SECTION 26 33 53 - STATIC UNINTERRUPTIBLE POWER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty three-phase, solid-state, uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment loads.

B. A static UPS is mandatory for all systems that require memory or control retention such as those found in baggage handling and building management systems.

1.2 SYSTEM DESCRIPTION

A. Design Requirements - UPS Module.

1. Voltage. Input/output voltage specifications of the UPS shall be:

   a. Rectifier Input: As required.

   b. Bypass Input (for dual-input modules): As required.

   c. Output: Three-phase, 4-wire-plus-ground, as required.

   d. Output Load Capacity: Specified output load capacity of the UPS shall be as required at 0.8 lagging power factor.

B. Design Requirements - Matching Battery Cabinet.

1. Battery Cells: Sealed, lead-acid, valve-regulated.

2. Reserve Time: 30 minutes at full load, 0.8 power factor, with ambient temperature between 20° and 30°C.

3. Recharge Time: to 95% capacity within ten (10) times discharge time.

C. Modes of Operation.

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

   a. Normal - The AC equipment is to be continuously powered by the UPS inverter. The rectifier/charger derives power from a utility AC source and supplies DC power to the inverter while simultaneously float- charging a power reserve battery.

   b. Emergency - Upon failure of utility AC power, AC equipment is to be powered by the inverter, which without any switching obtains its power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

   c. Recharge - Upon restoration of utility AC power, after a utility AC power outage, the rectifier/charger shall automatically restart, walk-in, and gradually

resume providing power to the inverter and also recharge the battery system.

d. Bypass - If the UPS must be taken out of service for maintenance or repair, or should the inverter overload capacity be exceeded, the static bypass transfer switch shall perform a reverse transfer of the connected equipment from the inverter to the bypass source without interruption in power to the mission critical AC equipment.

D. Performance Requirements

1. AC Input to UPS DD.

a. Voltage Configuration for Standard Units: three-phase, 4-wire plus ground.

b. Voltage Range: +10%, -20% of nominal.

c. Frequency: Nominal frequency +/-5%.

d. Power Factor: Up to 0.96 lagging at nominal input voltage and full rated UPS output with input filter.

e. Inrush current: 800% of full load current maximum.

f. Current Limit: 115% of nominal AC input current maximum and 100% of nominal for optional generator operation.

g. Input Current Walk-In: 15 seconds to full rated input current maximum. Field selectable 5 or 20 seconds.

h. Current Distortion: 10% reflected input THD maximum at full load with the optional input filter; 30% reflected input THD maximum at full load without the optional input filter.

i. Surge Protection: The UPS shall be able to sustain input surges without damage per criteria listed in ANSI C62.41 Category A and B.

2. AC Output, UPS Inverter.

a. Voltage Configuration: three-phase, 4-wire plus ground.

b. Voltage Regulation:

1) +/- 0.5% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

2) +/- 1.0% three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

c. Frequency: Nominal frequency +/-0.1%.

d. Frequency Slew Rate: 5.0 Hertz per second maximum. Field selectable from 0.1 to 5.0 Hz per second.

e. Phase Displacement:

1) +/- 0.5 degree for balanced load,

2) +/- 1.0 degrees for 100% unbalanced load.

f. Bypass Line Sync Range:

1) +/- 0.5 Hertz,
2) Field selectable +/- 0.5 to 5.0 Hz.

g. Voltage Distortion:
1) 1% total harmonic distortion (THD) for linear loads.
2) 2.5% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating.

h. Load Power Factor Range: 1.0 to 0.7 lagging without derating.

i. Output Power Rating: Rated kVA at 0.8 lagging power factor.

j. Overload Capability:
1) 125% for ten minutes (without bypass source).
2) 150% for one minute (without bypass source).
3) 200% for 10 cycles, pulse paralleling with the static switch.

k. Inverter Output Voltage Adjustment: +/-5% manual adjustment.

l. Voltage Transient Response:
1) 100% load step +/- 5.0%.
2) Loss or return of AC input power +/- 1.0%.
3) Manual transfer of 100% load +/- 3.0%.

m. Transient Recovery Time: to within 1% of output voltage within one cycle.

n. Voltage Unbalance: 100% unbalanced load +/- 1%.

o. Fault Clearing: Sub-cycle current of at least 300%.

1.3 ENVIRONMENTAL CONDITIONS

A. The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

1. Operating Ambient Temperature
UPS Module: 32°F to 104°F (0°C to 40°C).
Battery: 77 +/-9°F (25 +/-5°C).

2. Storage/Transport Ambient Temperature
UPS Module: -4°F to 158°F (-20°C to 70°C).
Battery: -4°F to 92°F (-20°C to 33°C)

3. Relative Humidity
0 to 95%, non-condensing.

4. Altitude (to 33°C)
Operating: to 6,600 ft. (2,000 meters) above Mean Sea Level. Derated for higher altitude applications.
Storage/Transport: to 40,000 ft. (12,200 meters) above Mean Sea Level.

5. Audible Noise
Noise generated by the UPS under any condition of normal operation shall not exceed 65 dBA measured 1 meter from surface of the UPS.

1.4 SUBMITTALS

A. Proposal Submittals

1. Submittals with the proposal shall include:

   a. System configuration with single-line diagrams.

   b. Functional relationship of equipment including weights, dimensions, and heat dissipation.

   c. Descriptions of equipment to be furnished, including deviations from these specifications.

   d. Size and weight of shipping units to be handled by installing contractor.

   e. Detailed layouts of customer power and control connections.

   f. Detailed installation drawings including all terminal locations.

B. UPS Delivery Submittals

1. Submittals upon UPS delivery shall include a complete set of submittal drawings and one (1) instruction manual that shall include a functional description of the equipment with block diagrams, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.5 WARRANTY

A. UPS Module

1. The UPS manufacturer shall warrant the UPS module against defects in materials and workmanship for 12 months after the installation is accepted by LAWA.

B. Battery

1. The battery manufacturer’s standard warranty shall be passed through to the end user.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. A minimum of twenty years’ experience in the design, manufacture, and testing of solid-state UPS systems is required. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

B. Factory Testing

1. Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

PART 2 - PRODUCT

2.1 FABRICATION

A. Manufacturers:

1. **Liebert.**
2. **Eaton Corp.**
3. **Toshiba.**

B. Materials

1. All materials of the UPS shall be new, of current manufacture, high grade and free from all defects and shall not have been in prior service except as required during factory testing.
2. The maximum working voltage, current, and di/dt of all solid-state power components and electronic devices shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of solid-state component sub-assembly shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 95% of their voltage rating at the maximum rectifier charging voltage.

C. Wiring

1. All electrical power connections are to be torqued to the required value and marked with a visual indicator.
2. Provision shall be made for power cables to enter or leave from the top or bottom of the UPS cabinet.

D. Construction and Mounting

1. The UPS unit, comprised of input transformer (if required), rectifier/charger with input filter, inverter, static transfer switch, output transformer and maintenance bypass switch, shall be housed in a single free-standing NEMA type 1 enclosure. Cabinet doors/covers shall require a tool for gaining access. Casters and stops shall be provided for ease of installation. Front access only shall be required for expedient servicing, adjustments, and installation. The UPS cabinet shall be structurally adequate and have provisions for hoisting, jacking, and forklift handling.
2. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. The UPS shall be constructed of replaceable subassemblies. Printed circuit assemblies shall be plug connections. Like assemblies and like components shall be interchangeable.

E. Cooling

1. Cooling of the UPS shall be by forced air. Low-velocity fans shall be used to minimize audible noise output. Fan power shall be provided by the UPS output.
2. The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded.

F. Grounding

1. The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. Provisions for local bonding shall be provided.

2.2 COMPONENTS

A. Input Transformer

1. When required, the input transformer shall be factory installed inside the UPS module cabinet without increasing the standard footprint.

B. Rectifier/Charger

1. General

   a. The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a phase-controlled, solid-state SCR type with constant voltage/current limiting control circuitry.

2. AC Input Current Limiting

   a. The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 115% of the full input current rating. The rectifier/charger shall operate at a reduced current limit mode whenever the critical load is powered from the UPS static bypass circuit such that the maximum UPS input current will not exceed 115% of full load input current. In addition, the rectifier/charger shall have a separate battery current limit, adjustable from 0 to 15% of the full load input current. An optional second circuit shall limit the battery recharge current to zero when activated by a customer-supplied contact closure to signal a customer function such as generator operation.

3. Input Current Walk-In

   a. The rectifier/charger shall contain a timed walk-in circuit that causes the unit to gradually assume the load over a 15-second time interval after input voltage is applied. Walk-in time shall be field selectable for 5 or 20 seconds.

4. Fuse Failure Protection

   a. Power semiconductors in the rectifier/charger shall be fused with fast- acting fuses, so that loss of any one-power semiconductor shall not cause cascading failures.

5. DC Filter

   a. The rectifier/charger shall have an output filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 1% RMS. The filter shall be adequate to insure that the DC output of the rectifier/ charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier/charger with the battery disconnected.

6. Automatic Rectifier Restart

    a. Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in, and gradually resume providing power to the inverter and also recharge the battery system.

7. Battery Recharge

    a. In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

8. DC Over Voltage Protection

    a. There shall be DC over-voltage protection so that if the DC voltage rises to the pre-set limit, the UPS is to shut down automatically and initiate an uninterrupted transfer of the connected equipment to the static bypass line.

C. Inverter

1. General

    a. The term inverter shall denote the solid-state equipment and controls to convert DC power from the rectifier/charger or battery to regulated AC power for supporting the critical load. The inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

2. Overload Capability

    a. The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

3. Fault Clearing and Current Limit

    a. The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.

4. Step Load Response

    a. The output voltage shall be maintained to within to-5.0% with a 0 to 100% step load change or a 100%-to-0 step load change. The output voltage shall recover to within 1% of nominal voltage within 1 cycle.

5. Voltage Distortion

    a. For linear loads, the output voltage total harmonic distortion (THD) shall not be

greater than 1%. For 100% rated load of 3:1 crest factor nonlinear loads, the output voltage total harmonic distortion shall not be greater than 2.5%. The output rating is not to be derated in kVA or kW due to the 100% nonlinear load with 3:1 crest factor.

6. Output Power Transformer
    a. A dry-type power transformer shall be provided for the inverter AC output. It shall have copper wiring exclusively. The transformers hottest spot winding temperature shall not exceed the temperature limit of the transformer insulation class of material when operating at full load at maximum ambient temperature.
7. Phase Balance
    a. Electronic controls shall be provided to regulate each phase so that an unbalanced loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement. With 100% load on one phase and 0% load on the other 2 phases or 100% load on 2 phases and 0% load on the other phase, the voltage balance is to be within 1% and the phase displacement is to be 120 degrees within 1 degree.
8. Fuse Failure Protection
    a. Power semiconductors in the inverter shall be fused with fast-acting fuses, so that loss of any one-power semiconductor will not cause cascading failures.
9. Inverter Shutdown
    a. For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.
10. Inverter DC Protection
    a. The inverter shall be protected by the following disconnect levels:
        1) DC Over voltage Shutdown.
        2) DC Under voltage Warning (Low Battery Reserve), user adjustable from 1 to 99 minutes.
        3) DC Under voltage Shutdown (End of Discharge).
11. Over Discharge Protection
    a. To prevent battery damage from over discharging, the UPS control logic shall automatically raise the shutdown voltage set point as discharge time increases beyond fifteen (15) minutes.
12. Inverter Output Voltage Adjustment
    a. The inverter shall use a software control to adjust the output voltage from +/- 5% of the nominal value.
13. Output Frequency
    a. An oscillator shall control the output frequency of the inverter. The oscillator shall be temperature compensated and hold the inverter output frequency to +/- 0.1% for steady state and transient conditions. Frequency drift shall not

exceed 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1% from the rated frequency.

D. Display and Controls

1. Monitoring and Control

a. The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. A graphical display shall be used to show a single-line diagram of the UPS, and shall be provided as part of the monitoring and controls sections of the UPS. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD display. Additional features of the monitoring system shall include:

1) Menu-driven display with pushbutton navigation.
2) Real time clock (time and date).
3) Alarm history with time and date stamp.
4) Battery backed-up memory.

2. Metering

a. The following parameters shall be displayed:

1) Input AC voltage line-to-line.
2) Input AC current for each phase.
3) Input frequency.
4) Battery voltage.
5) Battery charge/discharge current.
6) Output AC voltage line-to-line and line-to-neutral for each phase.
7) Output AC current for each phase.
8) Output frequency.
9) Percent of rated load being supplied by the UPS.
10) Battery time left during battery operation.

3. Alarm Messages

a. The following alarm messages shall be displayed:

1) Input Line Fault.
2) Input Phase Rotation Error.
3) Input Over/Under Frequency.
4) Input Current Limit.
5) Rectifier Fail.
6) Battery Test Failed.
7) Battery Low Warning (Adjustable 1 To 99 Minutes).
8) Battery Low Transfer.
9) DC Over Voltage Steady State.

10) Bypass Frequency Error.
11) Load On Bypass.
12) Excessive Auto Retransfers.
13) SBS SCR Shorted.
14) Bypass Sync Error.
15) Input Phase Loss.
16) I DC Peak.
17) Output Under Voltage Transfer.
18) Output Over Voltage Transfer.
19) Inverter Overload.
20) SBS Overload.
21) Inverter Overload Transfer.
22) Transfer Failed Shutdown.
23) Hardware Shutdown.
24) Output Power Supply Fail.
25) Inverter Control Fault Transfer.
26) EPO Latched (remote EPO activated).
27) System Fan Fail.
28) Ambient Over Temperature Limit.
29) Over Temperature Timeout Shutdown.

b. An audible alarm shall be provided and activated by any of the above alarm conditions.

4. Status Messages

a. The following UPS status messages shall be displayed:

1) Normal operation.
2) On SBS.
3) Load on UPS.
4) Load on bypass.
5) User Shutdown.
6) Battery Discharging.

5. Controls

a. UPS start-up, shutdown, and bypass operations shall be accomplished through the front-panel pushbutton controls. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic diagram screen shall be available on the LCD screen to depict a single-line diagram of the UPS and indicate switch positions and power flow.

6. On-Line Battery Test

a. The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode. If the battery fails the test, the system shall automatically do the following:

1) Maintain the load through the UPS.

2) Display a warning message.

3) Sound an audible alarm.

b. The battery test feature shall have the following user selectable options:

1) Interval between tests (2 to 9 weeks).

2) Date and time of initial test.

3) Enable/disable test.

E. Static Transfer Switch

1. General

a. A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating of 110% rated load continuously, 200% rated load for five seconds. The static transfer switch shall also have fault-clearing capabilities of: 1100 amperes for 1 second; 3000 amperes for 10 cycles; and 6000 amperes peak for the first half cycle.

b. The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS, or for bypassing the UPS for maintenance.

2. Uninterrupted Transfer

a. The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

1) Inverter overload capacity exceeded.

2) AC output over voltage or under voltage.

3) Battery protection period expired.

4) UPS fault condition.

b. The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

1) Inverter/bypass voltage difference exceeding preset limits.

2) Bypass frequency out of limits.

3) Bypass out-of-synchronization range with inverter output.

3. Uninterrupted Retransfer

a. Retransfer of the mission critical AC equipment from the bypass source to the

inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

1) Bypass out of synchronization range with inverter output.
2) Inverter/bypass voltage difference exceeding preset limits.
3) Overload condition exists in excess of inverter full load rating.
4) UPS fault condition present.

F. Internal Maintenance Bypass Switch

1. General

a. A manually operated maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter, and static bypass transfer switch.

2. Isolation

a. All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static bypass switch shall be provided when the UPS is in the maintenance bypass mode of operation.

3. Maintenance Capability

a. With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static bypass transfer switch.

4. Battery Cabinet System

a. The matching battery cabinet shall include sealed, lead-acid valve regulated battery cells housed in a separate cabinet that matches the UPS cabinet styling to form an integral system line-up. Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker with under voltage release (UVR) shall be included for isolation of the battery system from the UPS module. The UPS shall automatically be disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level. Casters and leveling feet shall also be provided with the battery cabinet for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, the interconnecting cables are to be provided, precut to the correct length and cable lugs installed, by the UPS manufacturer.

G. Accessories

1. Input Filter

a. The rectifier/charger shall include an input filter to reduce reflected input current distortion to 10% THD at full load with nominal input voltage. Another benefit of the input filter shall be to maintain the input power factor at 0.90-0.96 lagging minimum from full load to half load with nominal input voltage.

2. External Maintenance Bypass Cabinet

    a. A matching external maintenance bypass cabinet shall be provided to enable the UPS module to be completely isolated from the electrical system while the critical load is powered through the external maintenance bypass line. This optional cabinet shall provide make- before-break operation for transfers to and from the external maintenance bypass line with a single rotary switch. The following components shall be standard: single rotary switch with auxiliary contacts, inter-cabinet wiring, casters, and leveling feet. The following components shall be optional: input circuit breaker, shielded isolation transformer, and output circuit breaker. This matching cabinet shall bolt to the side of the UPS module with a barrier shield to separate the two cabinets. Only front access shall be required for installation and service.

3. Slim-Line Distribution Cabinet

    a. A matching distribution cabinet shall be provided for flexible cable distribution of power from the UPS output to the critical loads. The distribution cabinet shall include one or two 42-pole panel boards. Both plug-in and bolt-in style panel boards shall be available to accommodate specific site requirements. A main circuit breaker shall be provided with each panel board.

    b. The Slim-Line distribution cabinet shall be designed as a bolt-on section to the UPS module or Maintenance Bypass cabinet for field installation by the installing contractor. The Slim-Line distribution cabinet shall add no more than ten (10) inches to the width of the UPS system.

4. 1+1 Redundant Paralleling

    a. The UPS shall be available in a version capable of parallel-redundant operation. Two modules with the paralleling option board shall be connected to a simple parallel cabinet requiring no system-level controls or displays. The parallel cabinet shall include two module isolation circuit breakers and one system output breaker. All control and load- sharing logic shall be independent and contained within each module. The only control connection between the two modules shall be a single Category 5 Ethernet cable. The UPS modules shall load share within 1% when the Ethernet cable is attached. As a fail-safe operating mode, the UPS modules shall be capable of load sharing within 5% even if the Ethernet cable is removed or damaged after system start-up. In like manner, the system shall be capable of operating normally (including overload and fault handling, manual transfers and automatic transfers to bypass) for an indefinite period with no inter-module signals available.

5. Load Bus Synchronization

    a. The Load Bus Sync® circuit shall synchronize the output of two independent UPSs even if the UPSs are operating from asynchronous bypass sources (e.g. backup generator sets) or on battery power. The Load Bus Sync (LBS) circuit shall consist of a control enclosure and an option card inside each UPS module. The LBS control enclosure shall enable the operator to designate which bypass source will be the Designated Master source, and both UPS systems will synchronize their outputs to that source.

6. Programmable Relay Board

a. Eight sets of isolated Form C contacts shall be provided to indicate a change of status of any of the alarm conditions. Any of the UPS alarms can be programmed onto any channel of the programmable relay board.

7. Remote Status Panel

a. A remote status panel shall be provided and shall include the following:

1) Load on UPS LED.
2) Load On Bypass LED.
3) Battery Discharge LED.
4) Low Battery Reserve LED.
5) UPS Alarm Condition LED.
6) New Alarm Condition LED (for a second UPS alarm condition).
7) Audible Alarm with Reset pushbutton.
8) Lamp Test/Reset pushbutton.

b. The remote status panel shall be provided in a NEMA Type 1 enclosure for wall mounting.

8. Battery Circuit Breaker

a. A battery circuit breaker shall be provided to isolate the battery from the UPS. This breaker shall have an under voltage release (UVR) and auxiliary contacts, and shall be in a separate wall mounted NEMA-1 enclosure. The battery breaker provides a manual disconnecting means, short circuit protection, and over current protection for the battery system. When opened, there shall be no battery voltage in the UPS enclosure. The UPS shall be automatically disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level.

9. Internal Modem

a. The UPS shall come with an internal modem capable of dialing out from the UPS to notify up to two remote computers, terminals, PC's, or pocket pagers when important events occur. The modem will also be capable of accepting incoming calls, with the appropriate security, and connecting to a remote terminal, computer or PC, to perform all those functions normally available on the front panel including viewing monitoring screens.

10. SNMP

a. The UPS shall come equipped with an internal SNMP adapter, which will connect the UPS directly to any I.P. based network using Ethernet communications. The UPS will become a managed device on the network. From a network management station the system administrator shall be capable of monitoring important system measurements, alarm status and alarm history data. In the event of a utility failure the SNMP shall continue with live communication without the requirement of additional or separate UPS equipment until such time as the UPS shuts down for Low battery. On resumption of Utility power the SNMP shall resume full SNMP communication automatically.

11. IBM AS/400 UPS Signal
    a. The following isolated normally open contacts shall be provided for user connection to an IBM AS/400 UPS signal interface:
        1) UPS on (UPS is supplying power).
        2) Bypass active (bypass is supplying power).
        3) Utility failure (battery is discharging).
        4) Battery low (limited battery time remaining).
    b. A 50-foot shielded cable, compliant with NEMA Class 2 for plenum applications, with sub-miniature 9-pin D-type connector, shall be provided for connection to the signal interface.
12. IBM AS/400 Multi-Interface System
    a. An AS/400 Multi-Interface System shall be provided where a single UPS is powering multiple AS/400 units (up to 8). The MultiInterface Unit (MIU) shall provide the required UPS status information to each AS/400 so it can perform an automatic unattended orderly shutdown when necessary. Each AS/400 includes the software required to interface with the UPS. The following status messages are activated in the IBM system:
        1) UPS on (UPS is supplying power).
        2) Bypass active (bypass is supplying power).
        3) Utility failure (battery is discharging).
        4) Battery low (limited battery time remaining).
    b. Each AS/400 individually monitors the UPS status to determine when to initiate a quick power down to preserve data and protect hardware during a utility power outage. This system requires the optional remote contact board to provide isolated contacts. This system shall include a shielded primary cable with a 9-pin subminiature D-shell connector, the AS/400 Multi-Interface Unit (MIU), and shielded secondary cables with RJ11 and 9-pin subminiature D-shell connectors. Cables shall be available in selected lengths from 25 to 300 feet.
    c. IBM and AS/400 are trademarks of International Business Machines Corporation.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Factory-trained field service personnel shall perform the following inspections and test procedures during the UPS startup.
    1. Visual Inspection
        a. Inspect equipment for signs of damage.
        b. Verify installation is correct.
        c. Inspect cabinets for foreign objects.

d. Verify neutral and ground conductors are properly sized and configured.

e. Inspect battery cases.

f. Inspect battery for proper polarity.

g. Verify all printed circuit boards are configured properly.

2. Mechanical Inspection

a. Check all control wiring connections for tightness.

b. Check all power wiring connections for tightness.

c. Check all terminal screws, nuts, and/or spade lugs for tightness.

3. Electrical Inspection

a. Check all fuses for continuity.

b. Confirm input voltage and phase rotation is correct.

c. Verify control transformer connections are correct for voltages being used.

d. Assure connection and voltage of the battery string(s).

3.2 MANUFACTURER'S FIELD SERVICE

A. Service Personnel

1. The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory trained field service personnel dedicated to the start-up, maintenance, and repair of UPS and power equipment. The organization shall consist of regional and local offices.

2. The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, and 365 days/year. If emergency service is required, response time shall be 20 minutes or less.

3. An automated procedure shall be in place to insure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

B. Replacement Parts Stocking

1. Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.

2. Recommended spare parts shall be fully stocked by local field service personnel with back-up available from national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on-call 24 hours/day, 7 days/week, and 365 days/year for immediate parts availability. Parts from the national parts center shall be shipped within 4 hours on the next available flight out and delivered to the customer's site within 24 hours.

C. UPS Operator Training

1. Operator training courses for customer employees shall be available by the UPS manufacturer. The training course shall cover UPS theory, safety, battery considerations

and UPS operational procedures.

2. Training and materials shall be provided for LAWA personnel.

D. Maintenance Contracts

1. A complete offering of preventive and full service maintenance contracts for both the UPS system and battery system shall be available. An extended warranty and preventive maintenance package shall be available. Factory-trained service personnel shall perform warranty and preventive maintenance service.

END OF SECTION 26 33 53