

STATIC UNINTERRUPTIBLE POWER SUPPLY GUIDE SPECIFICATION

Model 9330 - 20 and - 40 (10 – 40 kVA)

PART 1 GENERAL

1.01 SUMMARY

- A. This specification describes a continuous-duty, on-line, solid state, three-phase uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the existing building electrical system to provide power conditioning and power backup for electronic loads. The system shall consist of a rectifier, DC to DC Boost Converter, battery charger, PWM inverter, sealed maintenance-free batteries, a control panel, and other features as described in this specification.

1.02 SYSTEM DESCRIPTION

- A. The UPS shall consist of the following components:
1. Input Rectifier
 2. Battery charger
 3. DC to DC Boost Converter
 4. PWM Inverter using IGBT switching devices
 5. Redundant power supply with four voltage source inputs
 6. Sealed Valve Regulated Recombinant Batteries
 7. Internal static bypass rated for continuous duty
 8. Internal maintenance bypass
 9. Monitoring and Control Components
 10. Remote Emergency Power Off (REPO)
 11. Two (2) EIA/TIA-232 (RS-232) Communication ports (One used for service requirements)
 12. Relay Interface (outputs), two programmable relay outputs rated @120VAC/5A
 13. Relay Interface (inputs), For use with (4) voltage-free contact inputs
 14. Communication interface allowing up to (4) communication interfaces at the same time
 15. (OPTION) 10% THD current harmonic input filter, mounted within the base unit enclosure
 16. (OPTION) "Line-Up and Match" External Maintenance Bypass Cabinet w/optional isolation or voltage matching transformer(s) and/or optional 42 pole power distribution panel
 17. (OPTION) Battery cabinets configurable for "Line-Up and Match" or "Remote" installation, for extended run time applications
 18. (OPTION) SBM cabinet to allow connection of up to 4 units, paralleled for up to three (3) times unit capacity and/or one additional unit for redundancy
 19. (OPTION) AS/400 interface Adapter
 20. (OPTION) SNMP Network Adapter
 21. (OPTION) Browser-capable/SNMP Network Adapter
 22. (OPTION) ModBus interface Adapter
 23. (OPTION) Multi Server interface Adapter
 24. (OPTION) Fully isolated form C relay interface (two voltage/current options)
 25. (OPTION) Modem with remote notification capability
 26. (OPTION) Rated, tested and labeled for 30kAIC installation.

- B. Modes of Operation: The UPS shall operate as a double conversion on-line, fully automatic system in the following modes:
1. Normal: The rectifier shall derive power as needed from the commercial AC utility or generator source and shall supply DC power to the DC-to-DC boost converter. The boost converter shall supply filtered and regulated DC to the PWM inverter. The battery charger shall simultaneously charge the battery. The inverter shall convert the DC power at its input to highly regulated and filtered AC power for the critical load.
 2. Emergency: Upon failure of the commercial AC utility or generator source, the inverter shall continue to supply power to the critical load. The inverter shall receive its power, without interruption, from the battery.
 3. Recharge: Upon restoration of the commercial AC or generator source the rectifier shall again supply DC power to the DC boost, which will again supply regulated and filtered DC to the inverter, for powering the critical load. Simultaneously, the battery charger shall recharge the battery. This shall be an automatic function and shall occur without interruption to the critical load.
 4. Bypass: The automatic bypass system shall transfer the critical load to the commercial AC source in the case of an overload, load fault, or internal failures. Return from bypass mode to normal mode shall be automatic except in the case that the overload exceeds specified limits or an internal failure occurs.
 5. Voltage and/or Frequency Converter: The UPS shall be capable of accepting any input voltage or frequency within its input spectrum and shall produce any of its available output voltage and frequency combinations (paragraph 2.04.C.1) on its output with the appropriate options.
- C. Future Expansion: Each UPS module of the 20kVA family shall be field upgradeable from 10kVA to 20kVA or 15kVA to 20kVA. Each UPS module of the 40kVA family shall be field upgradeable from 25kVA to 40kVA, 30kVA to 40kVA or 35kVA to 40kVA. In addition, up to four (4) UPS modules of the same size can be paralleled for up to three (3) times the capacity of one (1) module, with one module reserved for redundancy. These modules will also follow the same kVA upgrade capability as outline above.

1.03 REFERENCES

- A. ANSI C62.41/IEEE 587 - Standards for Surge Withstandability
- B. FCC (Federal Communications Commission) Rules and Regulations, Part 15, Subpart J, Class A certified compliance
- C. UL (Underwriters Laboratories) 1778 Listed (Rev. Jan 5, 2000)
- D. CSA 22.2, No. 107.1 M95
- E. IEC 62040-2 Emission and Immunity
- F. IEC 62040-3 (Uninterruptible Power Systems, Part 3)
- G. EN 60529 Equipment Protection
- H. National Electric Code (NFPA-70)
- I. ISO 9001

1.04 SUBMITTALS

- A. The UPS shall be supplied with sufficient documentation, including a concise operation and installation manual. One copy of the Installation and Operation manual shall be furnished. It shall possess sufficient detail and clarity to enable the owner's technicians to install, understand and operate the system equipment. The manual shall describe the UPS in full by including the following major items:
1. Introduction
 2. Installing the UPS System
 3. Installing and Connecting Batteries
 4. Installing a Remote EPO Control
 5. Understanding the UPS Operation
 6. Operational Controls and Features
 7. Using the Control Panel
 8. UPS Operating Instructions
 9. Using Features and Options
 10. Responding to System Events
 11. Communications
 12. Remote Notification
 13. Maintaining the UPS System
 14. Product Specifications

1.05 QUALIFICATIONS

- A. The manufacturer shall have a minimum of ten years experience in the design, manufacture and testing of solid-state, UPS systems. A list of installed systems of the same type as the manufacturer proposes to furnish for this application shall be available upon request.
- B. The manufacturer shall have ISO 9001 certification.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. The system shall withstand any combination of the following external environmental conditions without operational degradation.
1. Operating Temperature: 0 degrees C to +40 degrees C (32 degrees F to 104 degrees F) continuously without derating (prolonged operation above 25°C will void battery warranty).
 2. Storage Temperature: -20 degrees C to +60 degrees C (-4 degrees F to 140 degrees F). Prolonged storage above +40 degrees C (104 degrees F) will cause rapid battery self-discharge.
 3. Relative Humidity (operating and storage): 95% maximum non-condensing.
 4. Elevation: 5000 ft (1500 m) maximum without derating.
 5. Environmental conditions in accordance with EN 60529 for equipment meeting the IP20 classification.

1.07 WARRANTY

- A. System: The UPS manufacturer shall provide a system warranty against defects in material or workmanship for a period of 12 months from the date of equipment start up or 18 months from date of receipt by end user, whichever occurs first.
- B. Battery: The UPS manufacturer shall warrant the internal battery and batteries contained in the line and match battery cabinet for a period of 12 months from the date of equipment start up or 18 months from date of receipt by end user, whichever occurs first. The battery manufacturer, per the battery manufacturer's standard warranty, shall warrant custom battery systems. Custom battery manufacturer warranties may require record keeping of proper battery maintenance. Battery warranties will be voided in the event of the following:
 - 1. Prevailing ambient temperature of the battery area exceeds 25 degrees C (77 degrees F) for a prolonged period of time.
 - 2. Batteries are not re-charged within 6 months of date of system shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- 1. Approved Manufacturers: Powerware Corporation

2.02 UPS MODULE STANDARD FEATURES

- A. Rectifier: Incoming AC power shall be converted to DC by a full-wave diode bridge rectifier. The DC power shall then be processed by a high frequency resonant converter to supply power to the inverter. In the event of an AC power failure, the battery shall supply power to the resonant converter without interruption. During normal operation, the battery shall be charged by separate internal charging circuitry using an intelligent algorithm to maximize battery life.
 - 1. Overload Capability: The rectifier shall be capable of supplying an overload current of 126% to 150% of rated full-load current for up to 30 seconds and/or 101% to 125% of full rated current for up to 10 minutes. After this time, automatic transfer to bypass (if available) shall occur with no load interruption. Overload protection of the inverter shall be electronic and not require clearing of protective fuses.
 - 2. Current Inrush Limiting: The initial inrush surge shall be limited to six times the full load input current of the rectifier.
- B. Inverter: The inverter shall feature insulated gate bi-polar transistors (IGBT's) in a three-leg, pulse-modulation (PM) design. The regulation control shall include a DSP feedback loop, adjusting the band of the adaptive hysteretic switching, with frequencies between 15 and 30 kHz. The regulated output of the inverter shall supply power to the critical load.
 - 1. Output Voltage: The inverter output voltage is specified in paragraph 2.04.C.1.
 - 2. Voltage Regulation: The inverter steady-state output voltage regulation is specified in paragraph 2.04.C.2.
 - 3. Frequency Control: The inverter output frequency shall be controlled by an oscillator, which shall be operated as a free-running unit or as a slave for synchronizing with the bypass AC source. The inverter shall track the source to within 100 microseconds. If the AC source deviates from the selected line sync range (+/-1 Hz standard specified in paragraph 2.04.C.7.), the oscillator automatically shall revert to a free-running state until the source returns to within the allowable tolerance.

4. Shutdown: The inverter shall instantaneously shut off its power switching devices any time it is unable to support the critical load. The inverter shall be capable of operation during a manual transfer to bypass, if the bypass is enabled.
 5. Parallel operation: The inverter shall be capable of load balancing to provide high reliability when paralleling. Parallel systems shall pass operational information between each module, via the high-speed CAN communication network, however output synchronization shall be a function of the internal logic of each UPS module. Parallel systems shall be capable of output synchronization, even if the CAN (inter-module communication) network is lost, with each module sharing load.
- C. Batteries: The batteries shall be valve regulated, high-rate discharge, lead-acid cells, mounted in front-access slide out trays. Their expected life shall be 200 complete full load discharge cycles when operated and maintained within specifications. Standard run time operation of the UPS shall be accomplished using batteries mounted within the UPS enclosure. Their nominal battery string voltage shall be 288 VDC.
- D. Bypass: This feature shall provide an alternate power path to the commercial AC or generator source in the case of overload, load fault, or internal failure. The bypass source must be within the specified window to be considered acceptable source for bypass operation. Return to normal mode from bypass mode shall be automatic except when the overload continues to exceed specified limits or an internal failure has occurred. The input must match the output in nominal voltage, frequency, and grounding to use the bypass.
- E. Maintenance Bypass: A three-position manual maintenance bypass switch shall be incorporated inside the standard UPS system. This switch shall be used for UPS maintenance and test purposes. The switch shall include "UPS", "Bypass" and "Test" positions to ensure that the switch can properly bypass the loads, while performing maintenance on the UPS module. The switch shall be closed transition (Make Before Break) to allow bypassing, without removing power from the critical load
- F. Dual Feed Power Sourcing: All units shall be capable of connecting power feeds from two independent power sources. Primary power shall feed the UPS rectifier while the secondary source, if used, will feed the static and maintenance bypass. Removable jumpers shall be supplied with each unit to convert from a single feed to the dual feed configuration.
- G. Power Transformers: No transformers shall be required in either system input or output when operating in a 208/208 volt three phase wye connected environment. Optional transformers shall be available for other voltages and/or isolation requirements, mounted in a separate line-up and match enclosure.
- H. Monitoring and Control Components: The following components shall provide monitor and control capability:
1. Microprocessor-controlled Circuitry
 2. Digital Front Panel Interface
 3. Control Panel Indicators
 4. Control Panel Soft Keys
 5. Battery Monitoring to provide run time remaining and battery life remaining information
- I. Emergency Power Off (EPO): This feature shall provide immediate manual shutdown of power in an emergency situation. Screw terminals shall be provided in the UPS module, for connection of a Remote Emergency Power Off switch.
- J. Auto Restart: The UPS shall be capable of being programmed for auto-restart functionality
- K. EIA/TIA-232 (RS-232) Communication Interface: This feature shall allow full EIA/TIA-232 (RS-232) serial communications in several modes, including: Printer, Terminal, ASCII Computer, and Binary Computer Modes. This information shall be attainable through connection to the standard DB-9 port. The particular communications mode and the parameters for baud-rate, data bits, parity, and hand shaking shall be programmable from the front panel display.

- L. Communication Interface: The DB-9 port shall provide a direct connection for monitoring software, via serial communication, with a PC, workstation or server. This connection method allows bi-directional transfer of serial data, from UPS to connected device. Four communication card slots (X-slot form) will be provided to connect any combination of communication cards (Powerware "XCP" protocol). Intelligent communication devices shall be capable of operating in any of the card slots, with no interference between installed devices. Also, two individual programmable Form C relays shall be available to provide isolated NO or NC contacts for general alarm or general notice conditions.

2.03 UNINTERRUPTIBLE POWER SUPPLY OPTIONS AND ACCESSORIES

A. (OPTION) External parallel cabinet

- (OPTION) An external parallel cabinet shall be available which shall allow connection of up to four (4) UPS cabinets to be applied in parallel, with a maximum of three (3) capable of increasing system power levels and one (1) for redundant operation. Reverse transfer systems shall be field upgradeable to redundant or parallel for capacity operation. The systems shall employ load equalizing and CAN technology for reliability. Each Paralleled UPS cabinet shall include the control logic to synchronize to the output bus. Loss of all communication between paralleled UPS cabinets shall not cause the UPS systems to go to bypass, or drop the critical load. In addition, each paralleled UPS system must be able to continue to support the critical bus and share load, even in the event of a loss of all inter-module communication. Parallel cabinets shall match UPS cabinet appearance, but shall be designed for remote installation using customer supplied wiring and conduit.

B. (OPTION) Maintenance Bypass (MBP)

- A cabinet with optional transformers for voltage matching and/or isolation and optional Power Distribution Panel: The MBP option shall be available in a line-up and match cabinet. Configurations shall be available for 208, 480 or 600-volt input and 208 or 480-volt output, with isolation on either input or output, as required. The MBP cabinet shall also feature a make-before-break bypass switch and up to three (3) 70 Amp circuit breakers (20kVA family) or three (3) 150 Amp circuit breakers (40kVA family), for isolation and protection. An optional power distribution panel shall be available with 42 poles. The power distribution panel shall accept Square D Type QOB or QOU, bolt-on or snap-in circuit breakers.

C. (OPTIONS) Communications

- A communication method to notify IBM AS/400 systems of UPS status shall be offered as an option. Cables to connect the AS400 to the UPS shall be offered as an option in various lengths.
- A communication method to supply UPS data to an SNMP Network shall be provided as an option. SNMP adapters shall provide a communications interface between the UPS module and SNMP-compatible network management systems. This capability shall allow the unit to be monitored remotely over an Ethernet network.
- A communication method to allow the user to view UPS information via a standard WEB Browser shall be offered as an option. This capability shall allow the unit to be monitored remotely over the Internet.
- A communication method to supply UPS data to a ModBus Network shall be provided as an option. The ModBus connectivity method shall be capable of utilizing the standard ModBus protocol.
- A communication method to supply UPS data over standard telephone lines shall be provided as an option. This data shall pass through an optional Hayes compatible Modem. This modem shall connect to the DB9/RS232 port to allow the UPS system to call out to a remote location, if programmed to do so. This modem will also allow the user to send requests to the UPS for system data.

- A communication method to output UPS data to multiple DB9/RS232 connections shall be provided. The RS232 data shall be available on up to five (5) separate DB9 ports for simultaneous communication of up to five (5) separate devices requiring information from the UPS.
- A communication method to output UPS status, via isolated SPDT Form C dry contacts shall be provided. A minimum of four (4) contacts shall be provided, rated for 250VAC @ 5A or 30VDC @ 5A. These contacts shall be useable as either NO or NC. These contacts shall signal the following UPS conditions:
 - o UPS in Normal Operation
 - o UPS in Battery Operation
 - o UPS in Bypass Operation
 - o UPS in Alarm Condition
- A communication method to remotely display UPS status shall be provided. This display shall be capable of either being mounted on the wall, or sitting on a desk. This display shall be capable of mounting to a standard electrical outlet switch box. The display shall indicate the following UPS conditions:
 - o UPS in Normal Operation
 - o UPS in Battery Operation
 - o UPS in Bypass Operation
 - o UPS in Alarm Condition

The display shall also have an audible alarm, which will sound if an alarm condition becomes active on the UPS. This audible alarm shall have a silence switch.

2.04 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

A. System Continuous Rating:

1. The UPS Module shall be rated at ____ kVA. (Choose: 10kVA, 15kVA, or 20kVA for Model Family 9330 – 20, 25kVA, 30kVA, 35kVA or 40kVA for Model Family 9330 - 40.)
2. The UPS Module shall be rated at ____ kW. (Choose: 7kW, 10.5kW, or 14kW for corresponding kVA ratings of Model Family 9330 – 20, with kW = 0.7 times kVA rating, similarly, 17.5kW, 21kW, 24.5kW, or 28kW for Model Family 9330 – 40).
3. The Options Cabinet shall be rated at ____ kVA (Choose: 10kVA, 15kVA, or 20kVA for Model Family 20 I/O Cabinet without an Output Isolation Transformer. Choose: 9.5kVA, 14.25kVA or 19kVA for Model Family 20 I/O Cabinet with an Output Isolation Transformer. Choose 25kVA, 30kVA, 35kVA or 40kVA for Model Family 40 I/O Cabinet without an Output Isolation Transformer. Choose 23.8kVA, 28.5kVA, 33.3kVA or 38kVA for Model Family 40 I/O Cabinet with an Output Isolation Transformer.)
4. The Options Cabinet shall be rated at ____ kW (Choose: 7kW, 10.5kW, or 14kW for Model Family 20 I/O Cabinet without an Output Isolation Transformer. Choose: 6.65kW, 10kW or 13.3kW for Model Family 20 I/O Cabinet with an Output Isolation Transformer. Choose 17.5kW, 21kW, 24.5kW, or 28kW for Model Family 40 I/O Cabinet without an Output Isolation Transformer. Choose 16.6kW, 20kW, 23.3kW, or 26.6kW for Model Family 40 I/O Cabinet with an Output Isolation Transformer.)
5. If ratings for a 9330 – 20 Family UPS are less than 20 kVA (14 kW), then add: This model shall be field upgradeable to 20kVA/14kW. If ratings for the 9330 – 40 Family UPS are less than 40 kVA (28 kW), then add: This model shall be field upgradeable to a 40kVA/28kW.

C. System Environmental Impact:

Acoustical Noise: Noise generated by the UPS under normal operation shall not exceed 65 dBA (60 dBA typical) at one meter from any surface, measured at 25 degrees C (77 degrees F) and full load.

EMI Suppression: The UPS shall meet FCC Rules and Regulation 47, Part 15, Subpart J, for Class A devices.

D. System Input:

1. Single input: Nominal Input Voltage: _____ VAC, 3 -phase, ___ - wire plus ground.
(Choose one)

Single input:

208Y/120 VAC, 4 wire plus ground

220Y/127 VAC, 4 wire plus ground

*480 VAC, 3-phase, 3-wire plus ground

*600 VAC, 3-phase, 3-wire plus ground

*These voltages require the addition of the optional I/O cabinet.

2. Dual input: Rectifier Input Voltage: _____ VAC, 3 -phase, ___ - wire plus ground.

Dual input: Bypass Input Voltage: _____ VAC, 3 -phase, ___ - wire plus ground,

Dual input: Rectifier

208 VAC, 3-phase, 3 wire plus ground

220 VAC 3 phase, 3 wire plus ground

*480 VAC, 3-phase, 3-wire plus ground

*600 VAC, 3-phase, 3-wire plus ground

Dual input: Bypass

208Y/120 VAC, 3-phase, 4 wire plus ground

220Y/127 VAC 3-phase, 4 wire plus ground

*480 VAC, 3-phase, 3-wire plus ground

*600 VAC, 3-phase, 3-wire plus ground

3. Operating Input Voltage Range:

176 to 229 VAC for 208 VAC input

187 to 242 VAC for 220 VAC input

*408 to 528 VAC for 480 VAC input

*510 to 660 VAC for 600 VAC input

* These voltages require the addition of the optional I/O cabinet.

4. Operating Input Frequency Range: +/- 5 Hz from nominal operational Frequency

5. Input Power Factor: 0.96 lag minimum, 50 to 100% load (without optional input filter).

0.98 lag minimum @100% load, (with optional input filter).

6. Input Current Total Harmonic Distortion (THD): < 33% without optional input filter at loads from 50% to 100% of rated capacity. <10% with optional input filter, at full load and nominal line voltage.

7. Input Surge Withstandability: Per IEEE 587/ANSI C62.41. Category A and B, (6 kV)

8. Electrostatic Discharge (ESD): The UPS shall withstand up to 25 kV without damage and with no disturbance or adverse effect to the critical load

C. System Output:

1. Nominal Output Voltage: ____ VAC.
(Choose one:
208 VAC, 3-phase, 4-wire plus ground
220 VAC, 3-phase, 4-wire plus ground
480 VAC*, 3-phase, 4-wire plus ground
* This voltage requires the addition of the options cabinet. Input and output frequency must match if the bypass is enabled.
2. Output Voltage Regulation (Normal mode):
Less than +/-1% from nominal output voltage (100% Balanced).
Less than +/-1.5% from nominal output voltage (50% Un-Balanced).
Less than +/-1.5% from nominal output voltage (100% Un-Balanced).
3. AC to AC Efficiency: (100% load @ rated PF)

10kVA = 92.5%	25kVA = 91.5%
15kVA = 92.5%	30kVA = 91.5%
20kVA = 92.5%	35kVA = 91.5%
	40kVA = 91.5%
4. Manual Output Voltage Adjustment:
+/-5% from nominal (Adjustable at startup)
5. Load Unbalance: Maximum 100% of rated phase current
6. Transient Voltage Response: +/-5% from nominal RMS voltage for a 100% load step
Transient Voltage Response: +/-1% Loss or return of AC input
7. Transient Voltage Recovery: Within 4 ms to within +/-3% of nominal.
8. Line Sync Range: +/-1 Hz standard. Line sync range shall be selectable from +/-0.5 Hz to +/-5.0 Hz in 0.5 Hz increments. (Adjustable at startup)
9. Frequency Slew Rate: 1 Hz/second. (Adjustable at startup)
10. Frequency Regulation: +/-0.01 Hz free running.
11. Output Voltage Total Harmonic Distortion (THD):
1% maximum (linear load)
3.5% maximum (non-linear load).
Maximum single harmonic distortion < 2% with any load
12. Load Crest Ratio: 3:1
13. Current Overload Capability:
 - a. 100% continuous
 - b. 101% to 125% for 10 minutes.
 - c. 126% to 150% for 30 seconds.
 - d. 151% to 300% transfer to static bypass (maximum 10 cycles).
 - e. > 300% Current limit with transfer to static bypass (maximum 10 cycles).
14. Fault Clearing Capability:
 - a. Inverter Only:
 1. 150 A peak current for 10 cycles. (9330-20)
 2. 300 A peak current for 10 cycles (9330-40)

- b. With bypass available:
 - 1. 380A for 166ms (10 cycles) (9330-20)
 - 2. 790A for 166ms (10 cycles) (9330-40)
- 15. kAIC rating (optional):
 - a. Tested, rated and labeled for 30kAIC installation.
- 16. Noise Attenuation (when used with isolation transformer).
 - a. Common Mode: -100 dB up to 100 kHz.
 - b. Transverse Mode: -60 dB up to 100 kHz.

2.05 MECHANICAL DESIGN

- A. Enclosures (20kVA Family): The UPS, options cabinet, SBM (Parallel tie cabinet) and extended runtime battery cabinets shall be designed for office or computer room applications. The cabinets shall line up and match in style and appearance for an aesthetically pleasing appearance. Interconnecting cables shall be provided between UPS, Options and Battery cabinets. The 20kVA power processor cabinet shall measure 22" (559 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high, including a minimum battery configuration. Options cabinets for isolation, voltage conversion or installation of a PDM, shall measure 17" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Battery cabinets for additional run time, shall measure 17" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Parallel cabinets, to tie together the outputs of up to four UPS (UPM) modules, shall measure 17" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Each cabinet shall be mounted on casters and shall be shipped separately with stationary mounting plates. Each cabinet shall include stationary leveling provisions. Options and battery cabinets shall include all hardware necessary to bolt them to the UPS during installation. The mounting plates, used in shipping, shall be suitable for mounting the system to the building structure. Mounting instructions shall be provided in the Installation and Operation manual. Up to two (2) line-up and match battery cabinets shall be available for extended run time applications. A connection point shall be supplied for larger (customer supplied) battery systems.
- B. Enclosures (40kVA Family): The UPS, options cabinet, SBM (Parallel tie cabinet) and extended runtime battery cabinets shall be designed for office or computer room applications. The cabinets shall line up and match in style and appearance for an aesthetically pleasing appearance. Interconnecting cables shall be provided between UPS, Options and Battery cabinets. The 40kVA power processor cabinet shall measure 39" (559 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high, including a minimum battery configuration. Options cabinets for isolation, voltage conversion or installation of a PDM, shall measure 22" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Battery cabinets for additional run time, shall measure 17" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Parallel cabinets, to tie together the outputs of up to four UPS (UPM) modules, shall measure 17" (432 mm) wide, 31" (787 mm) deep, and 45" (1143 mm) high. Each cabinet shall be mounted on casters and shall be shipped separately with stationary mounting plates. Each cabinet shall include stationary leveling provisions. Options and battery cabinets shall include all hardware necessary to bolt them to the UPS during installation. The mounting plates, used in shipping, shall be suitable for mounting the system to the building structure. Mounting instructions shall be provided in the Installation and Operation manual. Up to three (3) line-up and match battery cabinets shall be available for extended run time applications. A connection point shall be supplied for larger (customer supplied) battery systems.
- C. Ventilation: The UPS shall be designed for forced air-cooling. Air intake shall be through the front of the UPS and shall exhaust through the rear. Fans shall be powered by the UPS stored energy system. At least 6" (102 mm) of clearance shall be required at the rear of the cabinet for proper air circulation. The optional battery cabinet (s), if used, shall be convection cooled.
- D. Each cabinet shall be rated as an IP20 enclosure, per the EN 60529 specification.

- E. Connections: All connections to the UPS shall be hard wired through the rear or bottom of the UPS. All external input and output connections to the options cabinet shall be from the back of the options cabinet. For remotely located battery cabinets, all external connections to the battery cabinet shall be from the back or side of the battery cabinet.
- F. Floor Point Loading: Maximum floor point loading shall not exceed:
 - 20kVAUPS module - 1.41 lbs/in² (0.10 kg/cm²) at six points
 - Optional Battery Cabinet - 1.4 lbs/in² (0.10 kg/cm²) at six points
 - 20kVA Optional I/O Cabinet - 1.35 lbs/in² (0.10 kg/cm²) at four points
 - Optional Parallel Cabinet - .45 lbs/in² (0.05 kg/cm²) at four points
 - 40kVAUPS module - 1.54 lbs/in² (0.11 kg/cm²) at nine points
 - Optional Battery Cabinet - 1.4 lbs/in² (0.10 kg/cm²) at six points
 - 40kVA Optional I/O Cabinet - 2.4lbs/in² (0.17 kg/cm²) at six points
 - Optional Parallel Cabinet - .55 lbs/in² (0.05 kg/cm²) at four points
- E. Shipping containers: The power processor, I/O cabinet, SBM and battery cabinets shall be shipped individually on pallets, with impact reducing corner posts and a corrugated top cap enclosed in stretch wrap.

2.06 BATTERY

- A. Battery Type: Sealed, maintenance-free, high-rate discharge, lead-acid cells.
- B. Nominal Battery String Voltage: 288 VDC (144 cells).
- C. Minimum Final Discharge Voltage: 240VDC, (1.67V per cell).
- D. Nominal Float Voltage: 324VDC, (2.25V per cell, float charger mode only).
- E. ABM replenish charge level: 340VDC, (2.36V per cell, ABM charge mode only).
- F. Standard internal battery run time shall be: 17 minutes (14 kW load), 26 minutes (10.5 kW load) and 45 minutes (7 kW load) when used on the 20kVA system. A 40kVA system will provide run times of 17 minutes (28 kW load), 21 minutes (24.5kW load) 25 minutes (21 kW load) and 32 minutes (17.5 kW load).
- G. Battery Recharge Time: 10x discharge time to 90% recharge, when using the standard internal battery.
- H. Battery Charger: Maximum charger ripple voltage at the battery (<.7% peak to peak)
- I. Battery Circuit Protection: A battery circuit breaker and fusing shall be provided for battery short circuit protection. A battery circuit breaker and fusing shall be provided in each additional matching cabinet provided for extended run operation. Battery breakers shall isolate each external battery string for individual string maintenance.
- J. Battery Management System: The UPS shall incorporate a real-time measure of battery status. The system's battery charger shall be capable of operating as a three-mode charger, or a float level charger. Charger mode configuration shall be configurable at start-up. Charger voltage settings shall be adjusted digitally, not requiring any manual potentiometer adjustments. The "three mode" charger will include a "constant voltage" mode, a "constant current" mode and an "open-circuit" mode. This open circuit mode shall not last longer than 30days, and shall not degrade the specified runtime performance. The float level charger shall be a two-mode charger with constant current, then constant voltage modes. The standard float voltage shall be 2.25Volts per cell. The charger shall also include separate temperature compensation, to maximize battery life. The UPS system shall run a system battery test, which will detect an open circuit condition that could jeopardize battery performance and system availability. A battery lifetime monitoring algorithm shall be provided to alert the user to replace the battery system when it nears its end of useful life, based on such parameters as discharge cycles, ambient temperature and elapsed calendar time.

2.07 CONTROLS AND INDICATORS

- A. Microprocessor-controlled Circuitry: Fully automatic operation of the UPS shall be provided through the use of microprocessor-controlled DSP. All operating and protection parameters shall be firmware controlled, thus eliminating a need for manual adjustment. The logic shall include system test capability to facilitate maintenance and troubleshooting. Start-up, battery charging, and transfers shall be automatic functions.
- B. Digital Front Panel Display: The UPS control panel shall be a digital front panel display which shall feature a 4 x 80 (4 lines, 80 characters) backlit LCD display. The LCD shall displays UPS status, metering, battery status, alarm/event queue, active alarms and UPS configurations. The front panel shall show a system mimic diagram with an outlined power path, current operating mode and event logs.
- C. Control Panel Indicators: The UPS control panel shall provide the following monitoring functions with indicator lamps:
 - 1. NORMAL: This shall indicate that the commercial AC utility or generator source is supplying power to the rectifier and the inverter is supporting the critical load. A text message shall indicate if the bypass line is not within tolerance.
 - 2. BYPASS: This shall indicate that the UPS has transferred the load to the bypass circuit.
 - 3. BATTERY: This shall indicate that the commercial AC utility or generator source has failed and the battery is supplying power to the inverter, which is supporting the load. A text message shall indicate if the battery charge is low or if the battery is installed but disconnected.
 - 4. NOTICE: This shall indicate that the UPS detects a notice condition, outlined in detail in the operator's manual.
 - 5. ALARM: This shall indicate that the UPS detects an alarm condition, outlined in detail in the operator's manual.
- D. Control Panel Controls: The UPS control panel shall provide the following functions from front panel push-buttons:
 - 1. EVENTS: Displays the list of Active System Events and a historical log of system events. Historical logs shall include a detailed time stamped list of the latest 500 events.
 - 2. METERS: Displays performance meters for the system or critical load. When selected, the front display shall show individual screens of input parameters, output parameters or bypass parameters including; voltage, current and frequency. In addition, the battery display shall show runtime remaining, voltage, current, temperature and battery life remaining.
 - 3. CONTROLS: Displays a System Controls screen. Allows selection of operating mode, normal, bypass, charger on/off and PPU on/off.
 - 4. SETUP: Allows display contrast, date and time information serial communication port configuration and display of firmware revision numbers.
 - 5. RETURN: Returns to main menu.

2.08 SYSTEM PROTECTION

- A. Input protection shall be provided by input circuit breaker (for the double conversion path) and transient suppression circuitry.
- B. Battery protection shall be provided an internal circuit breaker disconnect. Battery cabinets shall be protected by battery fuses and an internal circuit breaker disconnect.

- C. Current limiting circuitry shall protect the inverter output under any load condition. High speed semiconductor fusing shall protect the static bypass in the event of an output short circuit. In addition a thermal-magnetic, molded-case circuit breaker shall provide output protection when used with the matching options cabinet.

2.09 COMMUNICATION AND SYSTEM SOFTWARE

- A. The UPS shall provide at least 7 communication interface methods/channels for flexible interaction with users networks and systems, including at least the following:
 - 1. RS-232 port (s) for serial communication
 - 2. Communication bays to accommodate up to four (4) of the above listed communication options (2.03 C).
- B. Monitoring and computer system shutdown software shall be included as part of the UPS system. This software will allow display of UPS status on RS232 connected computer equipment. This software shall also provide minimal unit control functions. This software shall be usable with a range of operating systems including Windows, Novell Netware, UNIX, HP - UX, IBM AIX and OS/2, Linux, Solaris and VMS. SNMP software shall also be provided to allow network-connected systems using SNMP to communicate to the UPS system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions provided with each unit.

3.02 FIELD QUALITY CONTROL

- A. The following procedures and tests shall be performed by Field Service personnel during the UPS startup:
 - 1. Visual Inspection:
 - a. Visually inspect all equipment for signs of damage or foreign materials.
 - b. Observe the type of ventilation, the cleanliness of the room, the use of proper signs, insure that adequate service clearances are provided, and any other safety related factors
 - 2. Mechanical Inspection:
 - a. Check all the power connections for tightness.
 - b. Check all the control wiring terminations and plugs for tightness or proper seating.
 - 3. Electrical Pre-check:
 - a. Check the system for possible grounds.
 - b. Check the DC bus for a possible short circuit.
 - c. Check input and bypass power for proper voltages and phase rotation.
 - d. Check and adjust, if necessary, all power supply voltages.
 - e. Check all lamp test functions.
 - 4. Initial UPS Startup:
 - a. Verify that all the alarms are in an "OK" condition.
 - b. Energize the system and verify the proper DC and AC relationships.
 - c. Check the DC link holding voltage and AC output voltages.
 - d. Check the final DC link voltage and inverter AC output. Adjust if required.
 - e. Check for the proper synchronization.

- f. Check for the voltage difference between the inverter output and the bypass source.
 - 5. DC Inspection:
 - a. Check all the battery terminations.
 - b. Check for the proper control of battery charge voltage.
- B. Operational Training: Before leaving the site, the field service engineer shall familiarize responsible personnel with the operation of the UPS. The UPS equipment shall be available for demonstration of the modes of operation. Training shall be for one day.

3.03 MANUFACTURER'S FIELD SERVICE

- A. Proactive Service Support: The UPS manufacturer shall provide 7 x 24 system startup, 7 x 24 corrective maintenance, and one 7 x 24 annual performance check during the first year of product use as a standard provision of UPS purchase. In addition, if the user purchases a modem and provides a telephone line to the installation, 7 x 24 remote monitoring and advance response service as well as a monthly evaluation and performance report will be provided for the first year of use as well.
- B. Field Engineering Support: The UPS manufacturer shall directly employ a nationwide field service department staffed by factory-trained field service engineers dedicated to startup, maintenance, and repair of UPS equipment. The organization shall consist of regional and local offices managed on a regional basis, as well as factory-trained independent field service contractors. Field engineers shall be deployed in major metropolitan areas to provide on-site emergency response within 24 hours 80% of the time, or based on available optional service plans, within 4 hours on a 7 x 24 basis. A map of the United States showing the location of all field service offices must be submitted with the proposal.
- C. Spare Parts Support: Parts supplies shall be located in the field to provide 80% of all emergency needs. The factory shall serve as the central stocking facility where a dedicated supply of all parts shall be available within 24 hours.
- D. Maintenance Contracts: A complete range of preventative and corrective maintenance contracts shall be provided and offered with the proposal.
- E. Product Enhancement Program: The UPS manufacturer shall make available feature upgrade service offerings to all users as they are developed. These products shall be proposed as a field-installable, optional kit.