

Photovoltaic Panel Structure
and Parking Lot Addition
Shasta Community Health Center
Redding, CA

SECTION 16012 - ELECTRICAL

PART 1 GENERAL REQUIREMENTS

GENERAL CONDITIONS:

Comply with any specifications GENERAL CONDITIONS.

WORK INCLUDED:

All materials, labor, tools, and transportation to construct the following complete, functional electrical systems as shown on the plans and described in the specifications:

- Electrical power distribution
- Electric lighting and controls.
- New electric metering/disconnect

Conduits only, pull ropes, boxes and blank plates for the following systems:

- Data conduits

COMPLY WITH THESE CODES AND STANDARDS:

- All Federal, State, and Local laws and ordinances.
- 2007 California Electrical Code
- California Code of Regulations Titles 8 and 24
- Underwriters Laboratories.
- State and Local Fire Marshals
- City of Redding Public Works Construction Standards
- City of Redding Electric Utility Construction Standards

OTHER CONTRACTOR RESPONSIBILITIES:

- Staffing this work with qualified persons.
- Coordination of work with other trades to insure complete operable systems.
- Neat, orderly appearance of all work.
- Proper routing of raceways, positioning of equipment, and insuring adequate clearances. The drawings show approximate locations only. Report conflicting conditions to the Architect for adjustment prior to proceeding with work.
- Arranging all required inspections.
- Visiting the site prior to bid and completely informing him or herself as to all existing conditions and limitations that may affect the work. No allowances for extra expense will be made for neglect to discover conditions affecting his work.

SUBSTITUTION OF MATERIALS:

Special Components:

Certain components of this project (listed below) have been specifically selected for their electrical and/or physical characteristics. These characteristics have been incorporated into the contract documents for design criteria and calculations which have been utilized by the Architect, Consultants, Engineers & the AHJ (City of Redding Building Division) for code compliance, process evaluation, function & compatibility reviews. As such, proposed substitutions will be subject to substantial additional review by the Architect, Consultants, Engineers & the AHJ. Review(s) and additional engineering/design will be required to evaluate

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any changes to the specified components. Contractor and/or subcontractor wanting to substitute a component will be required to pay all of the Architect, Consultants, and Engineers fees for reviewing the documents; as well as, any fees imposed by the AHJ (City of Redding Building Division) for reevaluating the components. All work will be performed on a time and charges basis with all associated costs being the sole responsibility of the contractor regardless of the outcome of the review(s). Manufacturer's specifications will be available from the Architect along with construction documents prior to bidding. These components include:

- Photovoltaic modules
- Module rails/support system
- String combiner box
- Inverter
- DC surge protector
- Module & rail system grounding & bonding components
- Lighting fixtures, specific to photometric performance & footcandle levels

One proposed substitution will be considered for each item. Should this be rejected for any reason, supply the specified item. Should the Architect deem the review process could adversely affect the construction schedule, no substitutions will be allowed on the above components.

Generic Components:

Proposed alternatives for generic components as listed below may be submitted for approval. Manufacturers' names and catalog numbers indicate the type and quality of equipment or materials desired. One proposed substitution will be considered for each item. Should this be rejected for any reason, supply the specified item.

- Lighting controls
- Panelboards and metering equipment
- Wiring devices and device plates
- Fuses and circuit breakers
- Junction & pull boxes

SUBMITTALS AFTER AWARD OF CONTRACT:

Within 30 days of the award of contract, provide complete descriptive data on electrical materials. Assemble all material and submit at ONE time. Submittals omitted from items listed below will required to be supplied as specified by the engineer. A single additional submittal will be allowed for long lead time items. Always indicate which items on a catalog cut page you will be supplying. Submit a minimum of six (6) copies. Include the following items:

- Photovoltaic modules
- Module rails/support system
- String combiner box
- Inverter
- DC surge protector
- Module & rail system grounding & bonding components
- Lighting fixtures, lamps, ballasts & lighting controls
- Switchboards, panelboards and metering equipment

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- Wiring devices and device plates
- Fuses and circuit breakers

DIVISION OF WORK .

Close coordination between the electrical and other trades is a part of the work that is required by this contract. No allowance will be made for omissions based on incorrectly assuming another trade will be performing your work. Confirm your scope of work with the general contractor.

SERVICE CONTINUITY/ SCHEDULED OUTAGE(S):

Scheduled outage(s) will be required as a part of this project. Coordinate all unavoidable outages with the Owner, Engineer & Redding Electric Utility, keeping such outages to a minimum. **Include any cost for overtime work in the contract.** Within 10 days of the award of contract make a written notification of intended construction schedule to the Architect & REU. Coordinate all utility work & arrange for required utility & building division inspections. Comply with all utility company requirements.

UNDERGROUND [OVERHEAD] SERVICES

Work Included: All work necessary to provide underground electric grid tie complete with trenching, backfilling, conduits, metering facilities, main service disconnect(s), main over-current circuit protective device(s), and coordination with REU.

Work not included:

- Fees assessed by REU for associated permanent electric grid tie & metering. (Paid directly by owner.)

WARRANTY:

Unless otherwise indicated, materials, equipment and workmanship shall be guaranteed for a minimum of one year from the date of Owners beneficial use. Some components have a longer period for manufacture's warranty.

PART 2 PRODUCTS AND THEIR INSTALLATION

GENERAL

Provide all new materials and equipment without defects. Provide materials and equipment listed by UL wherever standards have been established by that agency. Install all equipment in accordance with manufacturer's recommendations and instructions. Provide materials meeting National Electric Code requirements, NEMA and ANSI standards. Like items of equipment shall be the products of a single manufacturer.

WIRING METHODS

Use the following wiring methods:

Conductors: Supply copper conductors. Insulation shall be THHN/THWN, unless specifically noted otherwise on the single line diagram, ie: Type USE as indicated for grounding/bonding.

Splices and Taps, Current carrying conductors:

Dry Locations:

#10AWG and smaller shall be spliced using twist on, tapered spring electrical wire connectors (wirenuts), U.L. 486C listed for wire range as appropriate. T&B, Ideal or 3M brands. #8AWG and larger shall be spliced using mechanical split bolt, two bolt, insulation piercing or mechanical type connectors or compression butt splice connectors as appropriate. Where connectors are not self insulating, insulate using a minimum of two layers of rubber tape, followed by three layers of friction tape and three layers of electrical tape. Apply extra tape at protruding edges. Where appropriate, heat shrink tube or boots may be substituted for the layers of friction and electrical tape. IlSCO, T&B, Burndy or equivalent.

Wet and Damp locations: (Outdoor lighting, exterior J-boxes, in-ground boxes, etc.)

For splices or taps, connectors shall be U.L. 486D listed.

#10AWG and smaller shall be spliced using twist on, tapered spring electrical wire connectors (wirenuts), U.L. 50 tested as raintight/watertight and listed for wire range as appropriate. King Safety Products, Shrink-Kon or equivalent.

#8AWG and larger shall be spliced using a non reversible compression type butt splice, IlSCO, T&B, Burndy or equivalent. as outlined above. Insulate using a minimum of two layers of rubber tape, followed by three layers of friction tape and three layers of electrical tape. Seal insulation with heat shrink tube. Where split bolt splices are required and heat shrink is not feasible, apply extra tape at protruding edges and seal with two additional final coatings of a waterproof sealant (3M Scotchcoat or equivalent).

ACEWAY INSTALLATION:

Location, Routing, and Grouping: Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes to provide a neat appearance. Follow surface contours as much as possible. Avoid obstruction of passageways.

- In outdoor, underground or wet locations, use watertight couplings, and connectors in raceways. Install and equip boxes and fittings so as to prevent water from entering the raceway.
- Install concealed, embedded, and buried raceways so that they emerge at right angles to the surface and have none of the curved portion of the bend exposed.

Support: Securely support raceways at intervals not exceeding CEC requirements. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screws on wood, toggle bolts on hollow masonry units, expansion anchors or lead "caulk-in" anchors on concrete or brick, and machine screws or welded thread studs on steel work. Support all raceways from structural members only. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers except galvanized tie wire may be used to secure conduit run through metal studs in walls or ceilings.

Underground Direct Burial Raceways: Coordinate installation of underground raceways with other outside and building construction work. Maintain existing outside utilities in operation. Identify and verify the location of all existing subsurface utilities and maintain them intact during construction. Supply rock-free backfill or provide 4" sand bedding and 4" cover. Place 6"

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wide, brightly colored, plastic warning tape above all conduits. ITT Blackburn "Terratape" or equal.

PENETRATIONS:

Fire rated: Where conduits pass through a fire rated wall, floor, or ceiling, close off space around conduit with a UL listed fire barrier sealant rated at the penetration's fire rating. Use 3M fire barrier caulk CP25 series or equal. Where penetration occurs in a finished area, provide paintable metal escutcheons on finished side(s).

Roofs: All conduit penetrations of roofs shall be flashed, counter-flashed, sealed and made watertight.

Floor slabs and CMU walls: Grout and seal watertight.

MATERIALS:

Photovoltaic Modules:

Sanyo HIT 215N Photovoltaic Module. Module efficiency 17.1%, cell efficiency 19.3%, power output 215 watts. Limited 20year power output and 5 year product workmanship warranty.

Module rails/support system:

UNIRAC solar mount. See architectural specifications

String combiner box:

24 circuit String combiner box by PV Powered. Each source circuit separately fused using a touch safe fuse holder. UL1741 listed by ETL, NEMA 4X enclosure, 21.5"H x 17.75"W x 8.5"D

Lockable exterior latch, SS hardware.

Inverter:

PV Powered 75kW, load rated AC & DC service disconnects, 95.5% efficiency rating, nEMA 4 enclosure. 93.7"H x 59.9"W x 35"D nominal. Additional clearance required for access doors.

DC surge protector:

CITEL DS60PV-1000 Type 1 heavy duty surge protector. UL1449 low voltage TVSS.

Module & rail system grounding & bonding components:

Wiley Electronics LLC.

WEEBL-6.7 lug assembly, WEEB-UMC bond plate, WEEB bonding jumper.

Lighting fixtures:

See lighting fixture schedule.

BOXES

Junction and Pull Boxes:

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Use boxes of code-gauge, galvanized steel with full-access covers. Provide boxes meeting CEC. minimum size requirements. Concrete pull boxes shall be reinforced, precast concrete or fiberglass. Provide boxes with minimum interior dimensions shown on plans (10"x17"x18" deep minimum). Provide 12" layer of crushed rock below all boxes. On boxes larger than 24"X36, provide box extension ring(s) so conduits enter box sides, and concrete base with drain hole. Supply bolt down lids. Where boxes are installed in roadways or parking areas, provide boxes and covers rated for full traffic, H-20-44 loading. In other areas use boxes and covers rated for light vehicular traffic ("parkway covers"). Provide boxes as manufactured by Brooks, Christy, Quickset or equal

Outlet and Device Boxes:

General: Provide boxes 1-1/2" min. deep. Provide the following types:

- EMT Raceway System:E
Exterior: sheet steel or cast steel as indicated.

Cast Steel Boxes: Provide boxes of cast ferrous metal with gasketed, watertight, cast ferrous metal covers and stainless steel screws. Provide boxes with threaded conduit hubs and cast mounting lugs where lugs are required. Use Crouse-Hinds or Appleton Type FS or FD boxes, or equal.

Box installation:

Provide pull boxes to limit conduit runs to less than 200 feet and to contain no more than the equivalent of four right-angle bends. Make all boxes accessible. Mount all boxes plumb and level. Install boxes in a secure, substantial manner, supported independently of conduit by attachment to the building structure or a structural member. Use machine screws or welded threaded studs on steel work. Seal any unused openings in any type box.

Mounting heights: See legend on plans.

WIRING DEVICES

General: In all finished areas, coordinate the color of all switches, receptacles, and device plates with the Architect.

Ratings (unless noted otherwise):

- All duplex receptacles: 20A-125V
- All toggle switches: 20 amps, 120/277V unless otherwise noted

1 pole, 2 pole, 3 way and 4 way switches:

P & S: "Industrial Heavy Duty Specification Grade" PS20ACx series

Hubbell: "Industrial Grade" HBL122x series

Leviton: "Industrial Specification Grade" 122X-2x series

Single and Duplex receptacles:

P & S: "Industrial Heavy Duty Specification Grade" 5362 series

Hubbell: "Heavy Duty Specification Grade" HBL5362x series

Leviton: "Industrial Specification Grade" 5362x series

Special Receptacles:

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Ground Fault Interrupter: same specification grade as standard duplex.

Device Plates:

- Supply plates by same manufacturer as device. Use these types:
- Exterior areas: gasketed weatherproof cover with vertical cover mounted hinge up.

BRANCH CIRCUIT PANELS

General: Supply circuit breaker panelboards rated as shown on the panelboard schedules. Provide copper main bus, neutral bus and ground bus . Provide features and accessories as indicated in the "remarks" area. Supply panels constructed to panelboard standards and meeting NEMA PB1. "Loadcenter" type panels are not acceptable. Panelboards with main breakers used as building disconnects shall be U.L. listed for use as service entrance equipment. Panelboards shall be as manufactured by G.E., IEM, Square D, Cutler Hammer, or equal.

Circuit Breakers: Circuit breakers shall meet the requirements of UL and NEMA AB-1. They shall be capable of interrupting the available fault current at the panel and have minimum fault rating as indicated on the panel schedule. Supply only full frame (1-inch per pole) bolt-on circuit breakers in panelboards. Use multiple pole circuit breakers where shown. Do not use single pole breakers with ganged handles. Supply typewritten panelboard directories affixed to inside of panel door.

CIRCUIT BREAKERS IN EXISTING PANELS

Circuit Breakers: Circuit breakers shall meet the requirements of UL and NEMA AB-1. They shall be capable of interrupting the available fault current at the panel and have minimum fault rating as indicated on the panel schedule. Supply circuit breakers of the same manufacturer as the existing panel and U.L. listed for use in the panel. AIC rating of breakers shall either match the rating of other existing breakers in the panel or as noted on the drawings, whichever is greater. Unless otherwise noted, use only full frame (1-inch per pole) breakers. Tandem or half- size breakers are not acceptable. Use multiple pole circuit breakers where shown. Do not use single pole breakers with ganged handles.

All circuit breakers shall be new unless specifically noted as "factory refurbished" on the drawings. Factory refurbished breakers are used only if new replacement breakers are not available and with specific permission of the engineer. Brokers shall test breakers for long time and instantaneous trip points and contact resistance and perform visual inspection of mechanism, contacts and frame. Broker shall provide 3rd party certification when indicated. Units shall be warranted for a period of one year.

Acceptable breaker brokers are A-Z Circuit Breaker, Circuit Solutions and Pacific Coast Breaker.

DISCONNECT SWITCHES - FUSED

Supply switches meeting all the requirements of non-fused switches described above. Provide fuses of the current ratings indicated and types specified herein. Utilize fuse mountings that reject Class H fuses and will accept only the current-limiting fuses specified. Fused switches shall meet the requirements of UL and NEMA KS 1 and be UL listed for application to a system

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having an available short circuit current as indicated. Provide units U.L. listed for use as service entrance equipment.

FUSES

Fuses, 0 to 600 Volts: Provide a complete set of current-limiting fuses wherever fuses are indicated. Supply a set of six spare fuses of each type and each current rating installed. Provide the following types:

- For 251 to 600 volts, 0 to 600 amps, UL Class RK-5, Bussmann Type LPS-R or equivalent.

Conductor color code: The following color code shall be consistently used throughout the electrical system.

Phase	A	B	C	N	G
208Y/120v	Black	Red	Blue	White	Green
480Y/277v	Brown	Orange	Yellow	Natural Gray	Green

Conductors #6 and smaller shall be factory colored along entire length, larger conductors may be phase taped. Conductors shall be identified at all access points, such as J-boxes, panels, disconnects, outlets and points of connection.

GROUNDING

General: Ground the neutral of all wiring systems in accordance with the CEC.. Ground all exposed noncurrent-carrying metallic parts of electrical equipment and raceway systems. Ground metal sheathing and any exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to that equipment. Bond all metallic piping systems to ground. Make all bonding connections in accessible locations.

Ground Conductors: Provide copper grounding conductors of the size shown meeting requirements for conductors in WIRING METHODS above.

LIGHTING

General: Supply fixtures, ballasts and lamps as shown on the lighting fixture schedule in the Drawings.

LIGHTING CONTROLS:

Lighting Contactor: Furnish electrically held multiple pole lighting contactor with 120 volt coil and contacts rated 20 amps at a maximum voltage of 480 volts. Furnish a NEMA 3R or 4X enclosure and mount contactors inside enclosure. Furnish surface enclosure as shown on the drawings.

Exterior Lighting Controller: Furnish a 2 circuit astronomic digital lighting controller. One circuit turns on at dusk and off at dawn controlled by a photo-sensor. The other circuit turns on at dusk and is turned off for a programmable period during the night. Other features include 7 day scheduling, special day scheduling, 32 set points, alkaline battery back-up for 100 hours,

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manual override to next scheduled event, automatic daylight savings and leap year compensation, AM/PM or 24 hour format. Supply Tork DZA400A or equivalent.

METER SOCKET/MAIN FUSED SWITCH

Supply a factory meter socket and fused switch as indicated on the one-line diagram. Equipment shall be rated as shown on one line diagram and shall comply with all requirements of REU. The meter socket and fused switch must be utility approved. Switch shall be rated NEMA 3R and be UL listed for use as service entrance equipment. Supply disconnect with current limiting fuses as indicated.

PART 3 EXECUTION

GENERAL

Coordinate electrical work with Owner and Engineer and work of other trades to avoid conflicts, errors, delays to project, and unnecessary interference with operation of any existing facilities.

CUTTING AND PATCHING:

Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition. Use skilled craftsmen of the trades involved.

CONSTRUCTION OBSERVATION:

All materials, equipment, and workmanship shall be subject to observation at any time by the Engineer or their representatives. Correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer.

OPERATION AND MAINTENANCE MANUALS:

Provide Operations and Maintenance manuals for the following systems:

- Photovoltaic modules
- Inverter
- Lighting control time clock

Contractor shall provide three copies of operating and maintenance manuals for the system including the following information, bound in hard backed, 3-ring binders with page lifters.

Include:

- Manufacturer's operating manuals
- A statement of guarantee, including date of termination and the name and phone number of the person to be called in the event of equipment failure
- Complete record drawings of wiring and conduits.
- Detailed catalog data on all installed system components
- A written report that all equipment is properly installed and functions correctly.

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SALVAGED MATERIAL:

All material required to be removed and salvaged shall become the property of the Owner and shall be delivered by the Contractor for storage where directed by the Owner.

TESTS:

Test all wiring and connections for continuity and grounds before fixtures and equipment is connected. Repair any defects. Check and correct load balance on all panels. Check motors for proper rotation direction.

After the electrical system installation is completed and at such time as the Engineer may indicate, conduct an operating test for approval. Demonstrate that the all components of all electrical systems operate in accordance with the requirements of these Specifications and Drawings. Perform the test in the presence of the Engineer or his authorized representative. Furnish all instruments and personnel required for the tests. Contractor personnel shall be present at the final test to do the following:

- Remove panelboard and switchboard covers as requested by the engineer.
- Locate and identify grounding and bonding points
- Demonstrate operation and programming of lighting controls and other special systems.
- Remove randomly selected wiring devices for inspection.
- Supply any lifts or ladders required to access lighting fixtures. Remove lenses and/or ballast covers for inspection.

END OF SECTION 16012