconnection shall not occur until the normal utility power has been stable for at least 60 seconds.
- H. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use.
- I. The system shall be capable of operating between a power factor of 0.9 lagging to 0.9 leading.
- J. All required overcurrent protection and electrical bussing sizes per NEC 690.

2.7 MONITORING

- A. A Data Acquisition and Monitoring System shall be provided as part of the System. The system shall allow measurement, calculation, and display of the following items (at minimum):
 - 1. Ambient temperature
 - 2. Wind speed
 - 3. Solar irradiation
 - 4. System electrical functions (instantaneous and accumulated power output (KW and KWH), AC and DC system voltage and amperage, and peak value tracking with associated time stamps).
 - 5. Pounds of CO2 emissions avoided from the generation of PV energy at the site.
- B. Provide a Web based software application to allow interactive display and user requests of system performance, including historical data.

- C. Load software on owner provided web page (URL) and train owner in operation and maintenance of software and related monitoring functions.

PART 3 – EXECUTION

3.1 REQUIRED PLACARDS

- A. Provide a placard on all disconnects with the following wording in 1/4" high lettering per NEC 690.17: "Warning - Electric Shock Hazard - Do Not Touch Terminals - Terminals On Both The Line and Load Sides May Be Energized In The Open Position".
- B. Main PV System Disconnect to be clearly labeled "Solar System Disconnect" and located within 10 feet of the main service disconnect switch.
- C. Provide grounding connection from the inverter assembly to the nearest building steel per NEC 690.45 and the manufacturers instructions. Inverters shall have GFCI protection, allowing grounding per NEC Table 250.122.
- D. Provide a placard on the Main PV System Disconnect with the following information in 1/4" high lettering per NEC 690.53: "Photovoltaic Power Source Disconnect Operating Current: XX Amps; Operating voltage:208 VAC; Maximum System Voltage: 480 VAC; Short-Circuit Current: XXX Amps", where XX is the maximum AC amperes of the installed system and XXX is the maximum short circuit current that the PV system can provide (from all strings in parallel).
- E. Provide a placard at the Main Switchboard with the following information in 1/4" High lettering per NEC 690.54: "Caution - Possible Backfeed From Photovoltaic Power System - 208V, XX Amps", where XX is the maximum AC amperes of the installed system.
- F. Provide utility-required System Directory placard and utility safety switch Identification placard as required by local utility company, to identify all system components.

3.2 UTILITY INTERCONNECTION

- A. The PV generation system shall not be interconnected with the Utility's distribution facilities until written authorization from the Utility Company has been obtained. Unauthorized interconnections may result in injury to persons and damage to equipment or property for which the installing contractor and City may be liable.

3.3 INSTALLATION STANDARDS

- A. System Installation shall conform to Manufacturers Installation Manual and approved project drawings and specifications.
- B. All Local and NEC codes shall be observed.

3.4 TESTING

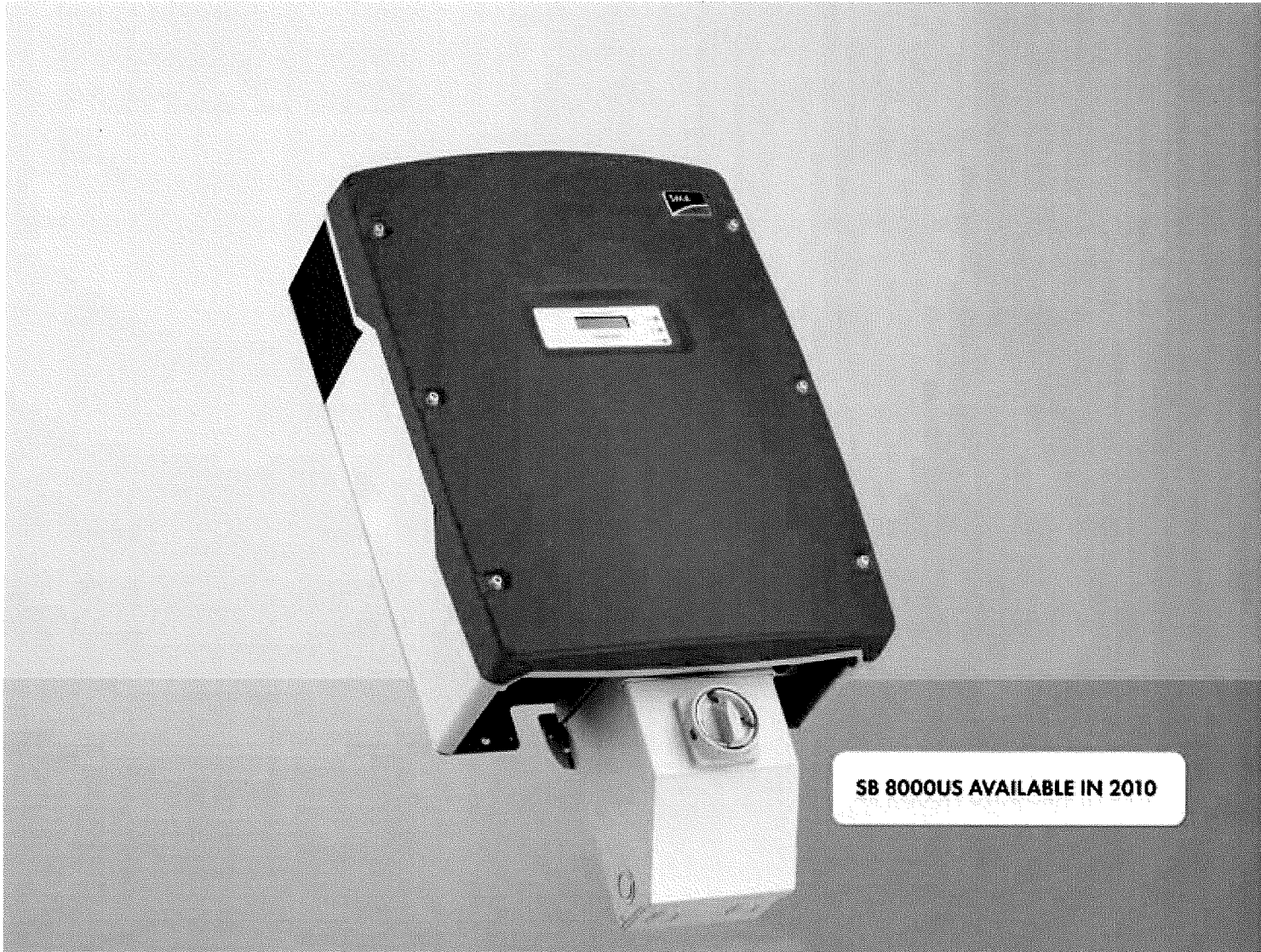
- A. Photovoltaic modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.
- B. Inverters shall be factory tested for performance and results shall be included in the O & M manuals.

- C. System testing of the installed photovoltaic array shall be performed on all system strings and recorded in the O & M manual.
- D. Megger test each roof array prior to energizing to establish that no shorts or ground exist at any point on the arrays.
- E. Testing to be performed per CPUC Electric Rule 21 testing procedures and requirements. All testing to be done on "no-cloud" days to avoid system fluctuation by passing clouds. Installer to provide all testing and certification / commissioning.
- F. Submittals, start-up, and testing shall conform to LEED Commissioning Requirements.
- G. System start-up procedure will be as outlined by the Manufacturer's Installation Manual and the Inverter Manual.

END OF SECTION



SUNNY BOY 5000US / 6000US / 7000US / 8000US



SB 8000US AVAILABLE IN 2010

- Highest CEC efficiency in its class
- Integrated load-break rated lockable DC disconnect switch
- Integrated fused series string combiner
- Sealed electronics enclosure & Opticool™
- Comprehensive SMA communications and data collection options
- Ideal for residential or commercial applications
- Sunny Tower compatible
- 10 year standard warranty
- UL 1741/IEEE-1547 compliant



SUNNY BOY 5000US / 6000US / 7000US / 8000US

The best in their class

Our US series inverters utilize our proven technology and are designed specifically to meet IEEE-1547 requirements. Sunny Boy 6000US, Sunny Boy 7000US and Sunny Boy 8000US are also compatible with the Sunny Tower. Increased efficiency means better performance and shorter payback periods. All four models are field-configurable for positive ground systems making them more versatile than ever. Throughout the world, Sunny Boy is the benchmark for PV inverter performance and reliability.

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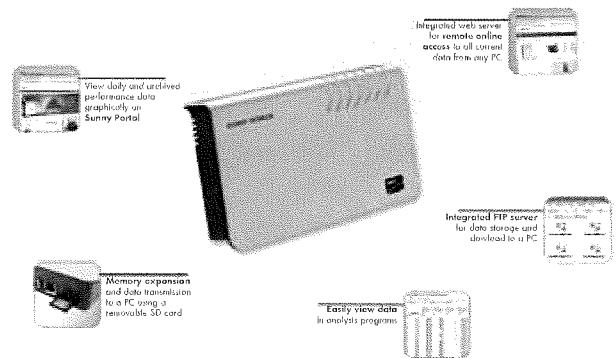
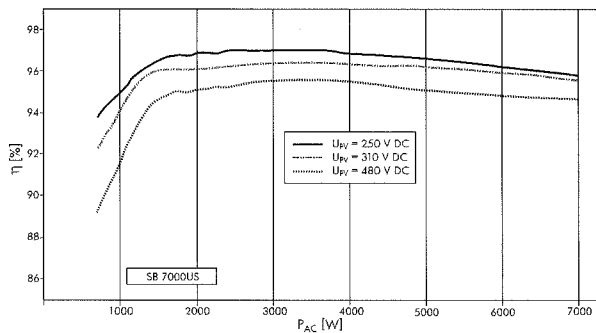
Technical Data

	SB 5000US	SB 6000US	SB 7000US	SB 8000US
Recommended Maximum PV Power (Module STC)	6250 W	7500 W	8750 W	10000 W
DC Maximum Voltage	600 V	600 V	600 V	600 V
Peak Power Tracking Voltage	250-480 V	250-480 V	250-480 V	300-480 V
DC Maximum Input Current	21 A	25 A	30 A	30 A
Number of Fused String Inputs	3 (inverter), 4 x 20 A (DC disconnect)	3 (inverter), 4 x 20 A (DC disconnect)	3 (inverter), 4 x 20 A (DC disconnect)	3 (inverter), 4 x 20 A (DC disconnect)
PV Start Voltage	300 V	300 V	300 V	365 V
AC Nominal Power	5000 W	6000 W	7000 W	8000 W
AC Maximum Output Power	5000 W	6000 W	7000 W	8000 W
AC Maximum Output Current (@ 208, 240, 277 V)	24 A, 21 A, 18 A	29 A, 25 A, 22 A	34 A, 29 A, 25 A	N/A, 32 A, 29 A
AC Nominal Voltage Range	183 - 229 V @ 208 V 211 - 264 V @ 240 V 244 - 305 V @ 277 V	183 - 229 V @ 208 V 211 - 264 V @ 240 V 244 - 305 V @ 277 V	183 - 229 V @ 208 V 211 - 264 V @ 240 V 244 - 305 V @ 277 V	N/A @ 208 V 211 - 264 V @ 240 V 244 - 305 V @ 277 V
AC Frequency: nominal / range	60 Hz / 59.3 - 60.5 Hz	60 Hz / 59.3 - 60.5 Hz	60 Hz / 59.3 - 60.5 Hz	60 Hz / 59.3 - 60.5 Hz
Power Factor (Nominal)	0.99	0.99	0.99	0.99
Peak Inverter Efficiency	96.8%	97.0%	97.1%	96.5%
CEC Weighted Efficiency	95.5% @ 208 V 95.5% @ 240 V 95.5% @ 277 V	95.5% @ 208 V 95.5% @ 240 V 96.0% @ 277 V	95.5% @ 208 V 96.0% @ 240 V 96.0% @ 277 V	N/A @ 208 V 96.0% @ 240 V 96.0% @ 277 V
Dimensions: W x H x D in inches	18.4 x 24.1 x 9.5	18.4 x 24.1 x 9.5	18.4 x 24.1 x 9.5	18.4 x 24.1 x 9.5
Weight / Shipping Weight	141 lbs / 148 lbs	141 lbs / 148 lbs	141 lbs / 148 lbs	148 lbs / 152 lbs
Ambient Temperature Range	-13 to 113 °F	-13 to 113 °F	-13 to 113 °F	-13 to 113 °F
Power consumption at night	0.1 W	0.1 W	0.1 W	0.1 W
Topology	Low frequency transformer, true sinewave	Low frequency transformer, true sinewave	Low frequency transformer, true sinewave	Low frequency transformer, true sinewave
Cooling Concept	OptiCool™, forced active cooling	OptiCool™, forced active cooling	OptiCool™, forced active cooling	OptiCool™, forced active cooling
Mounting Location: indoor / outdoor (NEMA 3R)	●/●	●/●	●/●	●/●
LCD Display	●	●	●	●
Communication: RS485 / wireless	○/○	○/○	○/○	○/○
Warranty: 10 years / 15 years / 20 years	●/○/○	●/○/○	●/○/○	●/○/○
Compliance: IEEE-929, IEEE-1547, UL 1741, UL 1998, FCC Part 15 A & B	●	●	●	●

● Included ○ Optional

NOTE: US inverters ship with gray lids.

Efficiency Curves



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Solar powering a green future™

STP210 - 18/Ub -1
STP200 - 18/Ub -1
STP190 - 18/Ub -1

200 Watt

POLY-CRYSTALLINE SOLAR PANEL

Features

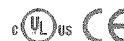
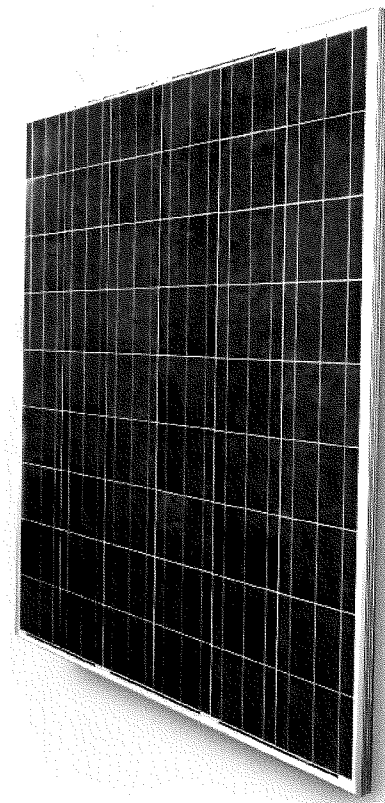
- High conversion efficiency based on innovative photovoltaic technologies
- High reliability with guaranteed +/-3% power output tolerance
- Withstands high wind-pressure and snow load, and extreme temperature variations

Quality and Safety

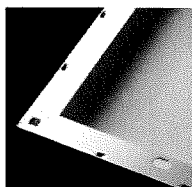
- 25-year power output transferable warranty
- Rigorous quality control meeting the highest international standards
- ISO 9001:2000 (Quality Management System) and ISO 14001:2004 (Environmental Management System) certified factories manufacturing world class products
- UL listings: UL1703, cULus, Class C fire rating, conformity to CE

Recommended Applications

- On-grid utility systems
- On-grid commercial systems
- Off-grid ground mounted systems



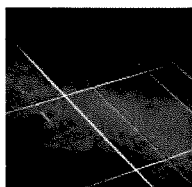
Suntech's technology yields improvements to BSF structure and anti-reflective coating to increase conversion efficiency



Unique design on drainage holes and rigid construction prevents frame from deforming or breaking due to freezing weather and other forces



Suntech was named Frost and Sullivan's 2008 Solar Energy Development Company of the Year



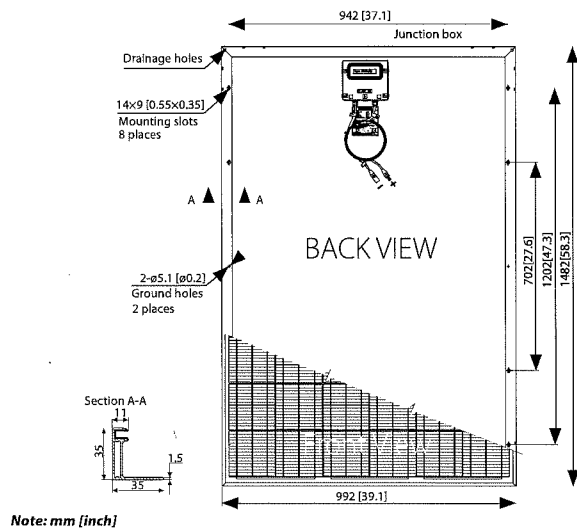
The panel provides more field power output through an advanced cell texturing and isolation process, which improves low irradiance performance

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Electrical Characteristics

Characteristics	STP210-18/Ub-1	STP200-18/Ub-1	STP190-18/Ub-1
Open - Circuit Voltage (Voc)	33.6V	33.4V	33V
Optimum Operating Voltage (Vmp)	26.4V	26.2V	26V
Short - Circuit Current (Isc)	8.33A	8.12A	7.89A
Optimum Operating Current (Imp)	7.95A	7.63A	7.31A
Maximum Power at STC (Pmax)	210Wp	200Wp	190Wp
Operating Temperature	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Maximum System Voltage	600V DC	600V DC	600V DC
Maximum Series Fuse Rating	20AMPS	20AMPS	20AMPS
Power Tolerance	±3 %	±3 %	±3 %

STC: Irradiance 1000W/m², Module temperature 25°C, AM=1.5



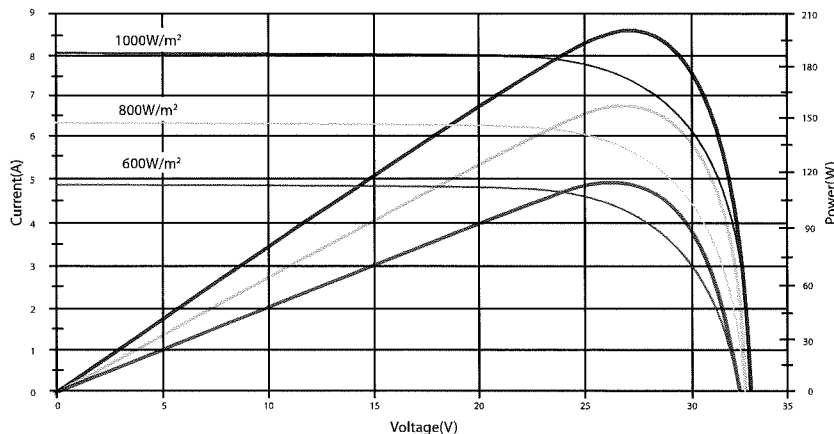
Mechanical Characteristics

Solar Cell	Poly-crystalline 156x156mm (6inch)
No. of Cells	54 (6x9)
Dimensions	1482x992x35mm (58.3x39.1x1.4inch)
Weight	16.8kg (37.0lbs.)
Front Glass	3.2 mm (0.13inch) tempered glass
Frame	Anodized aluminium alloy
Junction Box	IP65 rated
Output Cables	LAPP (4.0mm ²), asymmetrical lengths (-) 1200mm (47.2inch) and (+) 800mm (31.5inch), MC Plug Type IV connectors

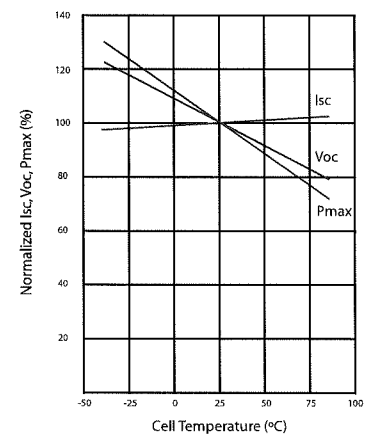
Temperature Coefficients

Nominal Operating Cell Temperature (NOCT)	45°C±2°C
Temperature Coefficient of Pmax	-(0.47 ± 0.05) %/°C
Temperature Coefficient of Voc	-(0.34 ± 0.01) %/°C
Temperature Coefficient of Isc	(0.055 ± 0.01) %/°C

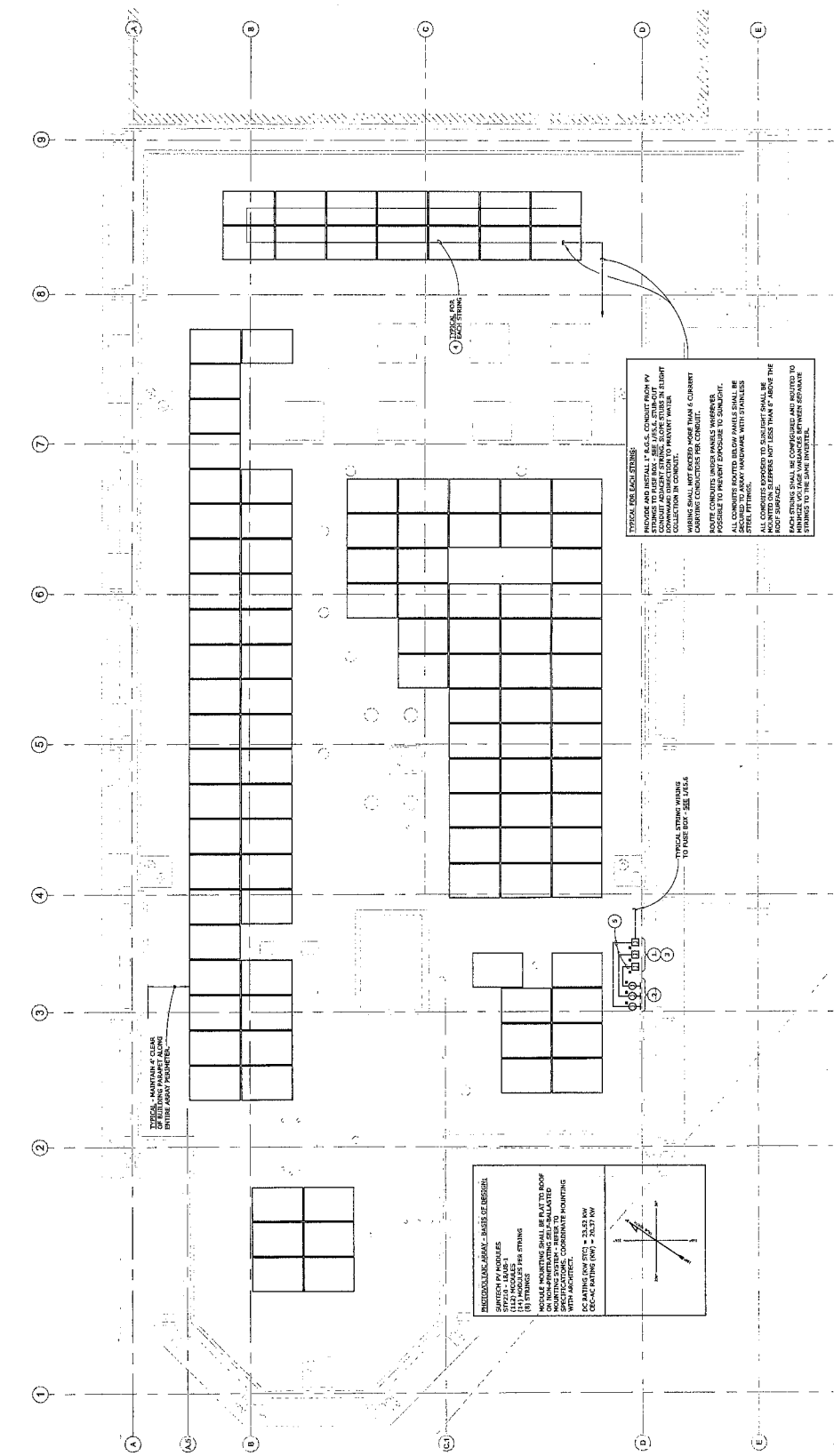
Current-Voltage & Power-Voltage Curve (200W)



Temperature Dependence of Isc, Voc, Pmax



4B5
16



CLAS ARCHITECTS

1000 S. G STREET
SANTA ANA, CA 92701
TEL: 714.952.8888
WWW.CLASARCHITECTS.COM



OMAHONY & MYER
ARCHITECTS
1000 S. G STREET
SANTA ANA, CA 92701
TEL: 714.952.8888
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SAUSALITO
PUBLIC SAFETY BUILDINGS
POLICE AND FIRE
29 CALLETA STREET
SAUSALITO, CA 94965
TEL: 415.389.7000
WWW.SAUSALITOPUBLICSAFETYBUILDINGS.COM



FIRE STATION
ROOF PLAN -
PHOTOVOLTAICS

DATE: 11/17/09
DRAWN BY: [REDACTED]
CHECKED BY: [REDACTED]
DATE: 11/17/09

Drawn: [REDACTED]
Checked: [REDACTED]
Date: 11/17/09

Drawn: [REDACTED]
Checked: [REDACTED]
Date: 11/17/09

Drawn: [REDACTED]
Checked: [REDACTED]
Date: 11/17/09

Drawn: [REDACTED]
Checked: [REDACTED]
Date: 11/17/09

Drawn: [REDACTED]
Checked: [REDACTED]
Date: 11/17/09

NOTE:
ALL EXPOSED CONDUITS ON ROOF SHALL BE RIGID GALVANIZED STEEL WITH WATER TIGHT FITTINGS.

- NUMBERED SHEET NOTES**
- 1 PROVIDE AND INSTALL SIGNAL RISE BOX FOR PV STING WIRING TO INVERTER. LOCATE RISE BOX IN ELECTRICAL ROOM AND CONDUIT DOWN TO ELECTRICAL ROOM - VERIFY (D) LOCATION, SEE FLOOR PLAN.
 - 2 IN PENETRATIONS ROOMS FOR PV WIRING TO ELECTRICAL ROOM - SEE FLOOR PLAN.
 - 3 SEE LEM FOR QUANTITIES AND SIZING. SIZE BOX AS REQUIRED.
 - 4 SEE LEM FOR STING SIZING.
 - 5 PROVIDE AND INSTALL STING WIRING IN CONDUIT FROM RISE BOX LOCATION TO (D) ROOF PENETRATIONS ROOMS TO ELECTRICAL ROOM, SEE LEM FOR SIZING.

PROVIDE AND INSTALL SIGNAL RISE BOX FOR PV STING WIRING TO INVERTER. LOCATE RISE BOX IN ELECTRICAL ROOM AND CONDUIT DOWN TO ELECTRICAL ROOM - VERIFY (D) LOCATION, SEE FLOOR PLAN.

ROUTE CONDUITS UNDER PANELS WHERE POSSIBLE TO PREVENT EXPOSURE TO SUNLIGHT. ALL CONDUITS SHALL BE RIGID GALVANIZED STEEL WITH WATER TIGHT FITTINGS. PROVIDE AND INSTALL STING WIRING IN CONDUIT FROM RISE BOX LOCATION TO (D) ROOF PENETRATIONS ROOMS TO ELECTRICAL ROOM, SEE LEM FOR SIZING.

PROVIDE AND INSTALL STING WIRING IN CONDUIT FROM RISE BOX LOCATION TO (D) ROOF PENETRATIONS ROOMS TO ELECTRICAL ROOM, SEE LEM FOR SIZING.

PROVIDE AND INSTALL STING WIRING IN CONDUIT FROM RISE BOX LOCATION TO (D) ROOF PENETRATIONS ROOMS TO ELECTRICAL ROOM, SEE LEM FOR SIZING.

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PROVIDE AND INSTALL STING WIRING IN CONDUIT FROM RISE BOX LOCATION TO (D) ROOF PENETRATIONS ROOMS TO ELECTRICAL ROOM, SEE LEM FOR SIZING.



DATE: 11/17/08
BY: [Signature]
CHECKED BY: [Signature]
PROJECT: SAUSALITO POLICE AND FIRE



SAUSALITO POLICE AND FIRE
22000 SERRA STREET
SAUSALITO, CA 94965

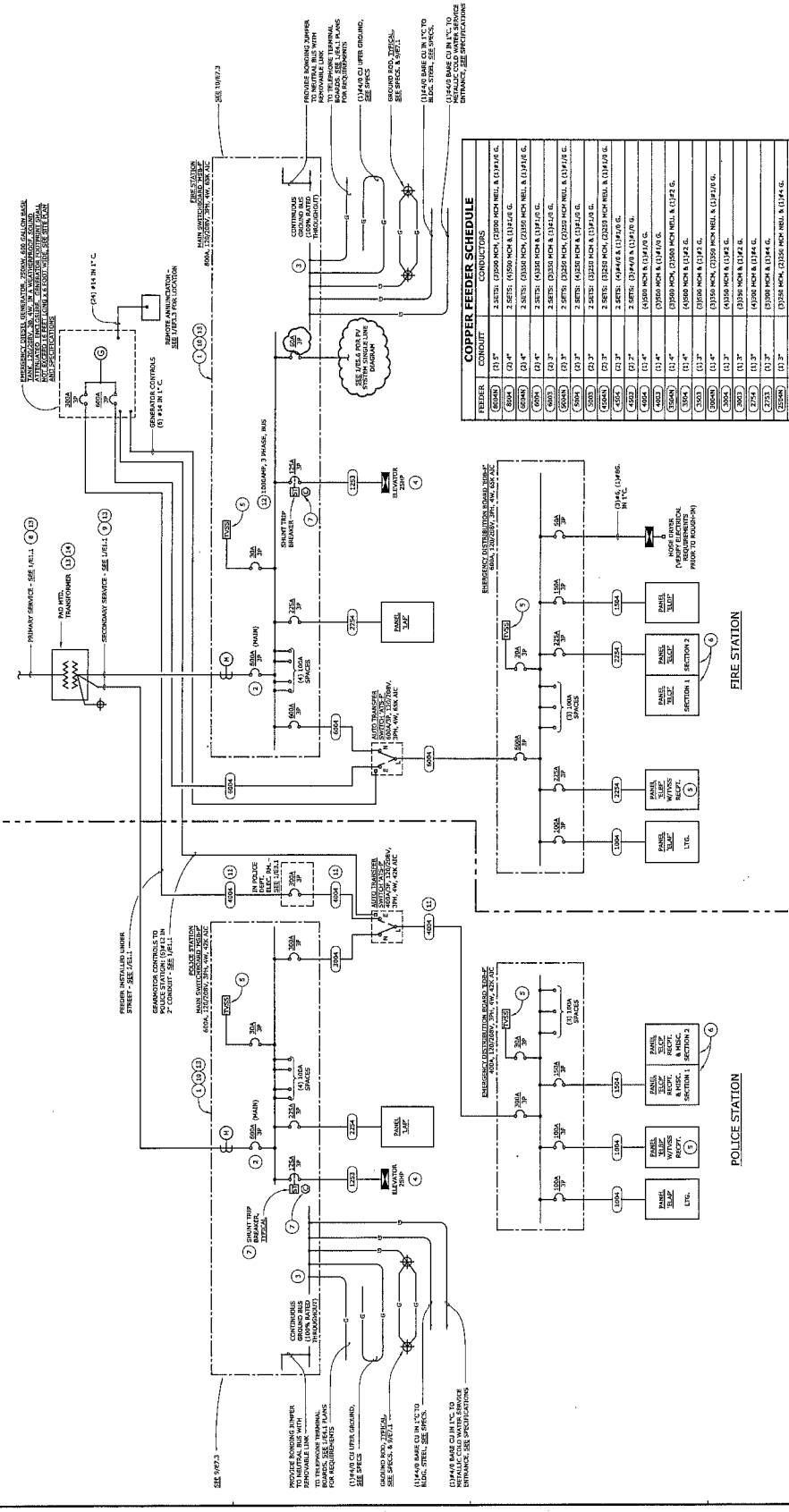


SAUSALITO POLICE AND FIRE
22000 SERRA STREET
SAUSALITO, CA 94965

SINGLE LINE DIAGRAM
DATE: 11/17/08
BY: [Signature]
CHECKED BY: [Signature]
PROJECT: SAUSALITO POLICE AND FIRE

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19

ES.1



COPPER FEEDER SCHEDULE table with columns for FEEDER, CONDUIT, and CONDUCTORS. Lists various feeders (C001-C035) and their specifications.

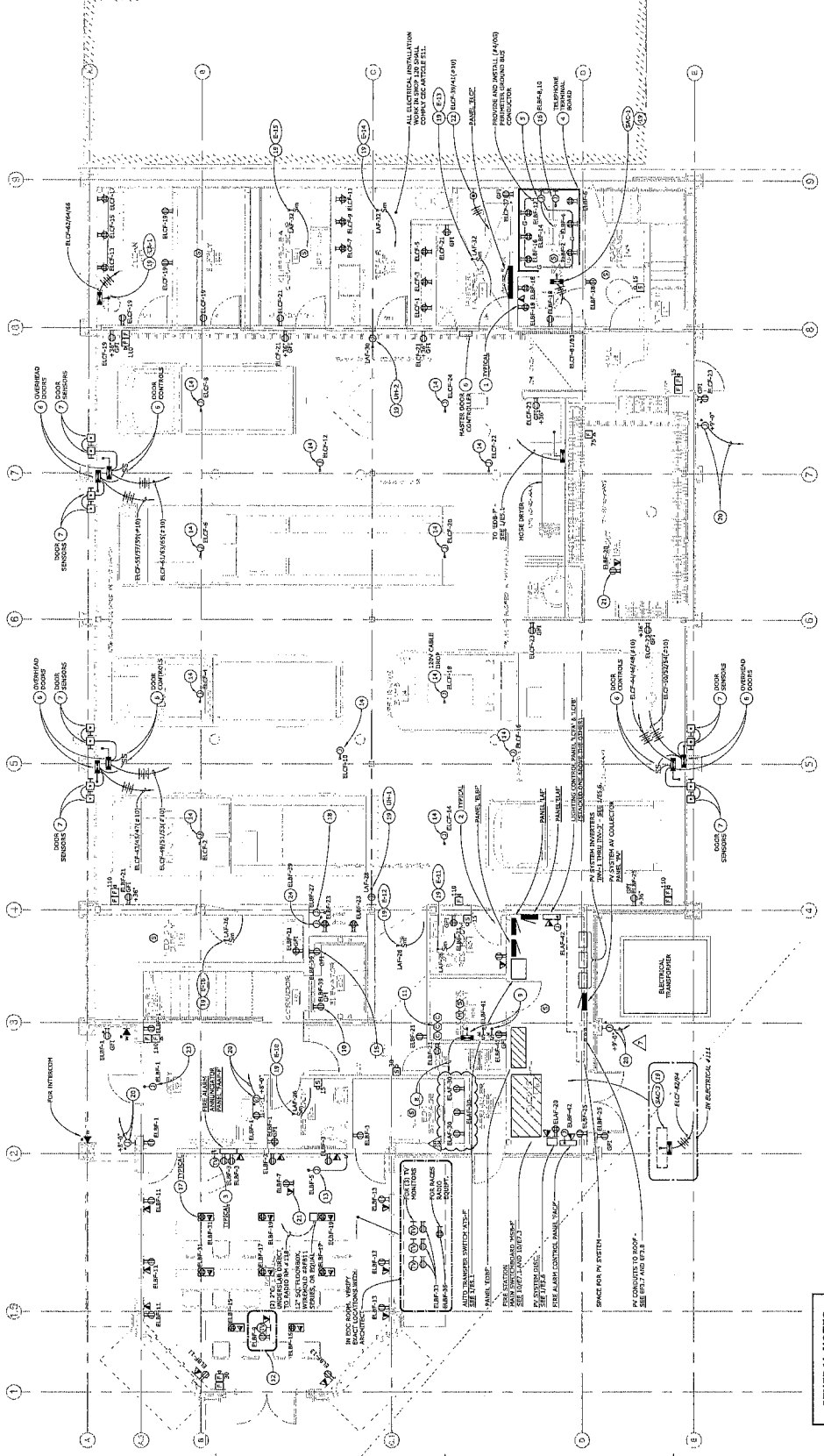
NOTE: PER CEC 110.06 PROVIDE AND INSTALL ELECTRIC ARCH FLASH WARNING SIGNS ON ALL SWITCHBOARDS, PANELBOARDS, CONTROL PANELS, METER SOCKET ENCLOSURES, AND MOTOR CONTROLS.

- NUMBERED SHEET NOTES: 1. VERIFY ALL ELECTRICAL SYSTEMS... 2. LABEL AS 'YOUR BUILDING DISCONNECT'... 3. PROVIDE WITH THIS... 4. DOUBLE CHECK... 5. VERIFY THE CHASIT... 6. PROVIDE AND INSTALL... 7. PROVIDE AND INSTALL... 8. THE CONTRACTOR... 9. FEEDER SIZE... 10. THE SWITCHBOARD... 11. PROVIDE AND INSTALL... 12. VERIFY THE CHASIT...

FIRE STATION

POLICE STATION

NOTE: NOT ALL FEEDERS ON THIS SCHEDULE ARE NECESSARILY USED ON THIS PROJECT.



NOTE:
ALL DEVICES INCLUDING LIGHT SWITCHES AND RECEPTACLES CONNECTED TO THE EMERGENCY POWER SYSTEM SHALL HAVE ENGRAVED NAME PLATES WITH THE WORDING "EMERGENCY" IN RED.

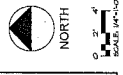
- NUMBERED SHEET NOTES**
- 1 DOUBLE ENDER RECEPTACLE AND TELEPHONE DATA OUTLET. SEE DET. 1
 - 2 SINGLE RECEPTACLE AND TELEPHONE DATA OUTLET. SEE DET. 2
 - 3 SINGLE RECEPTACLE AND CABLE TELEVISION OUTLET. SEE DET. 3
 - 4 METAL RAIN TYPICAL DATA. DO NOT MAKE CABLE PENETRATIONS THROUGH WALLS.
 - 5 PROVIDE ONE CABLE. SEE DET. 5. PROVIDE AND INSTALL A 1/2" INSULATED GROUND WIRE IN METAL RAIN TYPICAL DATA. SEE SPECIFICATIONS.
 - 6 PROVIDE ONE CABLE. SEE DET. 6. PROVIDE AND INSTALL A 1/2" INSULATED GROUND WIRE IN METAL RAIN TYPICAL DATA. SEE SPECIFICATIONS.
 - 7 PHOTO SENSORS AND PHOTO SENSITIVE DEVICES. ONE SENSORS SHALL BE INSTALLED AT 12" PACE AND THE OTHER SENSORS AT 36". CONNECT TO PHOTO SENSITIVE DEVICES. VERIFY LOCATION WITH ARCHITECT. VERIFY LOCATION WITH ARCHITECT.
 - 8 TO MAIN SWITCHBOARD ROOM. SEE SINGLE LINE DIAGRAM ELL.

- NUMBERED SHEET NOTES**
- 9 ELECTRICAL WIRE AND INSTALL USED DISCONNECT FOR ELEVATOR MOTOR AND TWO WIRE DISCONNECT FOR ELEVATOR MOTOR. PROVIDE AND INSTALL TELEPHONE AND ALARM CONNECTING RACEWAYS. PROVIDE AND INSTALL TELEPHONE AND ALARM CONNECTING RACEWAYS. SEE DET. 9.
 - 10 PROVIDE AND INSTALL LOW VOLTAGE TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.
 - 11 PROVIDE AND INSTALL LOW VOLTAGE TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.
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- NUMBERED SHEET NOTES**
- 20 FOR SHIP RISE IN ELEVATOR PIT. CONNECT COMPLETE. VERIFY LOCATION WITH MECHANICAL CONTRACTOR. PROVIDE AND INSTALL TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.
 - 21 PROVIDE AND INSTALL LOW VOLTAGE TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.
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- NUMBERED SHEET NOTES**
- 31 PROVIDE AND INSTALL LOW VOLTAGE TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.
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 - 40 PROVIDE AND INSTALL LOW VOLTAGE TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR AND TELEPHONE AND ALARM DISCONNECT TO ELEVATOR MOTOR. VERIFY LOCATION WITH ARCHITECT.

- GENERAL NOTES**
1. RELOCATED UTILITIES SHOWN IN AN ACCESSIBLE LOCATION ABOVE FINISHED CEILING.
 2. RELOCATED UTILITIES SHOWN IN AN ACCESSIBLE LOCATION ABOVE FINISHED CEILING.
 3. RELOCATED UTILITIES SHOWN IN AN ACCESSIBLE LOCATION ABOVE FINISHED CEILING.



485
20

485
18

E5.6

Contractor: JRM / JRM

Date: 11/12/09

Sheet No. 11

Scale: 1/8" = 1'-0"

**SINGLE LINE DIAGRAM
PHOTOVOLTAICS**

**SAUSALITO
PUBLIC SAFETY BUILDINGS
POLICE AND FIRE**

Project: 29 California Street
San Francisco, CA 94102



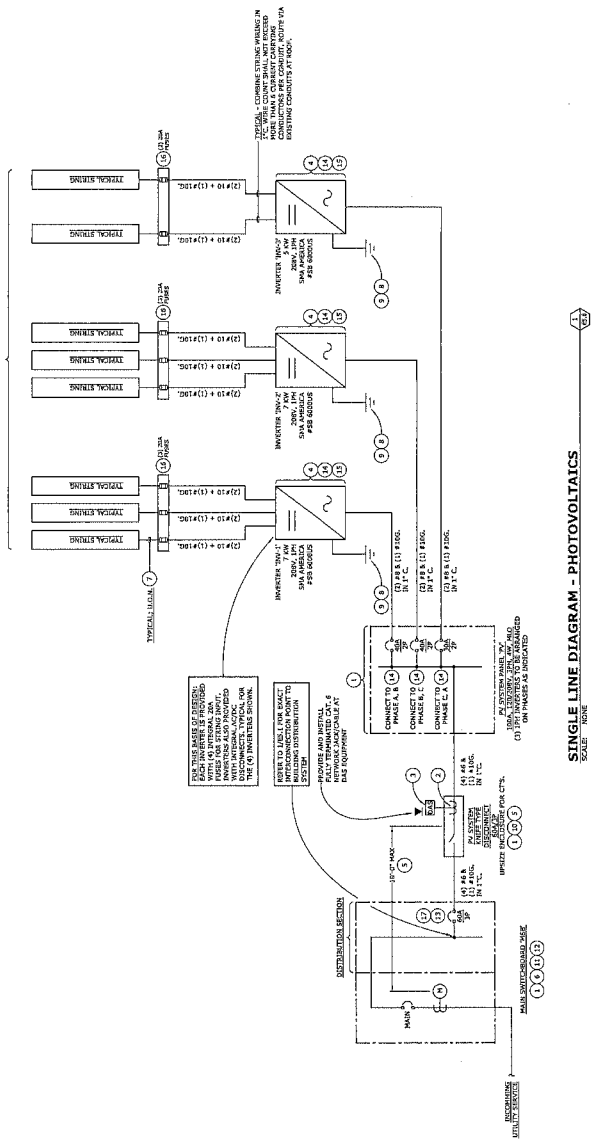
OMA HONY & MYER
1000 MARKET STREET, SUITE 100
SAN FRANCISCO, CA 94102
Tel: (415) 774-1111
Fax: (415) 774-1114



OMA HONY & MYER
1000 MARKET STREET, SUITE 100
SAN FRANCISCO, CA 94102
Tel: (415) 774-1111
Fax: (415) 774-1114



- PV DIAGRAM SHEET NOTES**
1. ALL PV SYSTEM INTERCONNECTIONS WITH THE DISTRIBUTION SYSTEM SHALL BE MADE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE CALIFORNIA ELECTRICAL CODE (CEC) AS REQUIRED BY THE ARTICLE 720 AND 725 AND THE SYSTEM INCLUDING ALL INTERSPACE WIRING AND CONDUIT.
 2. PROVIDER AND INSTALL ALL ENGINEERING AND PV MOUNTING BRACKETS, INCLUDING ALL INTERSPACE WIRING AND CONDUIT.
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SINGLE LINE DIAGRAM - PHOTOVOLTAICS
SCALE: NONE

