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(August 3, 2015)

Uninterruptible Power Supply (UPS)

The UPS system shall provide traffic signal system battery backup power in the event of loss or failure of normal utility power. The UPS system shall be constructed for full on line configuration (line interactive type), providing automatic voltage regulation and power conditioning when under normal utility power. The transfer from utility power to battery power and vice versa shall not interfere with the normal operation of the connected traffic signal controller including conflict monitor and any other peripheral devices within the traffic controller assembly.

The UPS system shall include the following equipment:

UPS System Equipment

UPS system cabinet assemblies shall include all necessary equipment and auxiliary equipment for controlling the operation of traffic signals and similar systems as required for the specific application. UPS system cabinets shall meet the requirements of the NEMA TS1 and TS2 specification or the California Department of Transportation "Transportation Electrical Equipment Specifications" (TEES) dated March 12, 2009 and the following requirements:

1. Cabinet shall be Model 334L, housing 1B, and mounting cage 1 per TEES.
2. Construction shall be of 0.125-inch sheet aluminum (5052 alloy), with mill finish. The aluminum shall not be anodized and the exterior shall not be painted.
3. The cabinet door(s) shall each have a three point latch system. Locks shall be spring loaded construction locks capable of accepting a Best 6 pin core. Green construction cores shall be installed for each cabinet core lock. One core removal key and two standard keys shall be included with each cabinet and delivered to the Engineer.
4. Cabinet lighting shall be LED light strips with power supply. LED rope lights are not permitted. Color temperature shall be 4000°K plus or minus 400°K. LED light strips shall be approximately 12-14 inches long, and have a minimum output of 400 lumens. There shall be two light strips for each rack assembly within the cabinet. Lighting shall be ceiling mounted and oriented parallel to the door face – rack mounted lighting is not permitted. Lighting shall be positioned near the inside faces of the cabinet so that the lighting shines onto the faces of the associated rack mounted equipment, as well as into the interior of the rack. Lighting shall not interfere with the proper operation of any other ceiling mounted equipment and shall not block tool access to lifting eye attachment nuts. All lighting fixtures above a rack shall energize whenever either door to that respective rack is opened. Each door switch shall be labeled "Light".
5. One controller unit shelf with drawer, which attaches to the front and back rails of the EIA rack, shall be provided in lieu of the two steel controller supporting angles specified in TEES 6.3.4.

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6. The cabinet shall be provided with a breaker panel with two 15 amp, 120 volt, single pole breakers, one each for the fan and the lights.
7. Each cabinet shall be provided with at least 20 empty neutral connections to accommodate field wiring. The neutral bus bars shall be of the style in which a lug is not needed to be applied to the neutral field wire(s). All of the neutral bars shall be secured in accordance with the TEES. All neutral bars shall be at the same electrical potential.
8. The electric fan shall have ball or roller bearings and capacity of at least 100 cubic feet per minute and shall be installed at the top of the cabinet. The fan shall be thermostatically controlled by a manually adjusted thermostat with a range of 32°F and 140°F.
9. Three battery shelves shall be furnished. Each shelf shall be capable of supporting three AlphaCell (220 GOLD-HP) batteries without visibly flexing. A minimum of two and one half inches of side clearance and six inches of overhead clearance is required for each battery.
10. A minimum of 12 inches of clearance shall be maintained between the bottom rack and the bottom of the cabinet.
11. The cabinet shall include a Generator Transfer Switch and enclosure in accordance with Section 9-29.13(8). The Transfer Switch enclosure shall be installed at the same location normally occupied by the police panel enclosure on the right side of the cabinet, as viewed from the front. The lock shall have an aluminum rain shield cover, attached to the door with a rivet.

UPS System Internal Components

The following equipment shall be furnished and mounted to the EIA rack.

1. Alpha – Controller Power Module - FXM 2000 w/SNMP module; part number 017-232-31. FXM 2000 shall face the front of the cabinet and be installed at the top of the EIA rack.
2. Alpha FXM 2000 support – shelf kit 19" EIA rack UPS Inverter SS with hardware; part number 3610030085.
3. Alpha - Automatic Transfer Switch (UATS). Automatic Transfer Switch shall face the back of the cabinet and be installed at the top of the EIA rack; part number 020-168-25.
4. Alpha - Rack mount brackets 2 each and attachment screws; part number 740-697-21.
5. Pull out drawer; part number 3610035000. Pull out drawer shall face the front of the cabinet.

The following equipment shall be installed on the battery shelves:

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1. Alpha - part number 181-233-10, which is the AlphaCell 220 GOLD-HP GXL Battery (Four batteries shall be provided).
2. Alpha - part number 012-306-21 Alpha Guard Battery Management System.
3. Alpha - part number 740-628-27 Battery Cable kit 48V 10 ft. ¼-20 termination.
4. Alpha - part number 189-236-10 Battery Heater Mats 14.25 inch 120V. One battery heater mat for each battery.

The Alpha components of the UPS system shall be manufactured by the following:

Alpha Technologies, Inc.
3767 Alpha Way
Bellingham, WA 98226
Phone: 360 647 2360
Email: alpha@alpha.com
<http://www.alpha.com>

Maintenance and Operations Manuals

The Contractor shall supply three Maintenance and Operations Manuals for each UPS system (each cabinet). Two Maintenance and Operations Manuals shall be in a paper format and one Maintenance and Operations Manual shall be in an electronic PDF format.

UPS System Laboratory Testing

Each UPS system shall be tested at the Washington State Department of Transportation Materials Laboratory located in Tumwater, Washington, prior to installation. The UPS system testing shall simulate the operations as installed in the field. The tests shall check the operation of each individual component as well as the overall operation of the system.

The State Materials Laboratory testing of the UPS system will consist of the following four separate stages:

1. Delivery and Assembly
2. Documentation
3. Demonstration
4. Performance Test

Testing will follow in the listed order with no time gaps between stages unless mutually agreed upon by the Contractor and State Materials Laboratory.

The Contractor shall designate a qualified representative for these tests. All communications and actions regarding testing of all equipment submitted to

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the State Materials Laboratory shall be made through this representative. These communications and actions shall include, but not be limited to, all notifications of failure or rejection, demonstration of the equipment, and the return of rejected equipment.

Contractor Quality Control Testing

Prior to delivery of the UPS system to the State Materials Laboratory, all components and equipment, including the batteries shall be fully installed in the cabinet and the UPS system operations shall be successfully tested by the Contractor's representative.

After the UPS system has been successfully tested, the batteries shall be removed from the cabinet and the cabinet and batteries shall be delivered, independently, to the State Materials Laboratory.

Stage 1: Delivery and Assembly

The Contractor shall provide all Work necessary to assemble the UPS system and make ready for demonstration at the State Materials Laboratory. Upon delivery, the batteries shall be reinstalled in the cabinet and the UPS system shall be made fully operational. All components for the complete UPS system, including the necessary test equipment, shall be ready for testing within 14 calendar days of delivery to the State Materials Laboratory.

Stage 2: Documentation

All documentation shall be furnished with the UPS system equipment prior to the start of testing. The documents to be supplied shall consist of the following:

1. Serial numbers when applicable.
2. Wiring diagrams for all equipment furnished. One set per cabinet.
3. Complete operations and maintenance manuals. Two sets per cabinet.
4. A description of the functions and the capabilities of individual components and of the overall UPS system.

Stage 3: Demonstration

The Contractor shall provide the following:

1. A presentation on how to operate the system.
2. A complete and thorough demonstration to show that all components of the UPS system are in good condition and operating properly.

The demonstration shall be performed by the Contractor's representative in the presence of State Materials personnel.

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Stage 4: Performance Test

The performance test will be conducted by State Personnel to determine if the UPS system performs correctly. The performance test shall include the testing of the following specifications:

1. Battery Discharge Rate
2. Battery Recharge Rate
3. Power Transfer Rate

Test results shall be within the manufacturers recommended values in order for the tests to be considered successful.

Equipment Failure or Rejection

All component or system failures shall be documented. This documentation shall provide the following information:

1. A detailed description of the failure.
2. The steps undertaken to correct the failure.
3. A list of parts that were replaced, if any.

All failed or rejected equipment shall be removed from the Materials Laboratory within three calendar days following notification; otherwise, the failed or rejected equipment will be returned, freight collect, to the Contractor.

Following final approval by the State Materials Laboratory, all equipment shall be removed from the State Materials Laboratory, by the contractor and delivered to sites as designated elsewhere in this contract.

UPS System Field Testing

After installation, the Contractor shall field test the UPS system to ensure the system operates in accordance with Plans, Specifications and manufacturer's instructions. The test shall ensure that that all components are operational within manufacturer's tolerances. The Contractor shall provide a testing procedure to the Engineer for approval. The testing procedure shall provide for operational testing of the following:

1. UPS Power Module
2. Surge Suppressor
3. Automatic Transfer Switch
4. Generator Power Transfer Switch

The field test shall demonstrate the loss of utility power and the switch over to battery power without interference with the normal operation of the connected

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traffic signal controller including conflict monitor and any other peripheral devices within the traffic controller assembly.