


<p style="text-align: center;"><b>TECHNICAL SPECIFICATIONS for</b>  <b>Single Phase, (3 to 20KVA) &amp; (3 to 15 KW)</b>  <b>Harsh Environment Outdoor Application</b>  <b>NEMA 3R Cabinet</b></p>	
<p><b>Harsh Environment UPS (HE-UPS)</b></p>	<p>HEU6501B 10/06/05</p>

**1. SCOPE**

- A. The UPS shall be a solid-state single phase UPS system designed to provide regulated and conditioned sinusoidal power to both linear and non-linear type loads. The UPS shall provide uninterruptible power during all modes of operation. There shall be no interruption of power to the critical load when the UPS transfers to and from battery operation. The specified equipment herein shall be referred to as a Harsh Environment UPS or HE UPS.
- B. The UPS and batteries shall be designed to fit into a NEMA 3R enclosure intended for outdoor installations. It shall be of modular construction for ease of servicing in the field.
- C. The primary input power source to the UPS shall be utility power.

**2. MODES OF OPERATION**

- A. **NORMAL:** During normal operation, utility (or generator) power is converted to DC, drawing sinusoidal input AC current at unity power factor under all load conditions, this converter supplies DC power to the Inverter and Battery Charger sections. The Inverter supplies the load through the Static Bypass Switch (SBS) without using the energy stored in the battery.
- B. **EMERGENCY:** Upon loss of input power or when power exceeds the specified input limits, the control logic shall allow the inverter to draw energy from the battery without interruption to the load and disconnect the input line. The transfer to battery shall be uninterrupted - "no break" power transfer. The inverter shall supply power from the batteries, through the Static Bypass Switch, to the critical load. The output shall be sinusoidal and within specified limits. If power is not restored before the batteries have been exhausted, the UPS shall completely shutdown - protecting the batteries from possible damage.
- C. **Failure:** In the event of a component failure in either the Rectifier/Converter or the Inverter the unit's SBS will transfer the load, without interruption to the utility power and will alarm providing visual and closed contacts for remote enunciation.
- D. **RECHARGE:** Upon restoration of input utility power and before the batteries are completely exhausted, the UPS shall automatically return to normal operation. This retransfer to normal operation shall be uninterrupted. The battery charger shall automatically recharge the batteries to full capacity.

### 3. APPLICABLE DOCUMENTS

- A. The following documents given below, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered superseding requirements. The following documents shall be for reference purpose only.
- **CSA Listing C22.2 No107.1-95, UL1778, UL924/A** - Underwriters Laboratories Inc. standard for UPS systems and Rectifying Equipment and Specialty Transformers
  - **IEEE C62.41-1991** - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
  - **ANSI NFPA 70** - National Electrical Code
  - **UL 50 and NEMA 250-1991** - Enclosures for Electrical Equipment
  - **CSA C22.1-94** - Canadian Electrical Code, Part I
  - **UL1449** - UL Standard for Safety Transient Voltage Surge Suppressors

### 4. MAJOR SYSTEM COMPONENTS

- A. The UPS and Batteries shall be designed to fit into a NEMA 3R enclosure intended for outdoor installation.
- B. The NEMA 3R cabinet is made of steel (Paint: O'Brien yoke white) with a customized coating system ensuring suitability for outdoor harsh environments. Stainless Steel and aluminum is available as an option.
- C. **BATTERY SUBSYSTEM:** Sealed, maintenance-free batteries shall be provided. The batteries shall have an expected life of ten (10) years. The batteries shall be fully wired and contained within either the UPS cabinet or a separate battery cabinet. Battery run time (based on 100% full load) shall be no less than the specified time. Optional extended battery run times shall be available.
- D. **INVERTER:** The inverter shall convert power supplied, from the utility, when within specified limits or from the batteries, when within the battery manufactures' specified limits, to AC power. It shall be a pulse width modulated (PWM) type design with out the need of a transformer. The unit shall have a single power PCB for maximum reliability.
- E. **Static Bypass Switch:** The unit shall contain a Static Bypass Switch (SBS) as a standard feature. The normal operating mode of the SBS is to connect the Inverter to the critical load with the utility in a standby mode; in case of any converter/rectifier or Inverter failure the SBS will transfer to the Utility without interruption to the critical load. The use of a transformer, to convert the utility, is permitted when the input utility voltage is not the same as the unit's output voltage requirements (i.e. the unit's input is specified as 208 VAC and the unit's output is specified as 277 VAC).
- F. **CHARGER:** The battery charger shall maintain the batteries at full charge. The standard battery charger shall recharge the battery in 10 times the discharge time maximum.
- G. **POWER CONNECTIONS:** The UPS shall be hard wired input and output.

H. AVAILABLE OPTIONS

SECONDARY AUXILIARY OUTPUT CIRCUIT BREAKERS (MAIN OR MAX. 10 TOTAL)
INTERNAL MANUAL MAINT. BYPASS SWT. SAME IN/OUT V (3-7.5KW)
INTERNAL MANUAL MAINT. BYPASS SWT. DIFFERENT IN/OUT V (3-7.5KW)
INTERNAL MANUAL MAINT. BYPASS SWT. SAME IN/OUT V (10-20KW)
INTERNAL MANUAL MAINT. BYPASS SWT. DIFF. IN/OUT V (10-20KW)
DUPLEX 120V RECEPTACLE FOR SERVICE
(5) FORM C CONTACTS ALARMS
MONITORING VIA RS232 AND RS485
GLOBAL MONITORING SYSTEM
EXTENDED WARRANTY AND SERVICE PLAN
HEATER STRIP WITH THERMOSTAT CONTROL
HEATING PAD ASSY. FOR QTY. 8 BATT SYSTEM
HEATING PAD ASSY. FOR QTY. 10 BATT SYSTEM
HEATING PAD ASSY. FOR QTY. 16 BATT SYSTEM
HEATING PAD ASSY. FOR QTY. 20 BATT SYSTEM
LIFTING EYES NEMA 3R AND NEMA 4
TVSS ASYY. FOR 208-240 AND 277V, 1PHASE
SPARE PART KITS AVAILABLE
RUNTIME UP TO 13 HOURS
CABINET STAINLESS STEEL (UPS)
CABINET STAINLESS STEEL (BATTERY)
CABINET ZINC ANODIZED ALUMINUM (UPS)
CABINET ZINC ANODIZED ALUMINUM (BATTERY)
HIGH ISOLATION TRANSFORMER WITH HARMONIC REDUCTION (UP TO K-50)
OUTPUT DISTRIBUTION UNIT
LONG LIFE BATTERY

Table 1

5. MONITORING AND COMMUNICATION SUBSYSTEM:

- A. The system status panel on the UPS shall have a 160-character liquid crystal display. The LCD display shall display UPS operating information such as input voltage, input current, output voltage, output kW, etc. The LCD display will be located inside the cabinet.
- B. Three (3) communication ports shall be provided. One port shall provide dry contact closures for the following parameters:
- Low Battery
  - On Bypass
  - Summary Alarm
  - Input Fail
  - UPS On
- C. The second and third ports shall be based upon the RS-232 / RS485 protocol. Operating parameters, including input and output data and UPS status, shall be available for remote monitoring via the RS-232/RS485 ports.

6. **Optional Global Monitoring System (GMS):** All GMS items are optional. The GMS shall allow for flexibility in local and remote communications including internet access

**2.1.1 Local On UPS Display**

- **Event Log:** Monitoring uP circuit acquires system data and displays up to 50 most recent Date/Time stamped events on the front panel display. Its key-selectable menu provides access to events, system information, display, freeze and delete functions.
- **Aux. CBs Trip Monitor with Event Log:** In addition to the event log and system data, this option registers trips of up to 20 auxiliary output circuit breakers for monitoring of dedicated circuits. Trip signals from the breakers are displayed on a CB trip screen. Trip modules mount easily on a DIN rail with aux.CB's.

**2.1.2 Local On PC - Via RS232 or RS485 Port:** This option requires a PC and LabView monitoring software on a Windows platform. Data sent to PC's is displayed as a control room panel for real-time monitoring. The distance to PC for RS232 cable shall be 25 – 150 ft, RS485 increases the range to 1000 ft

**2.1.3 Remote Dial Up- Monitor 2000:** The Monitor 2000 requires a phone line for remote operation. The device shall send data, voice and text messages to 32 destinations like phone, fax, pager and e-mail via phone line DSL service. The Manager 2000 Windows software installed on a remote PC displays UPS parameters, events and stats graphs. The device shall be installed in the unit and comes fully wired and function-tested

**2.1.4 Web/SNMP Card:** This option is a web enabled monitoring device for a unit with Internet or network connection. The internal IP internet address can be pre-installed in firmware to fit customer network settings. The SNMP/Web card can monitor the UPS on the network through a standard web browser. A Network Management System software with Alarm Viewer utility shall provide monitoring of multiple units on a single console application.

**6. HE-UPS SPECIFICATIONS**

The UPS shall meet the following minimum specifications:

<b>INPUT SPECIFICATIONS</b>	Voltages	120, 208, 240, or 277 VAC
	Voltage Range 3 & 5 KVA	-20% to +15%
	Voltage Range 7.5 – 20 KVA	-15% to +15%
	Frequency	Slew rate of 2 Hz/sec
	Protection	Input circuit breaker provided protection to the unit, load and personnel. Input Circuit Breaker will be higher interruption rated (10, 42, and 65 KAIC)
	Input Current	Sinusoidal, .95 PF under all line/load conditions
	Number of Wires	2 Wires Plus Ground

<b>OUTPUT SPECIFICATION</b>	Available Output Ratings (KVA or KW to be specified)	3 KVA / 2.1 KW 5.0 KVA / 3.5 KW 7.5 KVA / 5.2KW 10KVA / 7KW 12.5 KVA / 8.75 KW 15KVA/ 10.5KW 20 KVA / 14 KW 15 KW
	Output Voltages (All voltages are standard and present on all systems with output transformer)	Same voltage as Input or Multiple Output 120/240, 120/208, or 120/277 VAC
	Voltage Regulations	± 3% No Load to Full Load, High Line to Low Line
	Frequency	60 Hz +/-0. 5 HZ (when on inverter)
	Output Wave Form	Sine Wave
	Harmonic Distortion	<5 % THD; <3% Single Harmonic
	Crest Factor	3 to 1
	Overload	125% for Ten (10) Minutes; 150% Surge for 10 seconds
	Protection	Internal electronic overload protection. Circuit breaker provides inherent overload protection. Factory selectable voltage 120, 208, 240, or 277 for input or output voltage
	Efficiency	90% typical
	Isolation	Complete from line. Output neutral bonded to ground
	Noise Isolation	120 dB Common-Mode: -60 dB Transverse-Mode
	Power Connections	Hard Wired (Terminal Block) Optional Output Receptacle Panels w/ NEMA Type Receptacles and Overcurrent Protection
Number of Wires	2 Wires Plus Ground (120 or 277 VAC Output) 3 Wires Plus Ground (120/240 VAC Output)	

<b>BATTERY SPECIFICATIONS</b>	Run Time	5 minutes – up to 6 hrs available
	Optional Run Time	Select 15 min, 30 min, 45 min, 60 min, 90 min, 120 min, 180 min or 240 min.
	Battery Type	Sealed, Maintenance-Free (AGM) battery, (Optional Long Life Battery)
	Expected Life	10 Years
	Charger Ampacity	≤ 10 times discharge
	Float Voltage	2.25 Volts per Cell
	Protection	Fuses, DC Disconnect or Circuit Breaker

Recharge Time	Conforms to UL Standard	
External Battery	Provisions for hardwire connection of optional external battery cabinets or DC source.	
Packaging	NEMA 3R Anodized Aluminum with customized coating. Stainless Steel is available as an option.	
Nominal DC	Battery Qty.	
3 KVA/3 KW	96 VDC	(8) 12V
5 KVA/5 KW 7.5 KVA/7.5 KW	120 VDC	(10) 12V
10 KVA/10 KW 12.5 KVA/12.5 KW	192 VDC	(16) 12V
15 KVA/15 KW 20 KVA/14 KW	240 VDC	(20) 12V

<b>MONITORING AND COMMUNICATION</b>	Indicators	Internal Liquid Crystal Display for all alarms
	Contacts (electrically dry Rated for 120 VAC @ 2 amps or 24 VDC @ 5 amps)	Closing contacts for each of the following conditions: 1. Unit on Battery 2. Low Battery 3. Summary Alarm 4. UPS On 5. Input Fail
	Local Display	160-Character LCD Display
	Computer communications	RS-232 Interface Port RS-485 Interface Port

<b>ENVIRONMENTAL SPECIFICATIONS</b>	Agency Listings (Product listings)	UL1778, CSA Listed to UL924/A for outdoor application
	Surge Withstandability	ANSI C62.41-1980 Categories A & B
	Temperature	0° to +40°C (Operating) -20° to +40°C (Storage)
	Relative Humidity	0 to 95% Non-Condensing
	Altitude	Up to 6,000 Feet (1,829 Meters)
	Heat Dissipation @full load	859 BTU/Hour 3 KVA 1,314 BTU/Hour 5 KVA 1,973 BTU/Hour 8 KVA 2,629 BTU/Hour 10 KVA 3,287 BTU/Hour 12.5 KVA 3,926 BTU/Hour 15 KVA 5,257 BTU/Hour 20 KVA
	Audible Noise	57 dB measures on “response curve A”

<b>PHYSICAL SPECIFICATION</b>	Dimension (W x D x H)	39” (W) x 20” (D) x 74.5” (H)
	Weight HE unit and Battery Cab	3 KVA: 1246 lbs, battery included 5 KVA: 1399 lbs, battery included 7.5 KVA: 1935 lbs 10 KVA: 1080 lbs, 1771 lbs (battery) 12.5 KVA: 1305 lbs, 2075 lbs (battery) 15 KVA: 1545 lbs, 2549 lbs (battery) 20 KVA: 1999 lbs, 2549 lbs (battery)

## **7. QUALIFIED SYSTEMS**

The unit shall be CSA Listed to UL924 and UL924/A for outdoor application latest revision Standards (at the time this is written).

The UPS shall be uninterruptible power system and manufactured by: OnLine Power, 5701 Smithway St., Commerce, CA 90040. Tel: (800) 227-8899, (323) 721-5017 • Fax: (323) 721-3929 • 24 hour service: (800) PWR-SRVC.

The manufacturer shall be currently certified to ISO 9001 and have 20 years of UPS manufacturing experience.

## **8. USER DOCUMENTATION**

The specified UPS system shall be supplied with one (1) user's manual. Manuals shall include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures, and routine maintenance guidelines.

## **9. WARRANTY**

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for one (1) years. The warranty shall cover all parts and labor for one (1) year. Maintenance contract packages shall also be available.

## **10. QUALITY ASSURANCE**

### **Manufacturer Qualifications**

A minimum of twenty year's experience in the design, manufacture, and testing of solid-state UPS systems is required.

### **Factory Testing**

Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on the internal battery to guarantee rated performance.

## **2.0 PRODUCT**

### **2.1 FABRICATION**

All materials and components making up the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.

#### 2.1.2 Wiring

Wiring practices, materials, and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70) and other applicable codes and standards.

#### 2.1.3 Cabinet

The UPS unit comprised of: power module, battery module, control module, system interconnect module and user interface module housed in a single freestanding enclosure and meets the requirements of IP20. The UPS cabinet shall be anodized aluminum with a customized coating to meet NEMA 3R requirements.

#### 2.1.4 Cooling

The UPS shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.

### **2.2 COMPONENTS**

#### 2.2.1 Input Converter

##### A. General

Incoming AC power shall be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor correction to .95 or greater regardless of the nature of the load and input current shall be sinusoidal with less than 7 % total harmonic distortion regardless of load.

##### B. AC Input Current Limit

The input converter shall be provided with AC input over current protection. The unit has the Input Circuit Breaker.

##### C. Input Protection

The UPS shall have built-in protection against under voltage, Overcurrent, and over voltage conditions including low-energy surges introduced on the primary AC source and the bypass source. The UPS cabinet shall contain an optional input breaker sized to supply full (up to the 20 KVA model) rated load and to recharge the battery at the same time.



D. Input Converter

Input Converter shall automatically monitor and correct the input current to be sinusoidal (power factor correction)

E. Battery Recharge

To prolong battery life, the UPS shall contain battery charging. When an equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries to 90% charge in less than ten hours at nominal input voltage and nominal ambient temperature.

2.2.2 Inverter

A. General

The inverter shall convert DC power from the input converter output, or the battery, into precise regulated sine wave AC power for supporting the critical AC load.

B. Overload

The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 125% of full load current. A visual indicator / alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. 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. The load shall be transferred to bypass when any of the above conditions are exceeded.

C. Maximum Load Alarm

The user receives an alarm when the unit is overloaded (greater than 100%) such that the UPS will alarm before an overload condition.

D. Output Frequency

A microprocessor-controlled oscillator shall maintain the output frequency of the inverter. The oscillator shall hold the inverter output frequency to +/- 0.5% for steady state and transient conditions. The inverter shall track the bypass continuously providing the bypass source maintains a frequency within the user selected synchronization range. If the bypass source fails to remain within the selected range, the inverter shall revert to the internal oscillator.

E. Output Protection

The UPS inverter shall employ electronic current limiting.

F. Battery over Discharge Protection

To prevent battery damage from over discharging, the UPS control logic shall control the shutdown voltage set point. This point is dependent on the levels set by the manufacturer of the particular battery system employed.

### 2.2.3 Display and Controls

#### A. General

An internal panel will consist of a four line by twenty-character LCD display for additional alarm/configuration information. The unit shall also provide the data via RS232 / RS485.

If there is a fault condition, the UPS shall attempt to maintain conditioned power to the load, or at minimum transfer to bypass.

There shall also be indication on each module should the module fail and need to be replaced.

In addition to a visual fault signal, the UPS shall also record fault occurrences in a rolling event log. The event log on the standard unit shall record up to 255 occurrences, with the oldest events discarded first, etc. The user shall have access to the event log through the RS 232 / RS 485 Buses. Every alarm and/or event recorded in the event log will contain a time and date stamp.

### 2.2.4 Automatic Battery Test

The UPS shall initiate an automatic battery testing periodically, at a programmed day and time of day. The user will be able view the log of predetermined battery tests via the RS232 / RS 485.

Should a failure of the battery occur, the UPS will immediately return to normal mode and fault signals (visual and remote via serial ports) shall be communicated. No remote (via serial/contact closures) indication of the battery test shall be communicated during the duration of the automatic battery test.

The automatic battery test factory settings shall be enabled at a once a month at regular interval.

### 2.2.5 Bypass

#### A. General

A bypass circuit shall be provided as an integral part of the UPS. The bypass shall have an overload rating of 300% rated full load for 10 cycles and 1000% for sub-cycle fault clearing. The bypass 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 a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.

B. Automatic Transfers

The transfer control logic shall automatically activate the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

Inverter overload capacity exceeded  
Inverter over temperature  
UPS fault condition

For inverter overload conditions, the transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if one of the following conditions exists:

Inverter/Bypass voltage difference exceeding preset limits ( $\pm 15\%$  of nominal)  
Bypass frequency out of preset limits ( $\pm 5\%$  of nominal frequency)  
  
UPS fault condition present

2.2.6 Internal Battery

Flame retardant, valve regulated, gas recombination, lead acid batteries shall be used as a stored-energy source for the specified UPS system. The expected life of the battery shall be 10 years or a minimum 250 complete discharge cycles. For extended battery reserve time, additional battery modules may be added, if the frame size allows, external battery cabinets shall be also be available as an option.

**2.3 COMMUNICATIONS**

The UPS shall allow for flexibility in communications. The UPS shall be able to communicate through two communications ports simultaneously; the media of either communications port may change without affecting the operation of the UPS. The use of relay contacts shall not affect the operation of the two communications ports.

2.3.1 Relay Contacts

The relay contacts shall be available through at least one DB-9F communication connector, and shall be compatible with the AS 400 system. The UPS shall communicate via relay contact closure the following information:

Low Battery  
On Bypass  
Summary Alarm  
UPS On  
Input Fail

One connector to provide relay contacts shall be fitted on all UPS models as standard. Relay contacts shall be rated 48 VDC, 1 A. Additional signals such as on bypass and summary alarm shall be provided.

2.3.2 UPS Status Information

The software shall be able to retrieve all status information present in the UPS (and available on the display). Retrieval of data shall be through either serial communications or through a network connection via RS 232 / RS 485

## **2.4 ACCESSORIES (OPTIONAL COMPONENTS)**

### **2.4.1 External Battery Cabinets**

The UPS shall have the capability to add external battery cabinets to the base product. These external battery cabinets with chargers and front access battery terminals shall be installed in parallel to provide backup times as required. The connections between the UPS and the extended battery cabinets shall contain DC power only. All of these shall be able to be connected or disconnected safely by the user without interrupting power to the load. These shall be matching NEMA 3R Cabinets.

### **2.4.2 Maintenance Bypass Switch**

The optional Maintenance Bypass switch shall provide a functional bypass protection and shall allow the UPS to provide the load without interrupting power. The Maintenance Bypass Switch shall include a manual break before make bypass transfer switch. The Maintenance Bypass Switch shall be located behind a lockable front panel to provide operation security.

Other Options as shown in Table 1.

## **3.0 FIELD SERVICES (OPTIONAL)**

### **3.1 FIELD QUALITY CONTROL**

Factory trained field service personnel shall perform the following inspections and test procedures during the UPS start-up.

#### **3.1.1 Visual Inspection**

- A. Inspect equipment for signs of shipping or installation damage.
- B. Verify installation per drawings.
- C. Inspect cabinets for foreign objects.
- D. Verify neutral and ground conductors are properly sized and configured.

#### **3.1.2 Mechanical Inspection**

- A. Check all power modules are correctly fitted.
- B. Check all battery modules are correctly fitted.
- C. Check all terminal screws, nuts, and/or spade lugs for tightness.

#### **3.1.3 Electrical Inspection**

- A. Confirm input voltage and phase rotation is correct.
- B. Verify bypass voltage jumper is correct for voltages being used.

## **3.2 UNIT START-UP AND SITE TESTING**

The manufacturer's field service personnel shall provide site testing if requested. Site testing shall consist of a complete test of the UPS system and the associated accessories supplied by the manufacturer. A partial battery discharge test shall be provided as part of the standard start-up procedure. The test results shall be documented, signed, and dated for future reference.

## **3.3 MANUFACTURER'S FIELD SERVICE**

### **3.3.1 Service Personnel**

The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory trained Customer Engineers or 3<sup>rd</sup> party dedicated to the start-up, maintenance, and repair of UPS and power equipment. The organization shall consist of factory-trained Customer Engineers working out of District Offices in most major cities. An automated procedure shall be in place to insure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

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, call back response time from a local Customer Engineer shall be approximately 15 minutes or less.

### **3.3.2 Replacement Parts Stocking**

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

Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

### **3.3.3 UPS Maintenance Training**

Maintenance training courses for customer employees shall be available by the UPS manufacturer. This training is in addition to the basic operator training conducted as a part of the system start-up.

The training course shall cover UPS theory, location of subassemblies, safety, battery considerations and UPS operational procedures. The course shall include AC to DC conversion and DC to AC inversion techniques as well as control and metering, Troubleshooting and fault isolation using alarm information and internal self-diagnostics shall be stressed.

### **3.3.4 Maintenance Contracts**

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. Warranty and preventive maintenance service shall be performed by factory trained Customer Engineers.