SECTION 26 33 53

STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.01 WARRANTY

A. Require a two (2) year unconditional warranty on batteries.

B. Require a two (2) year warranty on the equipment.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. UPS Systems:

1. Controlled PowerCompany (CPC)
2. American Power Conversion (APC)
3. Liebert
4. Philips Chloride

2.02 EQUIPMENT

A. Emergency Power Supply (Battery or UPS):

1. Input Voltage:
   a) Single Phase: 120V or 277V, 1Ø, 60 Hz.
   b) Three Phase: 208V or 480V, 3Ø, 60Hz.
2. Output Power:
   a) As required at 0.8 power factor lagging minimum.
   b) Nominal Battery Voltage 384 VDC; Float Operation 2.27 VDC per cell.
   c) Ripple Voltage: less than 1% RMS voltage, with inverter fully loaded and battery disconnected.
   d) Battery AC Current Ripple: less than 1% nominal.
   e) Electronic current limiting input breaker and fuses.
   f) Output voltage: 120V or 277V, 1Ø, 60 Hz or 208V or 480V, 3Ø, 60Hz, ±5 percent.
   g) Total harmonic distortion: less than 3 percent at full resistive load.
3. Batteries:
   a) Battery operating time: 1.5 hours at full load and output voltage.
   b) Maximum recharge time: twelve hours following 1.5-hour discharge.
   c) Utilize Valve Regulated Lead-Acid (VRLA) batteries with a nominal voltage of 384VDC.
4. Efficiency: 86 percent minimum at full load.
5. Accessories:
   a) Remote battery alarm.
   b) Exercising Clock: simulate power interruption for a 15 minute duration every thirty days.

B. UPS Systems:

1. UPS shall be a true double conversion “on-line” system consisting of the following major components:
   a) Rectifier complete with power factor correction.

b) Battery Charger.

c) PWM Inverter utilizing IGBT's (Insulated Gate Bipolar Transistor).

d) Continuous Duty Static Switch.

e) Integral Valve Regulated Batteries in Standard Configuration.

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

   a) Normal: the rectifier derives power from a utility AC source and supplies DC power to the inverter as needed. The rectifier also corrects its input power factor to ~0.97. The battery charger automatically maintains the battery in a fully charged and optimal operational condition. The inverter converts the DC power into clean and regulated AC power that is then supplied to the critical load.

   b) Emergency: upon failure or degradation of the incoming AC power, either utility or generator, the critical AC load supplied by the inverter will draw its power from the batteries. There shall be no interruption of power switching from utility AC power to batteries or while switching from batteries back to utility AC power upon its restoration.

   c) Recharge: upon restoration of utility AC power, even if the batteries are discharged below limits, the UPS will restart, the rectifier and charger shall assume the inverter and battery recharge loads. If the bypass source is within acceptable limits, the UPS will retransfer the critical load back to the inverter.

   d) Bypass: when the inverter overload capacity is exceeded, the static transfer switch shall perform a transfer of the load from the inverter to the bypass source with no interruption in power to the critical load.

3. The system shall withstand any combination of the following external environmental conditions without operational degradation.

   a) Operating Temperature Range: 32ºF (0ºC) to 104ºF (40ºC) for the electronics, however the batteries should not be exposed to prolonged periods of temperature above 77ºF (25ºC). For every 15ºF (8ºC) above 77ºF battery life is cut in half, and may void the battery warranty.

   b) Storage Temperature Range: -4ºF (-20ºC) to 140ºF (60ºC) however batteries should not be exposed to temperatures above 77ºF (25ºC). For every 15ºF (8ºC) above 77ºF battery life is cut in half, and may void the battery warranty.

   c) Relative Humidity: continuous operation with a relative humidity up to 95% non-condensing at 77°F (25°C).

   d) Altitude: normal operation without de-rating is 0 to 5,000 feet (0 to 1,500 meters).

   e) Audible Noise: audible noise generated by the UPS shall not exceed 55 dBA when measured at 1 meter in front of the power converter using scale "A" of a standard ASA sound level-measuring device.

4. Cabinet: the UPS unit, comprised of the rectifier, charger, inverter, static transfer switch, and maintenance bypass shall be housed in a single, free standing NEMA type 1 enclosure. Cabinet doors and covers shall be removable for expedient servicing, adjustments, and installation. The UPS cabinet shall be structurally adequate and have casters for ease of maintenance and installation.

5. Rectifier: the rectifier section of the power converter module shall utilize fast acting Silicon Controlled Rectifiers (SCR's). This device shall be a six-pulse, solid-state device. It shall be capable of receiving utility input and rectifying it to produce Direct Current (DC) power at levels sufficient enough to supply the load via the inverter.

   a) Input Protection: the rectifier shall include protection against primary power surges, (except for lightning transients) and under or over voltage conditions. This protection is provided via Circuit Breakers, and Microprocessor Control of the rectifier.

   b) Filtering: sufficient filtering of the rectifier/charger output shall be provided to prevent damage to the battery. Ripple voltage shall not exceed 1% RMS.

c) In-Rush Limiting: when the primary power is applied to the rectifier, the current surge shall be limited to no more than 8 times nominal input current.

d) Automatic Restart: upon restoration of utility AC power after a power outage, the rectifier shall automatically restart, and assume the inverter and battery recharge loads.

6. Charger: a separate charging circuit shall be capable of recharging the batteries during normal operation to ensure maximum life from the battery system.

   a) Charger Capacity: the charger shall have sufficient capacity to recharge a fully discharged battery.

   b) Battery Test: the UPS shall periodically check the battery system for an open cell. If the UPS detects an open cell, an alarm condition shall be displayed and an audible alarm shall sound.

7. Inverter: the inverter section of the power converter module shall utilize Isolated Gate Bipolar Transistors (IGBT's). This solid-state device that incorporates pulse width modulation (PWM) technology, is capable of accepting the output of the rectifier or the battery system voltage and delivering AC power within specified limits to the critical load bus. The inverter shall be microprocessor controlled and include all necessary timing logic and control circuits.

   a) Inverter Start-Up: the inverter shall automatically start up when a start command is generated and shall be stable and ready to deliver power to the load within 2 seconds.

   b) Inverter Protection: inverter IGBT's shall be protected by current limiting circuits. The inverter shall be capable of running indefinitely with the batteries disconnected. For rapid removal of the inverter from the critical load, the inverter's control electronics shall instantaneously turn off the inverter transistors when the inverter's capacity is exceeded. Simultaneously, the static transfer switch shall transfer the load to utility power without interruption to maintain continuous power to the critical load.

   c) Inverter Oscillator: the inverter shall contain an oscillator capable of operating and maintaining the output frequency of the inverter within specified limits. The inverter oscillator shall be capable of frequency synchronization and phase locking to the utility power source frequency. When operating as a slave to the utility power and a failure occurs in the slaving signal, the inverter oscillator shall automatically revert to a free running state and maintain the specified limits. The oscillator shall not drift more than 0.1% while operating at maximum rated operating temperature.

   d) Phase Balance: electronic controls shall be provided to regulate each phase so that an unbalanced load will not cause the output voltage to go outside of the specified voltage unbalance or phase displacement limits.

8. Static Transfer Switch: an internally mounted static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be naturally commutated high speed devices (SCR's) rated to conduct full load current continuously while on bypass power (reserve source). The static switch shall be designed to avoid back-feed into the utility supply. Failure of one SCR shall not effect the operation of the UPS and the failure shall be shown on the LCD display.

   a) Bypass Transfer: the static switch shall automatically and successfully transfer the critical load from the inverter to the bypass source (reserve) under the following conditions:

      i) DC voltage out-of-limits failure.

      ii) Inverter failure.

      iii) Critical load current exceeds inverter overload rating.

      iv) Over-temperature develops within the inverter.

      v) Manual command is given.

      Reserve Transfer shall be automatically inhibited, whenever bypass source parameters are outside predetermined (adjustable) limits, or UPS output and bypass are not synchronized and phase locked.

   b) Retransfer: the static switch shall automatically and successfully retransfer the critical load from the bypass source to the inverter under the following conditions:

      i) Inverter output voltage returns to within specified limits.

ii) Critical load current reduces to within inverter limits.

9. Battery: the UPS shall be designed to utilize Valve Regulated Lead-Acid (VRLA) batteries with a nominal voltage of 384VDC.
10. Maintenance Bypass: bypass switching shall allow the critical load to be fed from a bypass (reserve) power source, while providing isolation of the static switch during maintenance. Provision for testing of the UPS operation without affecting or disconnecting the critical load shall be provided.
11. Front Panel Display: the UPS shall incorporate a Front Panel Display consisting of a backlit LCD Display of 8 lines by 21 characters. This LCD shall display UPS and Battery status, metering, and active alarms. This LCD shall also show a mimic diagram highlighting the current operating status of the UPS.
12. Control Panel Indicators:
    a) Summary Alarm: this shall indicate that the UPS has detected an alarm condition that is currently active.
    b) On By-Pass: this shall indicate that the by-pass path supplies the load.
    c) On Battery: this shall indicate that the UPS Inverter is supplied by the battery system. This shall be indicated when the AC input (Utility or Generator) has failed or is outside of the operating parameters of the Rectifier.
    d) System Normal.
13. Panel Controls:
    a) Inverter On/Off: the button shall allow the inverter to be turned either on or off.
    b) Cancel Audible Alarm: this key shall silence the current audible alarms. The audible alarm shall sound again the next time a new alarm state is detected.
    c) EPO: this button shall allow a user to quickly shut down the UPS system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate unit in an area that is not subject to unusual temperature extremes.

B. Require factory-authorized technician to test and start up system.

3.02 DEMONSTRATION

A. Provide training for DPS Maintenance Personnel on the proper use and maintenance of the all the equipment.

END OF SECTION 26 33 53