State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER	PAGE
DPS0831	1

ADDRESS CORRESPONDENCE TO ATTENTION OF:
JOHN ABBOTT
304-558-2544

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE

SHIP TO
WEST VIRGINIA STATE POLICE

4124 KANAWHA TURNPIKE
SOUTH CHARLESTON, WV
25309 304-746-2141

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
03/28/2008				

BID OPENING DATE: 04/15/2008 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
				ADDENDUM #02		
				THIS ADDENDUM IS ISSUED TO MODIFY THE ORIGINAL SPECIFICATIONS, AND TO EXTEND THE BID OPENING DATE, FROM 4/2/08 TO 4/15/2008; 1:30 PM		
				NEW BID OPENING DATE: 4/15/2008; 1:30 PM		
0001	1	LS		910-82		
				ELECTRICAL WIRING MAINT., INSTALLATION & REPAIR		

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

GENERAL TERMS & CONDITIONS
REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)

1. Awards will be made in the best interest of the State of West Virginia.

2. The State may accept or reject in part, or in whole, any bid.

3. All quotations are governed by the ***West Virginia Code*** and the ***Legislative Rules*** of the Purchasing Division.

4. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required $125.00 registration fee.

5. All services performed or goods delivered under State Purchase Orders/Contracts are to be continued for the term of the Purchase Order/Contract, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods, this Purchase Order/Contract becomes void and of no effect after June 30.

6. Payment may only be made after the delivery and acceptance of goods or services.

7. Interest may be paid for late payment in accordance with the ***West Virginia Code.***

8. Vendor preference will be granted upon written request in accordance with the ***West Virginia Code.***

9. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

10. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.

11. The laws of the State of West Virginia and the ***Legislative Rules*** of the Purchasing Division shall govern all rights and duties under the Contract, including without limitation the validity of this Purchase Order/Contract.

12. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.

13. **BANKRUPTCY:** In the event the vendor/contractor files for bankruptcy protection, this Contract may be deemed null and void, and terminated without further order.

14. **HIPAA Business Associate Addendum -** The West Viginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, and available online at the Purchasing Division's web site (**http://www.state.wv.us/admin/purchase/vrc/hipaa.htm**) is hereby made part of the agreement. Provided that, the Agency meets the definition of a Covered Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.

INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division.

2. **SPECIFICATIONS:** Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.

3. Complete all sections of the quotation form.

4. Unit prices shall prevail in cases of discrepancy.

5. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.

6. **BID SUBMISSION:** All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications.

SIGNED BID TO:

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

McKINLEY & ASSOCIATES
ARCHITECTS • ENGINEERS • INTERIOR DESIGN

March 26, 2008

ADDENDUM NO. 2

WEST VIRGINIA STATE POLICE – HEADQUARTERS ELECTRIC UPGRADE
SOUTH CHARLESTON, WEST VIRGINIA
McKinley Project No. 07080.01

TO ALL BIDDERS:

The following items revise the Bidding Document Drawings and Specifications dated February 20, 2008. Acknowledge receipt of this Addendum at the appropriate location indicated on the Bid Proposal Form; failure to do so may be deemed a lack of bid responsiveness and can be cause for rejection of the Bid.

1.0 PROJECT MANUAL:

1.01 **Revise:** **SPECIFICATION SECTION 263213 – GENERATOR SET:** Replace specification with specification 263213 included in this addendum. Revision opens specification up to allow alternate manufacturers listed. (Attached)

1.02 **Revise:** **SPECIFICATION SECTION 263353 – UPS 200 KVA:** Replace specification with specification 263353 included in this addendum. Revision opens specification up to allow alternate manufacturers listed. (Attached)

1.03 **Revise:** **SPECIFICATION SECTION 263600 – TRANSFER SWITCHES:** Replace specification with specification 263600 included in this addendum. Revision opens specification up to allow alternate manufacturers listed. (Attached)

2.0 CHANGES TO DRAWINGS:

2.01 **Revise:** **GENERAL:** The two new panels (PPR, PPR1) for the Master File/Records room shall be located as shown on attached **Sketch ADD2-SK2**. Provide the panels with branch breakers as shown in original drawings, but no branch circuit connections are to be made by Electrical Contractor. Panels are to be located flush in new wall, wall to be provided by Owner. Refeed existing panel in Master File/Records room via a new transformer and disconnect switch from panel DP as shown in revised One Line diagram on attached **Sketch ADD2-SK3**. Locate transformer and disconnect switch in basement work room as shown in attached **Sketch ADD2-SK1**. Verify location with Owner prior to installation. Splice new feeder to existing panel feeder below panel, Owner has located feeder and provided access to above ceiling for splicing.

2.02 **Clarification:** **DRAWING E1.01:** The conduit routing to and from the basement equipment to the 1st floor equipment may be routed below but tight to the plaster ceiling in the basement, with the exception of the corridor in the basement, where the conduit shall be installed directly across and above the ceiling.

The Maxwell Centre - Suite 100 • Thirty-Two Twentieth Street • Wheeling, WV 26003
Phone 304-233-0140 • Fax 304-233-4613 • E-Mail corporate@mckinleyassoc.com

2.03 **DRAWING E2.01:**

Delete: Delete Site Electric Note #2.

Delete: Delete Electrical General Note #14.

Revise: Revise Electrical General Note #23 to read: "TVSS EQUIPMENT FOR PANEL DP SHALL BE HUBBELL #HBL8P160 OR EQUIVALENT BY SIEMENS, EATON OR SQUARE D. PROVIDE DISCONNECT SWITCHES AND FUSING AS REQUIRED BY MANUFACTURER."

3.0 QUESTIONS FROM BIDDERS:

1. QUESTION: **Is the smoke detector to be purchased & installed by E.C. (Electrical Contractor)?**

   ANSWER: The smoke detector is to be purchased and installed by Owner. It is shown for reference purposes only on the drawings, the E.C. has no work associated with it.

2. QUESTION: **Dwg. E2.01 Site Electric Notes #2, (what is the scope of site lighting work? Is there any work for EC associated with Voice, Data or CCTV? If yes what is the scope?**

   ANSWER: Note is deleted, see above.

3. QUESTION: **General note #14 all items supplied by others are to be powered by E.C. what are these items?**

   ANSWER: Note is deleted, see above.

4. QUESTION: **Key note 5 is note shown on drawing? Where is this location for EMT?**

   ANSWER: Keynote 5 refers to the Work Room in the basement, and the Server Room Addition and Data Processing Rooms only.

5. QUESTION: **Would it be possible to surface mount Panels PPR & PPR1 to the side of the existing panels, remove the guts from existing tubs, install terminal blocks and extend circuits to the new panels via an extension added to the existing panels with a screwed cover? This would allow less down time.**

   ANSWER: The existing panel is to be re-fed from the new service, and the new panels located as shown in the attached sketches. Please see above for further information.

6. QUESTION: **The garage has a standing seam metal roof. What issues are presented by penetrating the roof through the eave for the new service masts?**

   ANSWER: The Owner shall provide the penetration and sealing for the service masts. The electrical contractor shall be required to provide the masts.

7. QUESTION: **Where can tools be stored on site?**

ANSWER: The Owner has a job site construction trailer/office that the electrical contractor can use on site, and the contractor will be given the key to maintain security.

8. QUESTION: **Will extended work hours or weekends be permitted?**

ANSWER: Work hours shall be permitted Monday through Friday from 7:00 a.m. to 8:00 p.m.

9. QUESTION: **Will there be any restrictions for contractor personnel entering areas of the building?**

ANSWER: At the Owner's discretion, the Owner shall provide an escort for personnel working in areas the Owner deems sensitive.

10. QUESTION: **How shall conduit be routed above ceiling in first floor corridor?**

ANSWER: Conduit may be routed above accessible ceiling in offices parallel to corridor, then may route directly across corridor above ceiling to Server Addition to minimize raceway length above corridor ceiling.

11. QUESTION: **Will any special Personal Protective Equipment be required for contractor personnel in the building where work is to be done?**

ANSWER: No.

12. QUESTION: **How shall penetrations through lath/plaster be patched?**

ANSWER: Patch around penetrations using similar material to penetrated material. I.E. patch penetrations through lath and plaster with lath and plaster. See specification 01045 "Cutting and Patching" for additional information.

13. QUESTION: **Is there any asbestos in the work area?**

ANSWER: Owner's representative has indicated there is no asbestos in the work area. If contractor encounters suspicious condition, refer to AIA Document A201, section 10.3 in Bid Documents for information.

END OF ADDENDUM NO. 2

Attachments:
Specification Section 263213 – Generator Set
Specification Section 263353 – UPS 200 KVA
Specification Section 263600 – Transfer Switches
Sketches:
ADD2-SK1 – Basement Power Plan
ADD2-SK2 – First Floor Power Plan
ADD2-SK3 – One Line Diagram

SECTION 263213 - GENERATOR SET

GENERAL REQUIREMENTS

SCOPE:

This installation of a standby electric power system shall include an Cummins/Onan Model 400 DFEH **or equal** series electric generating set rated for continuous standby service at 400 KW, 500 KVA Standby, at 0.8 PF, 277/480 volts 3 Phase 4 Wire, 60-Hz. The complete, operable standby system, factory tested, ready for installation, and shall be a package of new and current equipment consisting of:

1. A diesel engine driven electric generating set to provide standby power.
2. An engine-alternator control console resiliently mounted on the generating set. Shall include complete engine start-stop control, solid state monitoring systems, and Mainline Circuit Breaker.
3. Automatic Transfer Switches to initiate automatic starting and stopping for the engine and switching of the load, see specification 263600 for information.
4. Weather Proof Sound Level II Enclosure
5. **Minimum** 660 Gallon Subbase Tank

APPROVED MANUFACTURES:

1.) Cummins Power Generation
2.) **Caterpillar**
3.) **Detroit Diesel**

RESPONSIBILITY:

This system **should** be built, tested and shipped by the manufacturer of the alternator, who has been regularly engaged in the production of engine-alternator sets and associated controls for a minimum of ten years, so there is one source of supply and responsibility.

The manufacturer shall be printed literature and brochures describing the standard series specified (not one of a kind fabrication). The manufacturer shall furnish schematic and wiring diagrams for the engine-alternator set, automatic transfer switch and an interconnecting diagram showing connections to individual components, which constitute the standby power system.

The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include: (1) maximum power level, (2) maximum motor starting capacity, (3) structural soundness, (4) **(Deleted)**, (5) fuel consumption, (6) engine-alternator cooling air flow, (7) transient response and steady state governing, (8) alternator temperature rise per NEMA MG1-22.40, (9) single step load pickup per NFPA, F10, (10) harmonic analysis and voltage waveform deviation per MIL-STP-705B, method 601.4, (11) three-phase short circuit test for mechanical and electrical strength.

WARRANTY (U.S. AND CANADA):
The complete standby electric power system shall be warranted for a period of 5 years or fifteen hundred operating hours, whichever occurs first, from the date of initial start-up. The warranty must be provided by the system manufacturer. Multiple warranties for individual components (engine, alternator, controls, etc.) will be acceptable. Satisfactory warranty documents must be provided.

PRIME MOVER

ENGINE:
The engine shall be diesel-fueled, turbocharged, four-cycle (2-cycle engines are not acceptable), liquid-cooled with mounted radiator, fan and coolant pump.

The engine shall have coolant and oil filters with replaceable elements; lube oil cooler and a fuel transfer pump. Engine speed shall be governed by an Electronic governor to maintain Isochronous alternator frequency from no-load to full-load alternator output. The engine shall have a 24 Volt DC battery charging alternator with a transistorized voltage regulator. Remote, 2-Wire, starting shall be by a 24 Volt, solenoid shift, electric starter.

CONTROL CONSOLE

U.L. 508 LISTED CONSOLE, CUMMINS MODEL PCC 2100 **OR EQUAL** MOUNTED ON VIBRATION ISOLATORS, DC CONTROLS, AC CONTROLS, AND PANEL LIGHTING.

ENGINE MONITORING SYSTEM:
An engine monitor with digital display panel and common external alarm contact and individual alarm contacts indicating each of the following conditions:

SHUTDOWN FUNCTIONS:

ENGINE:
- Low Oil Pressure
- Low Coolant Level
- High Engine Temperature
- Overspeed
- Fail to Crank
- Overcrank

AC ALTERNATOR:
- AC Under Voltage Fault
- AC Over Voltage Fault
- Under Frequency Fault
- Alternator Over Current
- Alternator Short Circuit Fault
- Magnetic Pick-Up Failure
- Emergency Stop Fault

WARNING FUNCTIONS (PRE-ALARMS):

ENGINE:

Low Oil Pressure
High Engine Temperature
Oil Pressure Sender Failure
Temperature Sender Failure
Alternator Over Current
Low Engine Temperature
Engine Overload, with load shed contacts
Low Fuel Level
Low Battery Voltage
High Battery Voltage
Weak Battery
Up to Four Customer Inputs

DC ENGINE CONTROLS:

Run-Stop-Remote Switch, Remote Start-Stop Terminals, Oil Pressure Gauge, Coolant Temperature Gauge, Charge Rate Ammeter, and Solid State Engine Monitoring System.

AC OUTPUT CONTROLS INCLUDE:

AC Kilowatt Meter and Power Factor Meter, plus AC Voltmeter (dual range, indicates all voltages); AC Ammeter (dual range, indicates current each phase); Meter Switch, Voltmeter-Ammeter Phase Selector with an OFF position; Voltage Adjusting Rheostat; Frequency Meter; Running Time Meter; and Generator mounted Mainline Circuit Breaker 600 Amp 100 % rated.

ONAN ALTERNATOR

BRUSHLESS ALTERNATOR:

The alternator shall be a 4-pole, revolving field design with temperature compensated solid state voltage regulator and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semiflexible driving flange to insure permanent alignment. The insulation system shall be class F as defined by NEMA MG1-1.65. Actual temperature rise measured by resistance method at full load shall not exceed 105 Degrees C to provide additional allowance for internal hot spots. The three phase, brushless, broad range, reconnectible alternators shall have be twelve leads reconnectable. The minimum motor-starting shall be 515 KW, at 90% sustained voltage.

UNIT PERFORMANCE:

Frequency regulation shall be Isochronous from no load to rated load. Voltage regulation shall be within plus or minus +/- .5 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 35 percent of rated voltage when full, 3-phase, load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within 4.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage. A rheostat shall provide a minimum of plus or minus 5 percent voltage adjustment from rated value. Temperature rise shall be within NEMA MG1-22.40 definition.

WEATHERPROOF ATTENUATED GENERATOR ENCLOSURE:

The engine-generator shall be enclosed in a factory-installed weather-proof Sound Attenuated Enclosure. Reduction to be **minimum** 74 DBA at 23 feet. The enclosure shall be heavy gauge, reinforced sheet steel, and attached to the generator set standard mounting base. The enclosure shall have fixed intake and exhaust air louvers as required to meet the engine-generator cooling air requirements. A factory-installed critical grade exhaust silencer shall be also be provided and must be located inside the enclosure. Enclosures that mount Mufflers on the exterior will not be acceptable.

SUBBASE TANK

The engine generator shall be provided with a **minimum** 660 Gallon Sub-base tank, with a Secondary Containment. The generator shall be installed on the tank by the generator supplier and all fuel line piping shall be completed. Provide the tank with Low Level, High Level and Rupture Float switches. The High Fuel Float Switches **should** activate at 85% and 95% Full. These alarms shall be wired to the appropriate alarm terminal points in the generator control panel. Also provide a fuel level gauge, 2" locking fill cap, 2" working vent cap, 6" emergency vent, and 6" Secondary Containment Vent. All vent lines to be terminated outdoor.

INSTALLATION

GENERATING SET MOUNTING:
The electric generating set shall be equipped with manufacturer specified vibration isolators and a structural steel base which shall be adaptable for mounting to any suitable level surface.

EQUIPMENT

ACCESSORIES:
All accessories needed for the proper operation of the generating set shall be furnished. These shall include a critical muffler, flexible exhaust connection with flanges, nuts, bolts, and gasket set, 1.5 KW, 120 Volt, Single Phase Jacket Water Heater, Starting batteries, Battery Charger, battery cables, battery rack, and five sets of detailed operation and maintenance manuals with parts list.

START-UP & TESTING

The engine-generator set shall be tested under full rated load with a resistive-type load bank for two (4) hours. The supplier shall also demonstrate that the engine-generator meets NFPA 110 Para. 5-13.2.2 for single step load pick-up. The engineer and owner shall be notified in advance and be given the opportunity to witness this facility's test. A summary of these test results shall be provided to the owner at the completion of these tests.

After Load Bank Testing Simulate Power Failer and test for operable system. Train Maintenance Personnel in proper operation and maintenance of entire system.

END OF SECTION 263213

SECTION 263353 - UPS 200 KVA

PART 1 - GENERAL

1.1 SUMMARY

This specification describes a three phases, continuous duty, solid state Uninterruptible Power System, hereafter referred to as the UPS. The UPS shall operate in conjunction with the building electrical system to provide precisely controlled power for critical equipment loads. The system shall consist of a solid state inverter, rectifier/battery charger, a storage battery, a static bypass transfer switch, synchronization control circuitry, connection control circuitry, disconnection control circuitry, system metering, system status indicators, system alarm annunciation circuitry, and accessories as specified herein. The system shall automatically ensure continuity of electric power within specified tolerances, without interruption, upon failure or deterioration of the normal power supply. Continuity of electric power to the load shall be supplied by the batteries, up to the specified maximum protection time or until restoration of the normal input AC power source, whichever occurs first.

1.2 STANDARDS

The UPS shall meet the requirements of the following standards:

A. UL listed under 1778, Standards for Uninterruptible Power Supply Equipment

B. IEEE 587-1980/ANSI C62.41 1980 Standards for Surge Withstand ability

C. ISO 9001 Quality Standard

D. The UPS shall be designed in accordance with the applicable sections of the documents published by:

- National Fire Protection Association (NFPA)/ National Electric Code (NEC)
- National Electrical Manufacturer's Association (NEMA)
- Occupational Safety & Health Administration (OSHA)

E. All components shall be listed by Underwriter's Laboratories, Inc. (UL) whenever such listings have been established.

1.3 SUBMITTALS

Submittals shall contain the following documentation:

A. Installation Package: Complete electrical characteristics and connection requirements. Provide detailed equipment outlines with cabinet dimensions and spacing requirements; location of conduit entry/exit paths; location of floor/seismic mounting; available battery types/sizes; all cabinet weights; heat rejection and air flow requirements; single-line diagram; control, and external wiring.

B. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.

1.4 FINAL SUBMITTALS

Upon delivery of the UPS system, the following submittals shall be included:

A. A complete set of installation drawings showing all the information stated in section 1.3.

B. An installation and users manual showing safe and correct operation of all UPS functions.

1.5 QUALIFICATIONS & QUALITY ASSURANCE

A. Manufacturer's Certification: The manufacturer shall specialize in manufacturing of on-line, double conversion three phase UPS modules specified in this document with a minimum of **ten** years documented experience, and with a nationwide first party service organization. The manufacturer shall be ISO 9001 certified and shall design to internationally accepted standards.

B. Factory Testing: Prior to shipment the manufacturer shall complete a documented test procedure to test all functions of the UPS module and batteries (via a discharge test), when supplied by the UPS manufacturer, and guarantee compliance with the specification. The factory test shall be performed in the presence of the customer providing the manufacturer receives adequate prior notice **and if so requested**. The manufacturer shall provide a copy of the test report upon request.

C. Materials and Assemblies: All materials and parts comprising the UPS shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. All active electronic devices shall be solid state and not exceed the manufacturer's recommended tolerances for temperature or current to ensure maximum reliability. All semiconductor devices shall be sealed. All relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies and final products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All products shall be packaged in a manner to prevent penetration by debris and to allow safe delivery by all modes of ground transportation and air transportation where specified.

B. Prior to shipping all products shall be inspected at the factory for damage.

C. Equipment shall be protected against extreme temperature and humidity and shall be stored in a conditioned or protected environment.

D. Equipment containing batteries shall not be stored for a period exceeding three months without powering up the equipment for a period of eight hours to recharge the batteries.

E. Off loading from the truck and setting in place of all equipment including batteries specified herein shall be responsibility of the installation contractor, including and all associated labor, parts, tools and equipment.

F. Installation and wiring of all equipment shall be the responsibility of electrical installation contractor.

1.7 ENVIRONMENTAL REQUIREMENTS

The UPS shall be capable of withstanding any combination of the following environmental conditions in which it must operate without mechanical or electrical damage, or degradation of operating characteristics.

A. Temperature:

UPS Module Operating:	0°C to 40°C
Non-operating:	-25°C to +45°C (-4° to 113°F)

B. Relative Humidity (operating and storage): 0 to 95% non-condensing

C. Barometric Pressure: Up to 1,000 meters above sea level / Up to 10,000 meters above sea level non-operating

D. Audible Noise: Maximum 68 dB "A" weighing @ five feet

1.8 WARRANTY

A. UPS Module: The UPS shall be covered by a full parts and labor warranty from the manufacturer for a period of twelve (12) months from date of installation or acceptance by customer or eighteen (18) months from date of shipment from the manufacturer, whichever occurs first.

B. Battery: The battery manufacturer's warranty shall be passed through to the final customer and shall have a minimum period of one year.

1.9 SERVICE AND SPARE PARTS

The manufacturer shall, upon request, provide spare parts kits for the UPS module in a timely manner; as well as provide access to qualified factory trained first party service personnel to provide preventative maintenance and service on the UPS module when required.

1.10 MAINTENANCE, ACCESSIBILITY AND SELF DIAGNOSTICS

All UPS subassemblies, as well as the battery, shall be accessible from the front. UPS design shall provide maximum reliability and minimum MTTR (mean time to repair). To that end, the UPS shall be equipped with a self-test function to verify correct system operation. The self-test function shall identify the subassembly requiring repair in the event of a fault. The electronic UPS control and monitoring assembly shall therefore be fully microprocessor based, thus doing away with all potentiometer settings. This shall allow:

- Auto-compensation of component drift;
- Self-adjustment of replaced subassemblies;
- Extensive acquisition of information vital for computer-aided diagnostics (local or remote);
- Socket connection to interface with computer-aided diagnostics system.

The UPS shall be repairable by replacing standard subassemblies requiring no adjustments. Communication via a modem with a remote maintenance system shall be possible.

PART 2 - PRODUCT DESCRIPTION

2.1 APPROVED MANUFACTURERS & PRODUCT DESCRIPTION

A. Approved Manufacturer(s): The specified equipment **should** be manufactured by APC-MGE UPS SYSTEMS. **Approved alternate manufacturers are:**

1) **Liebert**
2) **Eaton Powerware**

B. Product Description: This specification describes a three phases, continuous duty, solid state Uninterruptible Power System, hereafter referred to as the UPS. The UPS shall operate in conjunction with the building electrical system to provide precisely controlled power for critical equipment loads. The system shall consist of a solid state inverter, rectifier/battery charger, a storage battery, a static bypass transfer switch, synchronization control circuitry, connection control circuitry, disconnection control circuitry, system metering, system status indicators, system alarm annunciation circuitry, and accessories as specified herein. The system shall automatically ensure continuity of electric power within specified tolerances, without interruption, upon failure or deterioration of the normal power supply. Continuity of electric power to the load shall be supplied by the batteries, up to the specified maximum protection time or until restoration of the normal input AC power source, whichever occurs first.

2.2 SYSTEM DESCRIPTION

A. UPS Design Requirements

1. Module Type: The UPS system shall be a single module system. The individual UPS modules **should** be scalable up to 225 kVA with minimal or no requirements for internal modification should the power level need to be increased.

2. Output Power Continuous Rating: The continuous output power rating of the UPS shall be 200 KVA at a 0.9 lagging power factor.
3. Input Voltage: 480 VAC, ±15%, 3 phase, 3 wire plus ground
4. Output voltage: 208/120 VAC, 3 phase, 4 wire plus ground (adjustable ±5%)
5. Battery Autonomy: The UPS shall be capable of operating at full load for 10 minutes at 0.8 PF output at a temperature of 25°C on battery power.
6. Battery Type: Valve regulated sealed lead acid (VRLA).

B. AC Input Characteristics

1. Voltage: 480 VAC, ±15%, 3 phase, 3 wire plus ground
2. Frequency: 60 Hz (±10%)
3. Power Factor: Up to .9 at full load and nominal input voltage
4. Total Harmonic Distortion: Less than 7.5% @ 225 kVA with full load and nominal input voltage
5. Power walk-in: 0 to 100% over a 5 second period
6. Inrush Current: 100% of nominal input current for less than one cycle
7. Reactive Current: Not to exceed 15% of the UPS nominal input current

C. AC Output Characteristics

1. Voltage: 208/120 VAC, 3 phase, 4 wire plus ground (adjustable ±5%)
2. Frequency: 60 Hz ±2.0 Hz synchronized with bypass (selectable in 0.25 Hz increments), 60 Hz ± 0.05 Hz free running
3. Voltage Regulation: ± 0.5% from no load to full load for balanced load
   +1% for 20% unbalanced load
   ±3% for 100% unbalanced load
4. Voltage Distortion: Maximum of 3% THD, and single harmonics of 1% maximum over the entire linear load
5. Voltage Transient (Step Load) Response: ± 2% for 100% step load change
6. Voltage Recovery Time: Return to within 0.5% of steady state within 16.67 milliseconds (one cycle).
7. Phase Angle Displacement: 120° ± 1° for balanced load
   120° ± 3° for 100% unbalanced load
8. Non-Linear Load Capability: Output voltage total harmonic distortion (THD) shall be less than 4% when connected to a 100% non-linear load with a crest factor not to exceed 3.5.
9. Slew Rate: 2 Hz/second maximum (selectable in 0.5 Hz/sec increments)
10. Power Factor: 0.9
11. Inverter Overload Capability: 125% of rated load for 10 minutes
    150% for 1 minute
12. Bypass Overload Capability: 212% for 200 milliseconds

D. Battery

1. Battery Voltage: 480 VDC nominal
2. Maximum DC Current: Maximum DC current at cutoff voltage **should** be 331 A.

2.3 MODES OF OPERATION

The UPS module shall be designed to operate as an on line reverse transfer system in the following modes:

A. Normal: The UPS module shall continuously supply 100% of the power to the critical load via the inverter. The rectifier/battery charger shall derive power from the utility AC source and supply DC power to the inverter while simultaneously float charging the batteries. The UPS module shall supply uninterrupted power to the total load during normal, emergency, or recharge operation.

B. Emergency: Upon failure of the utility AC power source, the critical load shall be supplied by the inverter, which, without any interruption, shall obtain its power from the battery. There shall be no interruption to the critical load upon failure or restoration of the utility AC power source.

C. Recharge: Upon restoration of the utility AC source (prior to complete battery discharge), the rectifier/battery charger shall power the inverter and simultaneously recharge the battery. This shall be an automatic function and shall cause no interruption to the critical load.

D. Bypass: The static switch shall be used to transfer the load to the system bypass without interruption to the critical power load. This shall be accomplished by turning the inverter off. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverter on.

E. Maintenance: A manual make before break (overlap) system maintenance bypass switch shall be provided to isolate the UPS system output and system static switch for maintenance. This shall allow each UPS module to be tested or repaired without affecting load operation.

F. Downgrade: If the battery only is to be taken out of service for maintenance, it shall be disconnected from the rectifier/battery charger and inverter by means of a battery disconnect. The UPS shall continue to function as specified herein, except for power outage protection and high transient response characteristics.

2.4 COMPONENT DESCRIPTION

A. Rectifier/Battery Charger: Incoming AC power shall be converted to a regulated DC output voltage by the rectifier/battery charger. A solid-state SCR phase-controlled bridge rectifier shall provide regulated DC voltage, which shall be subsequently filtered to provide power for the inverter and battery charging functions. The rectifier/battery charger shall employ input AC current limiting as well as battery charge current limiting for battery protection. The battery charging circuitry shall be capable of being set for automatic battery recharge operation, float service, manual battery charge service and equalizing or commissioning operation.

1. AC Input Protection: The rectifier/battery charger shall be protected by means of an AC input switch. The SCRs shall be protected by fuses that shall only open in the event of catastrophic failure to prevent destruction of the semiconductors and shall not operate as an over-current protection system. Overloads in excess of the rectifier/battery charger's normal rating or sensing of an abnormally high DC voltage condition shall cause the AC input switch to be shunt tripped open.

2. Input Harmonic Current Suppression: The rectifier/battery charger shall be designed to limit the input harmonic current distortion fed back into the input source to less than 10% with nominal input voltage and rated load on the UPS inverter output.
3. Power Walk In: The rectifier/battery charger **should** contain a walk in circuit that causes the unit to assume the load gradually after the input voltage is applied. Currents shall increase from 20% to 100% over a 5 second period after the battery open circuit voltage has been reached.
4. Inrush Current: The initial magnetization inrush current shall be limited to 100% of the rectifier/battery charger full load current.
5. Input Reactive Current: The rectifier/battery charger shall limit the reactive current to less than 15% of the nominal input current at no load preventing excessive reactive current from interfering with generation operation. Reactive current shall be inhibited with a 100% solid state system.
6. Overload Protection and Disconnection: An automatic input circuit breaker shall be provided to disconnect the rectifier/battery charger in the event of an overload or abnormally high DC bus voltage. The overload protection system shall not be activated when the rectifier/battery charger is started under any normal operating conditions.
7. Capacity: The rectifier/battery charger **should** have sufficient capacity to support a fully loaded inverter and recharge the battery to 95% of its full capacity within 10 times the discharge period when input current limit is set at 125% of the normal full load rating.
8. Current Limiting: Two separate and distinct current limiting schemes shall be employed in the rectifier/battery charger.

    a) Input AC Current Limit: The AC input current limit **should** operate such that the total DC output current of the rectifier/battery charger is sufficient to operate the inverter at rated load and recharge a discharged battery to 95% of its original capacity in 10 times the discharge period. Current demands in excess of this setting shall cause a corresponding decrease in the rectifier/battery charger output DC voltage. Input current limit shall be set at 150% of nominal input current. A programmable second step input current limit, allowing a further limit of the input current, shall be activated by a dry contact input.
    b) Battery Charging Current Limit: The battery charge current limit **should** limit the DC recharge current by reducing the rectifier/battery charger DC output voltage when a set current limit set in the UPS personalization is reached. The charger may apply up to 10% of the nominal DC current to the battery, ensuring a recharge time equal to 10 times the discharge time at full load. A second, lower charge current limit shall be provided and activated by a customer provided dry contact input.

9. Battery Charger Operation: The battery charger logic circuitry **should** be set up to manually accommodate four modes of operation by an internal selector switch.

    a) Automatic: In this mode of operation, the battery charge output voltage shall be set at a charge voltage which shall be slightly higher than the normal float voltage after the UPS experiences input AC power outages of a set (selectable between 0 - 255 seconds) duration. After (0 - 255 seconds) of operation at the charge voltage, the battery charger output voltage shall automatically revert to the normal float voltage condition. For input AC power outages of less than the selected duration, the normal float voltage level shall be maintained.

b) Float Service: In this mode of operation, the battery charger output voltage shall be capable of providing a float voltage that can be adjusted to the desired value depending on the number and type of cells used in the external battery.

c) Manual Charge Service: In this mode of operation, the battery charger output voltage shall be capable of being set to a voltage slightly higher than the normal float voltage setting. Normally, the charge voltage setting shall be set at the maximum float voltage setting specified by the battery manufacturer.

d) Equalize/Commissioning Service: This operation shall be performed with the UPS inverter turned off. The equalize or commissioning voltage shall be capable of being set at 2.4 to 2.6 Volts per cell for a lead acid battery. The equalize or commissioning operation shall only be performed:

1) on new batteries that are supplied dry charged with separate electrolyte
2) on an installed battery that has significant voltage differential from cell to cell
3) if specified by the battery manufacturer as part of the normal start-up sequence for commissioning the use of this battery

10. Timed Charged Sequence: The battery charger shall be equipped with a manual and selectable timer that can be used periodically to maintain the battery in optimum condition. At the conclusion of the selected charge period, the battery charger output voltage shall revert to the normal float voltage setting.

B. Inverter: The UPS output **should** be derived from a Pulse Width Modulated (PWM) output signal with active error gain correction, and **should** utilize IGBT (insulated gate bipolar transistors) on the inverter design. The inverter shall be capable of providing the specified precise output power characteristics while operating over the battery voltage range with no deterioration of performance specifications.

The inverter assembly **should** be constructed of modular rack mounted assemblies to facilitate rapid maintenance and inspection.

1. Output: The inverter output voltage and capacity shall be as specified and shall operate in accordance with the following regulation requirements:

a) Static Voltage Regulation: The inverter steady state output voltage shall not deviate by more than ± 0.5% due to the following conditions:

1) 0% to 100% load
2) Ambient temperature variations
3) Minimum to maximum DC bus voltage
4) Balanced load conditions
5) Loss or return of main *AC* input power

For balanced load conditions, the inverter phase displacement shall be 120° ±1° maximum. For 100% unbalanced loads, phase displacement shall be 120° ±3° degrees maximum.

b) Voltage Adjustments: The inverter shall have a control to manually adjust the output voltage ± 5% from the nominal value.

c) Frequency Control: The output frequency of the inverter shall be controlled by an oscillator, which shall be operated as a free-running unit when not synchronized to the bypass AC input source. The inverter shall track the synchronizing source within ± 2 degrees. If the external synchronizing source deviates from the preset frequency by ±0.5 Hz, the oscillator shall automatically revert to a free-running mode of operation.
A customer provided contact closure shall be provided to (1) allow the unit to be operated continually on its internal oscillator with the static bypass transfer switch disabled or (2) for normal operation whereby the UPS inverter synchronizes to the bypass AC input source and the static bypass transfer switch is enabled.

d) Frequency Regulation: The inverter free-running (non-synchronized mode of operation) steady state output frequency shall not deviate by more than ± 0.1% from the nominal frequency due to the following conditions nor should the inverter output have any frequency transients for the system disturbances:

1) 0% to 100% load
2) Ambient temperature variation.
3) Minimum to maximum DC bus voltage

e) Harmonic Distortion: The inverter shall provide active output filtering necessary to limit the output voltage waveform distortion (THD) to:

1) Total Harmonic Distortion (THD) maximum of 3%, and single harmonics of 1% maximum over the entire linear load
2) Non-Linear Load Capability. Output voltage total harmonic distortion (THD) shall be less than 4% when connected to a 100% non-linear load with a crest factor not to exceed 3.5.

f) Dynamic Regulation: The inverter dynamic voltage regulation shall not exceed ± 5% due when a 100% load step is applied or removed with 0% or 100% initial load.

g) Transient Recovery: The output voltage shall return to within ± 0.5% of the steady state value within 16.67 milliseconds (1 cycle).

h) Overload: The inverter shall be capable of supplying currents and regulated voltage for overloads up to 125% of full load current for a period of 10 minutes and 150% current for one minute. The static bypass transfer switch shall transfer the load to bypass if the overload exceeds the inverter's instantaneous rating of approximately 167% or the time periods previously stated.

i) Fault Clearing: The inverter shall electronically current limit to protect against excessive overload conditions. Simultaneous to turning the inverter off, the static bypass transfer switch shall be used to transfer the load to the bypass AC input source, which shall be used to provide the necessary fault clearing current required. If the bypass is not available, the inverter shall current limit at 212% of rated output current for 200 milliseconds. If the fault is not cleared, the inverter shall shut down if bypass is still not available.

j) Inverter DC Protection: The inverter shall be protected by the following features that shall be independently adjustable for maximum system flexibility.

1) Output Protection: The inverter shall immediately current limit to protect against overloads and abnormal load conditions, which exceed the unit's rating without sustaining any damage to any part of the UPS.

2) Over-current Protection: The inverter shall be protected from excessive overloads, including faults and reverse currents, by fast-acting fuses to prevent damage to power semiconductors. The purpose of the inverter output fusing shall be only to clear inverter failure faults. These fuses shall not clear in the event of a load short on the inverter output.

3) Surge Protection: The inverter shall have built-in protection against under voltage, over current, and over-voltage surges on the output caused by load transfer between the UPS and the bypass AC input source.
4) Output Load Power Factor: The UPS inverter shall be designed to provide the rated kW specified when connected to loads with power factors ranging from 0.8 lagging to unity and shall have a minimum output power factor of 0.9.
5) Thermal Overload Protection: The inverter shall be provided with thermal overload protection to alarm and then protect against fan failures and high internal ambient temperature conditions.

C. Static Bypass Transfer Switch: A static bypass transfer switch shall be provided as an integral part of the UPS. The control logic shall contain an automatic transfer circuit that senses the status of the inverter logic signals and alarm conditions to provide an uninterrupted transfer of the load to the AC bypass input source without exceeding the transient limits specified herein when a malfunction occurs in the UPS or when an external overload condition occurs. The static bypass transfer switch shall be an electronic static type switch, which provides a make before break or seamless overlap type transfer. The static bypass transfer switch shall be 100% rated for continuous duty and shall not rely on any mechanical current carrying components.

a) Uninterrupted Transfer: The static bypass transfer switch shall automatically cause the bypass source to assume the critical load without interruption after the logic senses one of the following conditions:

1) Inverter overload exceeds UPS maximum output rating
2) Battery protection period expired and bypass source is available
3) Inverter failure

b) Interrupted Transfer: If the bypass source is beyond the conditions stated below, an interrupted transfer (not less than 0.2 seconds in duration) shall be made upon detection of a fault condition.

1) Bypass voltage greater than ± 10% from the UPS rated output voltage
2) Bypass frequency greater than ± 2 Hz (selectable in 0.25 Hz increments) from the UPS rated output frequency

c) Automatic Uninterrupted Forward Transfer: The static bypass transfer switch shall automatically forward transfer, without interruption, after (1) the UPS inverter is turned "ON", or (2) after an instantaneous overload-induced reverse transfer has occurred and the load current returns to less than the unit's 100%.
d) Manual Transfer: A manual static transfer shall be initiated from the System Status and Control Panel by turning the UPS inverter off.

e) Overload Ratings: The static bypass transfer switch shall have the following overload characteristics:

1) 1000% of UPS system output rating for 0.1 seconds
2) 160% of UPS system output rating for 5 minutes

3.0 SYSTEM CONTROLS AND INDICATORS

Galaxy PW System **or equal** Status and Control Panel: The control panel on Galaxy PW™ **or equal** UPSs shall comprise the controls and indications required to check the general status of the system. The control panel shall be designed to provide an easy and rapid overview of system status and shall not require particular training. The UPS information shall concern only the UPS on which the panel is located..

The control panel shall indicate:

- normal operation (load protected)
- operation with load on battery power
- abnormal situations (operating problem)
- dangerous situations (load not protected)

A. System Status and Control:

1. The UPS **should** be provided with a status/control panel for each of the UPS modules. The System Bypass Cabinet used on multi-module systems shall also include an LCD display and control panel for system level monitoring. The UPS control panel shall include a day light visible high contrast display for status/alarm, metering and display of operating instructions.
2. The control panel shall include an LED mimic diagram to indicate the power flow of the UPS module.
3. UPS operation shall be controlled via a microprocessor controlled logic system. All operations and parameters are firmware controlled and shall not require any manual adjustments or potentiometers.
4. The UPS microprocessor personalization shall be protected by a password and electronic key.

B. Self Test and Diagnostics: The logic circuitry shall include self-test and diagnostic circuitry such that a fault can be isolated down to the printed circuit assembly or plug-in assembly level. Every printed circuit assembly or plug-in power assembly shall be monitored. Diagnostics shall be performed via a PC through the local diagnostic port on the unit.

C. Display and Controls: The UPS modules and System Bypass Cabinet shall be provided with a system status and a control panel that controls, monitors and displays system operation and parameters. The UPS display **should** utilize a combination of front panel steady state and flashing LEDs, a 40-character x 5-line backlit LCD display and mechanical keypad. The display/keypad shall incorporate multiple menus (listed below) which provide step-by-step procedures for system operation, display metering (listed below) functions, and display of more than 40 normal and alarmed conditions (listed below).

1. LED Indicator Panel: The control panel **should** have an LED indicator array showing with the following LED indicators:

"Rectifier/charger" LED

a) light off: rectifier/charger OFF
b) light shines green: rectifier/charger ON
c) light shines red: rectifier/charger fault

In the event of a rectifier charger fault the associated alarms **should** be displayed on the alphanumeric display panel:

a) input circuit breaker Q1 open
b) protection fuse at the rectifier/charger input (FUE) blown
c) abnormally high internal rectifier/charger temperature
d) abnormally high battery charge current
e) abnormally high battery voltage
f) fault, non-calibration or non-personalization of the electronic control board for the rectifier/charger
g) fault on the electronic power-supply board
h) abnormally high temperature in the harmonic filter inductor

"Battery" LED

a) light off: battery float charging
b) light flashing green: battery recharging
c) light shines green: load on battery power
d) light flashing red: low-battery shutdown warning
e) light shines red: battery at end of back-up time and circuit breaker QF1 open, or battery fault

"Static-bypass" LED

a) light off: bypass AC source within specified tolerances and static bypass open
b) light shines green: static bypass closed
c) light shines red: the stored alarm indicates one or several of the following faults:
d) bypass AC source voltage or frequency outside specified tolerances
e) static-bypass fault
f) abnormally high internal static-bypass temperature
g) static-bypass ventilation fault
h) power-supply fault for the static-bypass control function
i) fault on the electronic board controlling the transfer function
j) non-calibration or non-personalization of the electronic control board for the inverter
k) fault on the electronic power-supply board
l) fault on monitoring the "inverter ready" response channels (parallel UPS system)

"Inverter" LED

a) light off: inverter OFF
b) light flashing green: inverter starting, inverter ON but not connected to the load
c) light shines green: normal inverter operation

d) light shines red: inverter fault, the stored alarm indicates one or several of the following faults:

- inverter shutdown due to inverter output voltage outside specified tolerances
- protection fuse at the inverter output (FUS) blown
- abnormally high inverter-output transformer temperature
- abnormally high inverter temperature
- output-voltage fault (amplitude or phase) (parallel UPSs)
- fault, non-calibration or non-personalization of the electronic control board for the inverter
- fault on the electronic power-supply board

"Load" LED

a) light off: load not supplied
b) light shines green: load supplied via the inverter or the bypass AC source (via the static bypass)

"Anomaly" indicator LED: This indicator light indicates the presence of anomalies.

2. Audible Alarm: The UPS shall be equipped with an audible alarm which will sound under the following situations:

a) load supplied by the bypass AC source;
b) load on battery;
c) operating problems that cause a summary alarm or major alarm condition and require operator attention

The alarm **should** sound slowly and discontinuously for a minor problem or when the inverter is on battery power. When the alarm "LOW BATTERY SHUT-DOWN" is activated, the buzzer **should** sound more rapidly. Finally, if the inverter shuts down, the sound **should** be loud and continuous. The buzzer may be reset by pressing the alarm acknowledge button. If the buzzer is reset, a higher level alarm shall set it off again.

3. Keypad: The Galaxy PW **or equal should** be equipped with a mechanical keypad to allow the navigation of the display and operation of the UPS. The keypad **should** consist of the following keys:

"Inverter ON" button: This button is used to start the inverter locally.

"Inverter OFF" button: This button turns the inverter off locally. The key **shall** be depressed for over three seconds to turn inverter off to avoid accidental transfer to bypass.

Menu Select Keys: These keys are used to select commands in the main menu and access the secondary messages.

Validation Key: This key is used to validate the user's choice once a menu item is selected.

Menu Settings Key: This key is used to access the main menu: display language, display-contrast setting, sound level of the buzzer, lamp test, date and time settings, inverse-video and event log.

"V" Voltage key: This key is used to access voltage measurements:

a) normal AC source phase-to-phase volt-ages
b) bypass AC source phase-to-phase and phase-to-neutral voltages
c) load phase-to-phase and phase-to-neutral voltages

"A" Current key: This key is used to access current measurements:

a) normal AC source, bypass AC source and load currents
b) percent load
c) load crest factor

"W. Hz" Power /Frequency Key: This key is used to access other measurements:

a) normal AC source, bypass AC source and inverter frequencies
b) level of active and apparent power drawn by the load
c) load power factor
d) inverter load level (percent)

"Primary Message" key: This key is used to access the primary messages.

"Battery" key: This key is used to access battery measurements

a) battery voltage (or the DC voltage on frequency converters without a battery)
b) battery current (charge or discharge)
c) battery temperature
d) available battery backup time
e) inverter load level (percent)

"Forced-transfer" key: This key is used to voluntarily transfer the load to the inverter or from the inverter to the static bypass (return transfer). Transfer and return transfer are carried out only following confirmation requested by the system display and a warning as to the risk of an interruption in the supply of power to the load.

"Alarm reset" key: This key is used to reset stored alarms. The system accepts resetting only when alarms have been cleared.

"Buzzer reset" key: This key is used to stop the buzzer. However, new alarms set the buzzer off again.

4. LCD Display: The LCD display **should** continuously indicate the system operating status as well as list primary and secondary messages relating to UPS status and operation:

Primary Messages:

LOAD PROTECTED / ON-LINE MODE: This is the normal display when there are no alarms or problems and the load is correctly supplied by the inverter, in on-line mode.

LOAD PROTECTED / PARALLEL ON-LINE MODE: This is the normal display when there are no alarms or problems and the load is correctly supplied by the inverter in a parallel UPS system, in on-line mode.

LOAD NOT PROTECTED / ON-LINE MODE: This display indicates that the load is not supplied by the inverter, or that there is no battery backup. The buzzer sounds continuously.

LOAD NOT PROTECTED / PARALLEL ON-LINE MODE: Situation identical to that in the previous screen, but for parallel UPS systems.

LOAD PROTECTED / BATTERY DISCHARGING: Remaining battery time (min) = XX % kW used = XXX
The load is supplied by the inverter, but the normal AC source is down or outside tolerances and power is supplied by the battery. This message indicates the remaining battery time in minutes prior to inverter shut-down and the percent load. The battery time calculation takes into account:

a) the percentage of full rated load power currently being drawn
b) the type of battery
c) battery temperature
d) battery age

The buzzer **should** sound slowly and discontinuously during:

LOAD PROTECTED / LOW-BATTERY SHUTDOWN WARNING: Remaining battery time (min) = XX % kW used = XXX. This message replaces the preceding if the power outage persists and the warning level has been reached. The user is warned that the battery is about to shut down. The buzzer sounds rapidly and discontinuously.

LOAD PROTECTED / ECO MODE: This is the normal display when there are no problems: the load is supplied by the inverter or the bypass AC source, and battery backup is available.

LOAD NOT PROTECTED / ECO MODE: This display indicates that the load is supplied but has no battery backup. The arrow indicates the presence of one or more problems specified in secondary messages. The buzzer sounds continuously.

LOAD FORCED TO INVERTER ECO MODE: The load has been transferred to the inverter following a specific request by the user.

Secondary Messages:

LOAD ON MAINS 2: The load has been transferred to the bypass AC source (M2) and is no longer protected (only in on-line mode). The buzzer sounds continuously.

MAINS 2 OUTSIDE TOLERANCES / TRANSFER DISABLED / CHECK MAINS 2: The bypass AC source (M2) frequency or voltage is outside tolerances and the inverter is unable to synchronize. Transfer of the load from the inverter to the bypass AC source (M2) or vice-versa will result in an interruption of the supply of power to the load. The buzzer sounds slowly and discontinuously.

BATTERY OVERTEMPERATURE, CHECK VENTILATION: The battery temperature is outside tolerances. The buzzer sounds slowly and discontinuously.

BATTERY ROOM VENTILATION / FAULT / CHECK VENTILATION: A fault requiring servicing has occurred in the battery room ventilation system. The rectifier/charger shuts down after a 30-second time delay. The user must take steps to re-establish correct operation of the ventilation system. This message also signals an abnormally high temperature in the filter inductor. The buzzer sounds slowly and discontinuously.

MAINS 1 OUTSIDE TOLERANCES / CHECK MAINS 1: The normal AC source (M1) frequency or voltage is outside specified tolerances and the rectifier/charger has shut down. The inverter is on battery power.

MAINS 1 INPUT SWITCH Q1 IS OPEN: The normal AC input (M1) switch Q1 is open. It must be closed for rectifier/charger start-up. The buzzer sounds slowly and discontinuously.

INTERNAL UPS FAULT / LOAD TRANSFER FAULT / CALL MAINTENANCE: A fault has occurred in the static switch that transfers the load between the inverter and the bypass AC source (M2). Servicing by the after-sales support department is required. The buzzer sounds continuously.

OVERLOAD / RATED CURRENT PER PHASE = XXX A / CHECK LOAD LEVEL: This display informs the user that load current is greater than rated current, and gives the value. The buzzer sounds continuously.

UPS SHUTDOWN DUE TO AN OVERLOAD / CHECK LOAD LEVEL: This message follows the preceding when the overload persists. The UPS has shut down and the buzzer sounds continuously.

INVERTER NOT IN PHASE WITH / MAINS 2 / TRANSFER DISABLED /CHECK MAINS 2: The phase difference between the inverter and the bypass AC source (M2) is outside tolerances. Transfer of the load between the inverter and the bypass AC source (M2) will result in an interruption in the supply of power to the load. For parallel UPSs, this message should be interpreted as meaning the phase difference between the inverter for which the message is displayed and the other inverter is outside tolerances.

UPS SHUTDOWN BY AN EXTERNAL COMMAND: The inverter has received a command to shut down. The command is in the form of a signal received from the remote indications relay board.

MAINS 2 INPUT SWITCH Q4S IS OPEN: The bypass AC source (M2) input switch Q4S is open, i.e. backup power for the load via the bypass AC source (M2) is not available.

INVERTER OUTPUT SWITCH Q5N IS OPEN: Inverter output switch Q5N is open, i.e. the load cannot be supplied via the inverter.

BYPASS SWITCH Q3BP IS CLOSED: Maintenance bypass switch Q3BP is closed. The system is in maintenance configuration and the load is supplied by the bypass AC source.

STATIC SWITCH (M2) OFF DUE TO AN OVERLOAD: The load is no longer supplied by the bypass AC source (M2), due to an extended overload. The buzzer sounds continuously.

BATTERY CHARGING: The battery is currently being recharged.

BATTERY AT END OF SERVICE LIFE CALL MAINTENANCE: The battery is nearing the end of its estimated service life. This information is based on average service-life calculations since its initial installation. The buzzer sounds slowly and discontinuously.

EMERGENCY OFF: This message is displayed when the external emergency-off pushbutton is pressed. The result is:

a) shutdown of the inverter
b) shutdown of the rectifier/charger
c) opening of the battery circuit breaker
d) blocking of the static bypass
e) opening of the backfeed protection contactor (M2)
f) opening of the Q1 circuit breaker (M1)
g) activation of a relay contact on the remote-indications relay board

Servicing by the after-sales support department is required. The buzzer sounds discontinuously.

THE BATTERY C.B. QF1 IS OPEN / CHECK THE INSTALLATION: Battery circuit breaker QF1 is open. The load is no longer protected because battery power is no longer available in the event of a normal AC source outage. The buzzer sounds continuously.

LOW BATTERY SHUTDOWN: The inverter has shut down at the end of battery power. The buzzer sounds continuously.

INTERNAL UPS FAULT / INVERTER FAULT / CALL MAINTENANCE: A fault has occurred in the inverter. Servicing by the after-sales support department is required. The buzzer sounds continuously.

INTERNAL UPS FAULT / CHARGER FAULT / CALL MAINTENANCE: A fault has occurred in the rectifier/charger. Servicing by the after-sales support department is required. The buzzer sounds slowly and discontinuously.

FORCED TRANSFER TO INVERTER REQUESTED, POWER TO LOAD MAY BE INTERRUPTED, CONFIRM YOUR REQUEST WITH KEY: The requested transfer to the inverter may provoke an interruption in the supply of power to the load if Mains 2 characteristics are not within the specified tolerances.

THE NUMBER OF UPS READY IS INSUFFICIENT, LOAD TRANSFER IN STAND BY: This message may be displayed in non-redundant, parallel UPS systems, when the number of ready inverters in not sufficient to supply the load.

INVERTER NOT CONNECTED: This message may be displayed in parallel UPS systems, when the inverter is not connected to the load.

PARALLEL UPS, FORCED TRANSFER INHIBITED: This message is displayed when forced connection is requested on a parallel UPS system for a power extension.

INTERNAL UPS FAULT, SELF-TEST FAULT: Communication between the system and the display is faulty. The buzzer sounds slowly and discontinuously.

FORCED TRANSFER TO M2 REQUESTED, POWER TO LOAD MAY BE INTERRUPTED CONFIRM YOUR REQUEST WITH KEY: This message is displayed following pressing of the "forced-transfer" key, when the load is supplied via the inverter.

UPS SUPPLIED BY A GENERATOR SET: This message informs the user that the UPS has received the order to limit the current drawn by the rectifier/charger. It is displayed when the corresponding signal is transmitted by the remote indications board which must be configured for this function.

VENTILATION FAULT: This message is displayed when a fault occurs on a fan.

Power Measurements: The UPS display **should** indicate all of the following power measurements for the specific UPS module. System power measurements **should** be displayed on the System Bypass Cabinet display.

a) AC rectifier input source (utility 1)

- phase-to-phase voltages
- currents of the three phases
- frequency

b) AC bypass input source (utility 2)

- phase-to-neutral voltage
- phase-to-phase voltages
- frequency
- currents of the three phases

c) Battery

- voltage
- charge or discharge current
- remaining battery time (for the specific UPS module)
- battery temperature

d) Output load

- phase-to-neutral voltage
- phase-to-phase voltages
- currents of the three phases
- frequency
- active and apparent power
- frequency

Event logging & time-stamping: The Galaxy PW **or equal should** be equipped with a time stamped event log that shall:

a) log all UPS events and alarms with a date and time stamp
b) allow referencing of the last 500 alarm / events that occurred on the UPS module
c) provide general statistical data on UPS operation
d) provide measurement records for a number of physical values concerning system operation.

The time-stamping information **should** be accessed via the Galaxy PW™ **or equal** keypad and display (standard equipment). This information shall also be accessible via the RS232/485 communications board.

The event/alarm log **should** also provide the following system parameters:

a) total backup time (h): this is the total time of operation on battery power since initial startup of the UPS. It is expressed in hours.
b) total time on static switch (h): this is the total time of operation on the static switch since initial startup of the UPS. It is expressed in hours.
c) total time on UPS (d): this is the total time that the load has been supplied by the UPS since initial startup. It is expressed in days.
d) total time with Tbatt > 25° C (h): this is the total time of operation with the battery temperature greater than 25° C since initial startup of the UPS. It is expressed in hours
e) elapsed backup time (min): this is the total time of operation on battery power since the last reset. It is expressed in minutes
f) nb of backups: this is the number of times the load was supplied by the UPS from battery power since the last reset
g) nb of backups < 1 min: this is the number of times the load was supplied by the UPS from battery power for less than one minute, since the last reset
h) 1 min < nb of backups < 3 min: this is the number of times the load was supplied by the UPS from battery power for more than one minute and less than three minutes, since the last reset
i) number of backups > 3 min: this is the number of times the load was supplied by the UPS from battery power for more than three minutes, since the last reset
j) number of overloads < 5 s: this is the number of times the UPS was overloaded (output current greater than In) for less than five seconds, since the last reset
k) number of overloads > 5 s: this is the number of times the UPS was overloaded (output current greater than In) for more than five seconds, since the last reset
l) number of times TBatt. > 25° C: this is the number of times the battery temperature was measured at over 25° C, since the last reset

Operating Log: The UPS **should** maintain an operating log that indicates the last 30 measurements recorded for the given parameter in chronological order. Measurements shall be taken every 30 days. The displayed measurements are instantaneous values. The following parameters **should** be tracked for the operating log:

The battery capacity is the value measured by the UPS microprocessor. It is expressed in Ampere-hours. This value changes over time depending on the parameters of the battery itself and its environment. This measurement is used to check that the battery is capable of supplying the rated power in the event of a utility outage.

The backup time is the value calculated by the UPS microprocessor on the basis of measurements carried out on the battery. It is expressed in minutes. The calculation uses the percent load and the battery charge status at the time of the measurement.

The load level is the ratio between the power supplied by the UPS to the load at the time of the measurement and the rated output of the UPS. It is expressed as a percentage.

Automated Battery Testing: The Galaxy PW **or equal** shall be equipped with a battery management system that logs battery environmental parameters, cycling history and monitors general battery health. The system shall also perform battery performance tests at predetermined intervals to assess battery health.

The battery monitoring system **should** be displayed on the LCD screen. When the battery test button is depressed it shall indicate battery charge status and the estimated remaining service life of the battery. The user shall be able to select the option of manually or automatically (at user predetermined intervals) initiating a battery test. Following the completion of a battery test, the system shall indicate a positive or negative test result prompting further analysis of the battery bank. In the event that the diagnostic system determines that it is dangerous to continue testing the batteries the test shall be interrupted and the operator notified to check the appropriate alarm.

Automatic Diagnostics: The UPS shall be equipped with a continuously operating auto-diagnostic system that evaluates the operating condition of the UPS and all the sub components. In the event that the diagnostics system detects a problem, the system shall sound an audible alarm to alert the operator.

5. Dry Contacts: The Galaxy **or equal** shall incorporate a dry contact relay array along with three communications card ports for use with the optional communication card offerings.

Alarm dry contacts shall be available for external connection. Each alarm shall include form C contacts (configurable as normally open or closed) and rated for 5 Amp @ 250 Volts.

Inputs:

a) Emergency off: A normally closed contact causes shutdown of the inverter and the rectifier/charger, opening of the battery circuit breaker, blocking of the static bypass and activation of a relay contact on the "Media Contacts 11" board.

b) Battery room ventilation fault: A normally open contact causes shutdown of the rectifier/charger.
c) Battery circuit breaker QF1 closed: A normally open contact prevents inverter start-up if the circuit breaker is open.
d) Battery temperature: A PC board placed near the battery supplies information on the battery temperature, thus enabling the rectifier/charger to regulate the battery voltage.
e) "Auxiliary" signals: Depending on the selected settings, these signals may be used to provoke:

- forced shutdown of the inverter (whatever the status of the bypass AC source)
- protected shutdown of the inverter (load transfer to the bypass AC source)
- limiting of the current drawn by the rectifier/charger (programmable value) when supplied by an engine generator set with an insufficient power rating. The additional power required by the inverter is supplied by the battery, which discharges.
- limiting of the battery charge current (programmable value) if the normal AC source is replaced by an engine generator set with an insufficient power rating

Outputs:

a) an auxiliary 24 V power supply, isolated and backed up, is used to supply:

- the undervoltage release of the battery circuit breaker(s) QF1
- the board that measures the temperature in the battery room

b) "low battery" warning signal (volt-free changeover contact) indicating that battery time is about to run out. The warning threshold may be personalized.
c) "load on UPS" signal (volt-free changeover contact) indicating that the load is supplied by the inverter. For a single-UPS unit, one volt-free changeover contact may be used to indicate that the load is supplied by the bypass AC source
d) "load on battery power" signal (volt-free changeover contact) indicating that the inverter is supplied by the battery in the following cases:

- normal AC source outage or voltage drop
- rectifier/charger shutdown
- rectifier/charger current limiting. This signal, which may be used to initiate process saving and shutdown procedures, is time-delayed 30 seconds to avoid unnecessary operations following micro-breaks.

e) "maintenance position" signal (volt-free changeover contact) indicating that:

- maintenance bypass switch Q3BP is closed
- bypass AC source input switch Q4S is open
- inverter output switch Q5N is open
- battery circuit breaker QF1 is open

f) signal to open battery circuit breaker(s) QF1 in the event the "emergency off" button is pressed or to avoid an excessive battery discharge (lasting more than three times the rated backup time plus two hours)
g) repo contact (volt-free changeover contact) used to trip switching devices in the event of an emergency shutdown

h) . "general alarm" information (volt-free changeover contact), which includes:

- internal faults
- information on temperatures outside tolerances in the battery room (optional)
- overload information (> In)
- static-switch ventilation and power-supply faults

3.1 MECHANICAL DESIGN AND VENTILATION

A. Enclosure: The UPS shall be housed in a freestanding enclosure with a dead front construction. The back of the UPS shall be capable of being mounted as close to a wall as practical. The UPS cabinet shall be designed for top cable entry with optional bottom entry cabinets available. Copper wire or bus shall be exclusively for all internal electrical connections excluding heat sink subassemblies.

1. Dimensions: The core UPS module enclosure dimensions shall not exceed 75" high by 81.07" wide by **36**" deep. Installation drawings shall indicate specific module dimensions.
2. Access: Front access only shall be required for installation and maintenance. All power connections and component removal shall be possible from the front only.
3. Color: The cabinet shall be painted an off-white (RAL 9002) color.

B. Ventilation: Forced air-cooling shall be provided to ensure that all components are operated within their specified temperature ratings. Power component modules shall be cooled by redundant fans located directly above critical power components ensuring that the cooling air path is not obstructed. Internal air baffles shall carry heated air from large magnetic components directly outside of the UPS to minimize the interior cabinet temperature. Redundant fans shall also be located above the air baffles. Fan failures or a thermal overload shall be annunciated by a contact closure. Air inlets shall be provided from the front of the UPS enclosure. Air exhaust shall be from the top portion of the unit. Air filters on the inlets shall be provided as standard and shall be readily replaceable from the front of the unit with out the requirement of opening the UPS module doors.

1. Airflow: Airflow shall be up to 2,500 CFM per UPS module.
2. Heat Rejection: Maximum heat rejection per UPS module at full load **should** be 60,050 BTUs per hour (480V/208V).

3.2 BATTERY

A. Battery Disconnect Breaker: Each UPS module shall be furnished with a battery disconnect breaker mounted internal to the UPS. The battery disconnect breaker shall allow complete interruption of all DC current to the UPS module. The battery breaker shall automatically open in the event of the battery voltage falling to the maximum allowable discharge voltage, activating the emergency power off (EPO / REPO) system or when activated to open by other customer specified controlled systems.

B. Battery System: Battery systems shall be provided in accordance with the appended manufacturer's specifications.

C. Battery Type: Batteries shall be sealed maintenance free high rate discharge, lead acid cells consisting of 240 cells per string.

D. DC Cutoff Voltage: Battery end voltage shall not exceed 1.67V per cell.

4.0 ACCESSORIES

A. Battery Cabinet: Matching battery cabinets shall be available in both adjacent or Stand alone versions. All power wiring and control cables for adjacent versions shall be included. Battery disconnect shall be provided. The run time shall be 10 minutes at full load.

B. Remote Alarm Status Panel: A wall mounted panel, **approximately** 17.5"Hx12"Wx4"D, with eight indicating LED's shall display UPS status and any active alarms. The alarms shall be a latching type, such that if an alarm is triggered, the LED will stay ON (latch) even if the alarm is corrected. This feature will provide the operator the chance to verify the occurrence of the alarm. The parameters monitored and controls provided on the RASP panel include:

1. UPS on line (Green LED)
2. UPS on battery (Yellow LED)
3. Load on bypass (Yellow LED)
4. UPS summary alarm (Red LED)
5. Low Battery shutdown

The Remote Alarm Status Panel shall also be equipped with:

- Alarm Test/Reset push-button: (white LED) to reset the latching alarm
- Audible Alarm: for alarm annunciation
- Audible Alarm reset push-button: (white LED) to silence the audible alarm

The RASP door shall be equipped with a key lock. The recommended maximum distance from the UPS module shall be 500 feet.

C. Communication and Software Options: The UPS module **should** be able to accommodate up to three of the following communications options **or their equivalents**:

1. RS232 U-Talk or Dry Contacts (66060): The U-Talk protocol shall be used with Solution-Pac 2 for remote monitoring or graceful shutdown for most popular file servers. The dry contacts will close on predefined conditions to monitor UPS operations. Requires one communication slot and optional cables. The dry contacts will close on the conditions listed below, but shall be user programmable to close on preset thresholds of other user UPS parameters:

   - UPS on Line
   - Load on Bypass
   - UPS on Battery
   - Low Battery Warning
   - Battery Fault
   - General Alarm

Two (2) dry contact inputs shall also be provided to turn the UPS inverter on and off remotely upon closure of the contacts. This feature may also be disabled if required.

2. Network Management Card (66074): The Network Management Card (NMC) shall provide a web interface, SNMP (Simple Network Management Protocol), logging and email capabilities. The NMC shall be used for remote monitoring or graceful shutdown for most popular file servers.

H. Network Based Power Management Software – COORDINATE TYPE WITH OWNER:

1. Solution-Pac 2 **or equal** software shall facilitate the management of the UPS over any point in a wide area network (WAN) or local area network (LAN). The software shall use a distributed, TCP/IP based architecture and must be SNMP manageable. To reduce the volume of network traffic, the software will employ trap reception acknowledgement. The software must be capable of graceful server shutdown of individual or multiple servers from any point on the network for up to 50 servers per card.
2. Enterprise Power Manager software shall facilitate the management of the UPS and servers over any point in a wide area network (WAN) or local area network (LAN). The software shall provide an overall, consolidated view of the main operating parameters of all power devices on the network. The information shall be accessible from any workstation using a standard web browser. The software shall use Secure Sockets Layer (SSL) and several levels of password protection for complete security. MGE network device required.

5.0 FIELD QUALITY CONTROL & SERVICE ORGANIZATION

5.1 FIELD SERVICE ENGINEER QUALIFICATIONS

The manufacturer must employ a 7 X 24 nationwide (international where applicable) field service organization with rapid access to all regions of the nation. The responding service professionals must be factory-trained engineers with an accredited and proven competence to service three phase UPS.

5.2 SPARE PARTS

Field Engineers must have immediate access to recommended spare parts with additional parts storage located in regional depots. Additional spare parts shall be accessible on a 7 x 24 basis from the national depot and must be expedited on a next available flight basis or via direct courier (whichever mode is quickest).

5.3 MAINTENANCE TRAINING

The manufacturer shall make available to the customer various levels of training ranging from basic UPS operation to UPS maintenance.

5.4 MAINTENANCE & SERVICE CONTRACTS

The manufacturer shall offer additional preventative maintenance and service contracts covering both the UPS and the battery bank. Accredited professional service engineers employed exclusively in the field of critical power systems service shall perform all maintenance and service. The manufacturer shall also offer extended warranty contracts.

END OF SECTION 263353

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. Provide Automatic Transfer Switch sized as indicated on drawings. Transfer Switch shall be a complete factory assembled power transfer Switch with electronic controls designed for designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of the normal source and one phase of the emergency source, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. The generator set manufacturer shall warrant transfer switch to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product and employed by the generator set supplier shall service the transfer switches.

1.2 CODES AND STANDARDS

A. The automatic transfer switch shall conform to the requirements of the following codes and standards:

1. UL1008. The transfer switch shall be UL listed and labeled.
2. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
3. CSA 282, Emergency Electrical Power Supply for Buildings
4. IEEE Standard C62.41 and C62.45.
5. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
6. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
7. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
8. NEMA ICS10-1993 – AC Automatic Transfer Switches.

B. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

a. Onan Model OTEC
b. ASCO 7000
c. Equivalent manufacturer approved by the engineer during submittal.

PART 2 - PRODUCTS

2.1 POWER TRANSFER SWITCH

A. Ratings

1. Transfer Switches shall be 600 Amp 3 pole 277/480 Volt 3 phase 4 wire with a withstand and closing rating of 60,000 Amps, in a NEMA 1 enclosure.
2. Main contacts shall be rated for the operation voltage as installed.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

B. Construction

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions.
2. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
3. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.
4. Transfer switches shall be 3-pole and shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
5. Enclosures shall be UL listed and NEMA 1 rated. The enclosure shall provide NEC wire bend space when both sources and the load are all connected from either the top or bottom of the transfer switch. The cabinet door shall be key-locking.

C. Warranty

1. Manufacturer's standard warranty to replace defective equipment for a period of 5 years from substantial completion date.

D. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

2.2 TRANSFER SWITCH CONTROL

A. Solid-state under voltage sensors shall simultaneously monitor both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

B. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensor. Solid-state time delay start, adjustable from 0 to 15 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be silver, dry type contacts factory wired to a field wiring terminal block.

C. The switch shall transfer when the emergency source reaches the set point. Provide a solid-state time delay on transfer, adjustable from 2 to 120 seconds, factory set at 3 seconds.

D. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 6 seconds to 30 minutes, factory set at 5 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

E. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 2 seconds to 10 minutes, and factory set at 5 minutes, beginning on return to the normal source.

F. The control system shall include field adjustable provisions to control the speed of transfer of the transfer switch.

G. Power for transfer operation shall be from the source to which the load is being transferred.

H. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time, as follows:

Normal Available	Start (Gen Set)	Emergency Available
Transfer Timing	Transfer Complete	Retransfer Timing
Retransfer Complete	Timing for Stop	

I. The transfer switch **should** be provided with a battery charger for the generator set starting batteries, **unless the generator has an integral charger**. The battery charger shall be a float type charger rated 10 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs.

J. Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.

2.3 FRONT PANEL DEVICES

Provide control switches mounted on cabinet front for:

A. Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

B. Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

C. Provide LED-type switch position and source available indicator lamps on the front of the transfer switch cabinet.

D. Provide manual overide switch to bypass the control system and transfer load from source to source when control is disabled.

2.4 CONTROL INTERFACE

A. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

B. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

C. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.

2.5 ENCLOSURE

A. Enclosures shall be UL listed. The cabinet door shall be key-locking.

B. Transfer switch equipment shall be provided in a NEMA 1 or better enclosure.

C. Enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

PART 3 - OPERATION

3.1 Open Transition Sequence of Operation

A. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

B. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
2. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.
4. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
5. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

C. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
2. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
3. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 4 - OTHER REQUIREMENTS

4.1 FACTORY TESTING

A. The transfer switch supplier shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

4.2 SERVICE AND SUPPORT

A. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

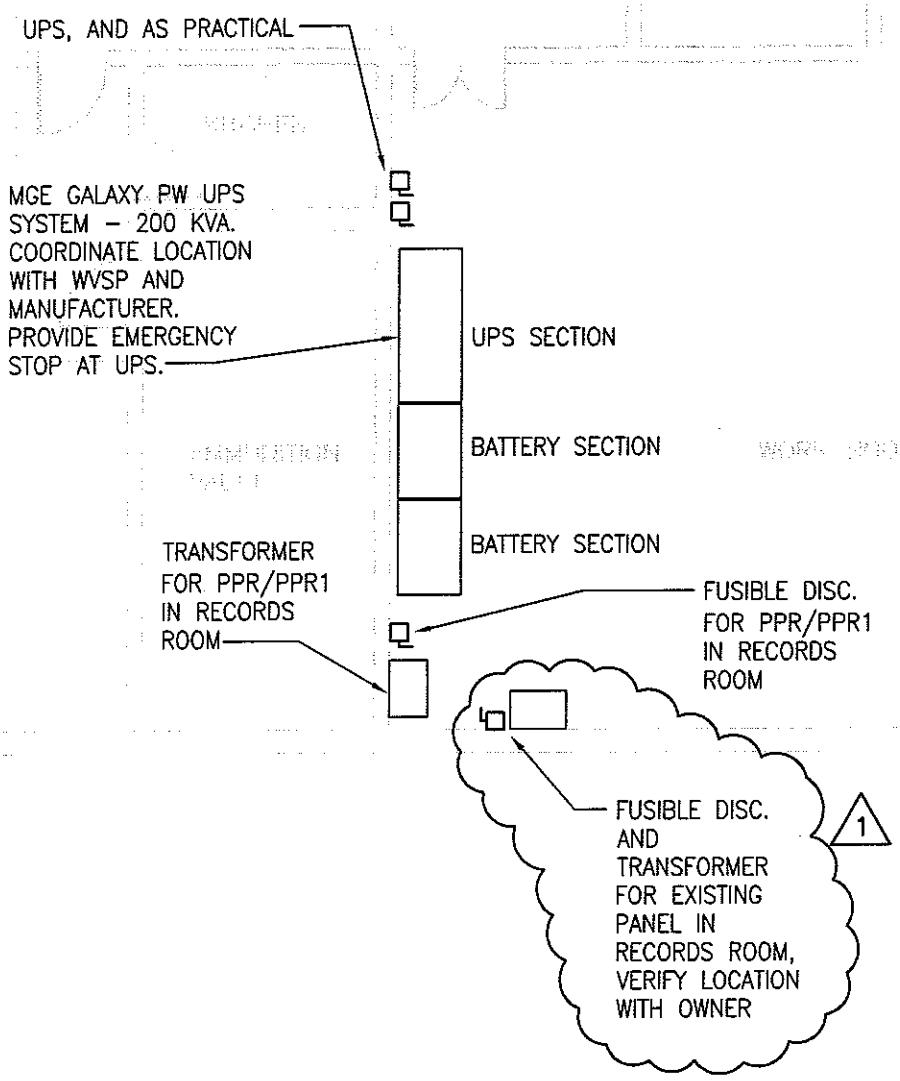
B. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

START UP SERVICES:

Supplier shall provide startup services for one full day to test Transfer Switches as well as the Generator and related and instruct owner on operation and proper maintenance.

END OF SECTION 263600



1 BASEMENT FLOOR POWER PLAN
1/8" = 1'-0"

ELECTRICAL UPGRADE
WEST VIRGINIA STATE POLICE HEADQUARTERS
SOUTH CHARLESTON, WEST VIRGINIA

McKINLEY & ASSOCIATES
ARCHITECTS/ENGINEERS
32 – 20th STREET / SUITE 100 / WHEELING, WEST VIRGINIA 26003
PHONE (304) 233-0140 FAX (304) 233-4813

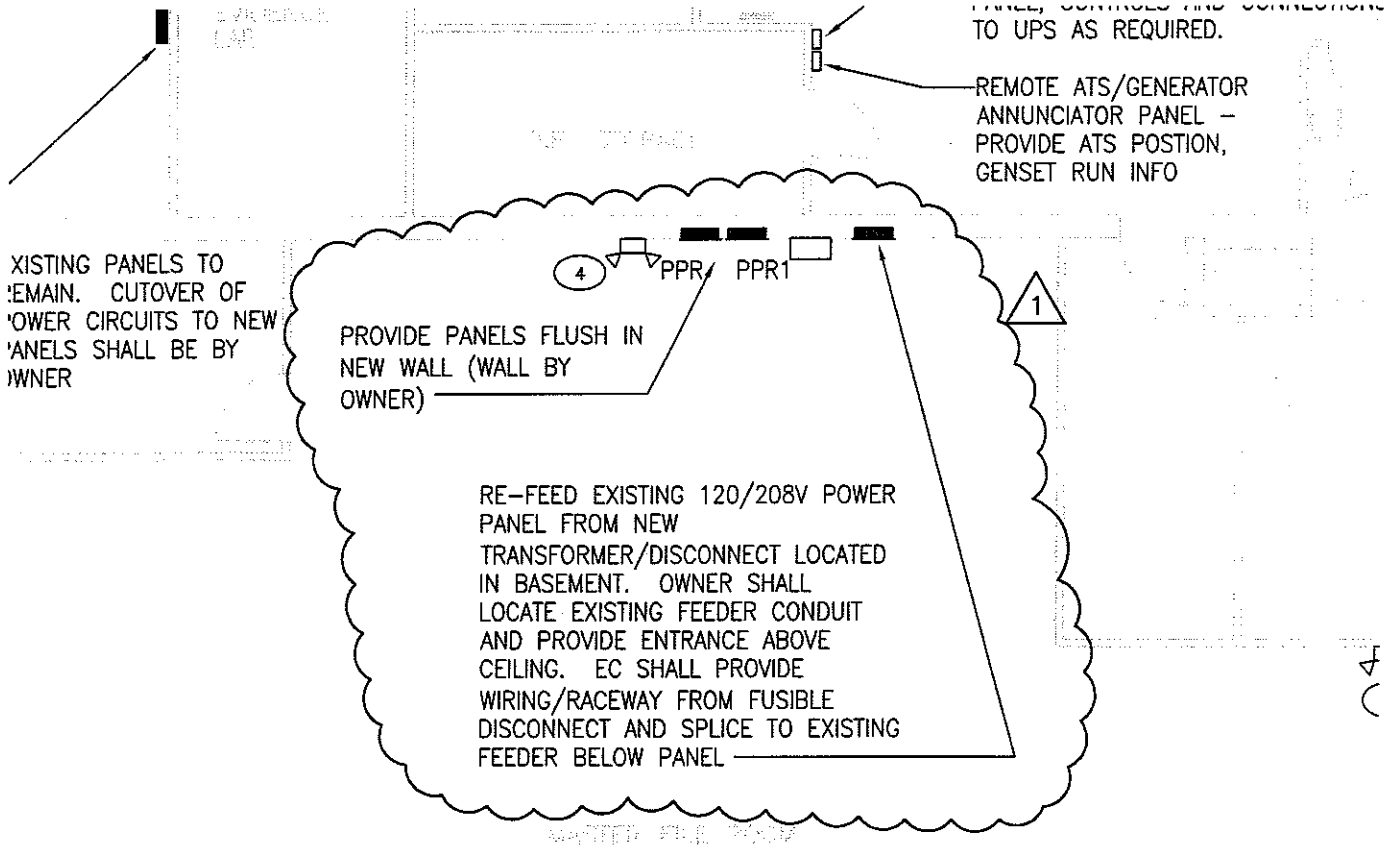
DRAWING TITLE
BASEMENT POWER PLAN
ADDENDUM #2 REVS

DATE
03-26-08

DRAWING REF.
E1.01

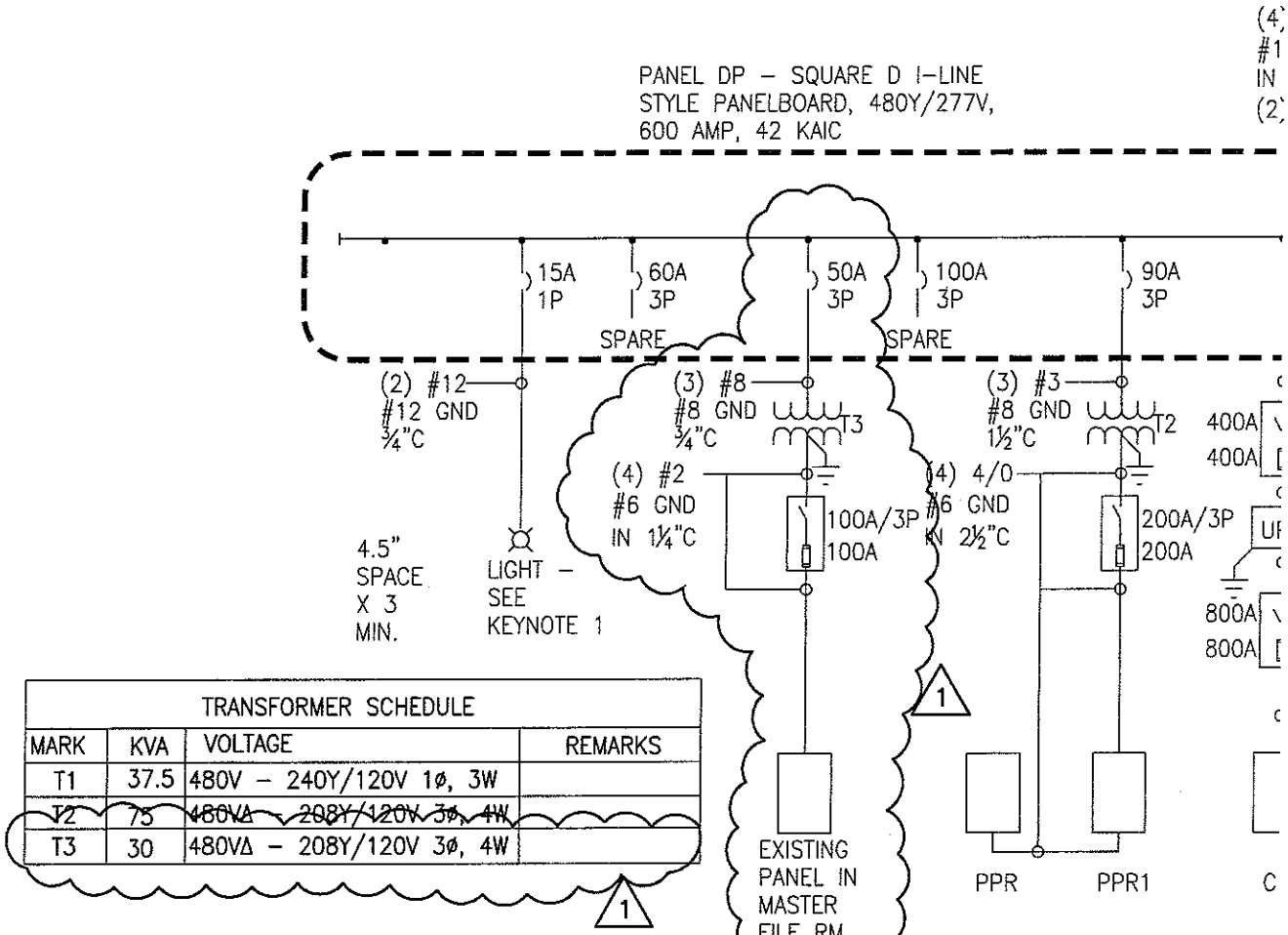
DRAWING No.
ADD2-SK1

41



1 FIRST FLOOR POWER PLAN
1/8" = 1'–0"

ELECTRICAL UPGRADE WEST VIRGINIA STATE POLICE HEADQUARTERS SOUTH CHARLESTON, WEST VIRGINIA	DATE 03–26–08
	DRAWING REF. E1.02
McKINLEY & ASSOCIATES ARCHITECTS/ENGINEERS 32 – 20th STREET / SUITE 100 / WHEELING, WEST VIRGINIA 26003 PHONE (304) 233–0140 FAX (304) 233–4613	DRAWING TITLE FIRST FLOOR POWER PLAN ADDENDUM #2 REVS
	DRAWING No. ADD2–SK2



TRANSFORMER SCHEDULE			
MARK	KVA	VOLTAGE	REMARKS
T1	37.5	480V – 240Y/120V 1ø, 3W	
~~T2~~	~~75~~	~~480VΔ – 208Y/120V 3ø, 4W~~	
T3	30	480VΔ – 208Y/120V 3ø, 4W	

1

ONE LINE DIAGRAM

NTS

ELECTRICAL UPGRADE
WEST VIRGINIA STATE POLICE HEADQUARTERS
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ONE LINE DIAGRAM
ADDENDUM #2 REVS

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03-26-08

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DRAWING No.
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