

APC by Schneider Electric
MGE EPS 8000 INTEGRATED PARALLEL MODULE UPS
555/625/750/800 kVA
Uninterruptible Power Supply

THIS GUIDE SPECIFICATION IS WRITTEN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI) MASTERFORMAT. THIS SECTION MUST BE CAREFULLY REVIEWED AND EDITED BY THE ARCHITECT OR THE ENGINEER TO MEET THE REQUIREMENTS OF THE PROJECT. COORDINATE THIS SECTION WITH OTHER SPECIFICATION SECTIONS IN THE PROJECT MANUAL AND WITH THE DRAWINGS.

WHERE REFERENCE IS MADE THROUGHOUT THIS SECTION TO "PROVIDE", "INSTALL", "SUBMIT", ETC., IT SHALL MEAN THAT THE CONTRACTOR, SUBCONTRACTOR, OR CONTRACTOR OF LOWER TIER SHALL "PROVIDE", "INSTALL", "SUBMIT", ETC., UNLESS OTHERWISE INDICATED.

THIS SECTION IS WRITTEN TO INCLUDE THE 2004 MASTERFORMAT AND THE 1995 MASTERFORMAT VERSIONS. WHERE APPLICABLE, THESE ITEMS ARE BRACKETED AND, IN EACH CASE, UNLESS OTHERWISE INDICATED, THE FIRST CHOICE APPLIES TO THE 2004 MASTERFORMAT AND THE SECOND CHOICE APPLIES TO THE 1995 MASTERFORMAT.

SECTION [26 33 63] [16611]

SOLID STATE UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, [Division 01 - GENERAL REQUIREMENTS] [Division 1 - GENERAL REQUIREMENTS], and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SUMMARY

- A. **Scope:** Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for a solid state uninterruptible power supply (UPS) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. **Section Includes:** The work specified in this Section includes, but shall not be limited to, a continuous duty, three-phase, solid state, static UPS. The UPS shall operate in conjunction with the existing building electrical system to provide precisely controlled power for critical equipment loads. The system shall consist of a solid state inverter, rectifier/battery charger, a storage battery, a static bypass transfer switch, synchronization control circuitry, connection control circuitry, disconnection control circuitry, system metering, system status indicators, system alarm annunciation circuitry, and accessories as specified herein. The system shall automatically ensure continuity of electric power within specified tolerances, without interruption, upon failure or deterioration of the normal power supply. Continuity of electric power to the load shall be supplied by the batteries, up to the specified maximum protection time or until restoration of the normal input AC power source, whichever occurs first.

1.3 REFERENCES

- A. **General:** The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. **Institute of Electrical and Electronics Engineers, Inc. (IEEE):**

1. ANSI/IEEE C62.41, "Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits" (copyrighted by IEEE, ANSI approved).

C. **International Organization for Standardization (ISO):**

1. ISO 9001, "Quality Management Systems - Requirements."

D. **National Fire Protection Association (NFPA):**

1. NFPA 70, "National Electrical Code" (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

E. **Underwriters Laboratories, Inc. (UL):**

1. UL 1778, "Standard for Uninterruptible Power Supply Equipment" (copyrighted by UL, ANSI approved).

1.4 SYSTEM DESCRIPTION

A. **UPS Design Requirements:**

1. **Output Power Continuous Rating:** The continuous output power rating of the UPS shall be [_____] kVA at a 0.9 lagging power factor.

INSERT KVA ABOVE. INSERT VOLTS BELOW.

2. **Input Voltage:** [_____] volts AC, -10 percent +10 percent, three-phase, 3 wires plus ground.
3. **Output Voltage:** [_____] volts AC, ± 5 percent, three-phase, 3 wires or 4 wires plus ground.

INSERT VOLTS ABOVE. INSERT MINUTES BELOW.

4. **Battery Autonomy:** UPS shall be capable of operating at full load for [_____] minutes at 0.9 PF output at a temperature of 77 °F (25 °C) on battery power.
5. **Battery Type:** Sealed, high rate discharge, flame-retardant, valve regulated lead acid (VRLA).

B. **AC Input Characteristics:**

INSERT VOLTS BELOW.

1. **Voltage:** 480 volts AC, -15 percent +10 percent, three-phase, 3 wires plus ground.
2. **Frequency:** 60 hertz, ± 10 percent.
3. **Power Factor:** 0.9 lagging.
4. **Total Harmonic Distortion:** Maximum 5 percent at full load at nominal input voltage.
5. **Power Walk-In:** 0 percent to 100 percent over a 10 second period.
6. **Inrush Current:** 600 percent of nominal input current for less than one cycle.
7. **Reactive Current:** Less than 30 of nominal input current at no load.

C. **AC Output Characteristics:**

1. **Voltage:** 480 volts AC (adjustable ± 5 percent), three-phase, 3 wires plus ground or three-phase, 4 wires plus ground.
2. **Frequency:** 60 hertz, ± 2.0 hertz, synchronized with bypass (selectable in 0.25 hertz increments), 60 hertz, ± 0.1 percent free running.
3. **Voltage Regulation:** ± 1 percent for balanced load, ± 2 percent for 50 percent step load.
4. **Voltage Distortion:** Maximum 2 percent total (THD) and 1 percent on any single harmonic when the UPS is connected to 100 percent linear loads.
5. **Voltage Transient (Step Load) Response:** Less than ± 3 percent for 50 percent step load change, less than ± 4 percent for 75 percent step load change, less than ± 5 percent for 100 percent step load change (defined as 0 percent to 100 percent of nominal load).
6. **Voltage Recovery Time:** Return to within ± 1.5 percent of nominal voltage within 167 milliseconds maximum.
7. **Phase Angle Displacement:** 120 degrees, ± 3 degrees for balanced load; 120 degrees, ± 3 degrees for 100 percent unbalanced load.

8. **Non-Linear Load Capability:** Output voltage total harmonic distortion shall be less than 4 percent when connected to a 100 percent non-linear load with a crest factor not to exceed 3.5 percent.
9. **Slew Rate:** 1.0 hertz/second maximum (selectable in 0.5 hertz increments up to 2.0 hertz).
10. **Power Factor:** 0.9.
11. **Inverter Overload Capability:** 125 percent of rated load for 10 minutes, 150 percent of rated load for 1 minute.

D. **Battery:**

1. **Battery Voltage:** Range shall be 400 volts DC to 545 volts DC, 480 volts DC nominal.

INSERT AMPERES BELOW.

2. **Maximum DC Current:** Maximum DC current at cutoff voltage shall be [____] amperes.
3. **DC Cutoff Voltage:** Maximum of 1.67 volts per cell.
4. **DC Ripple:** Maximum of 1 percent of DC voltage.
5. **Low Battery Protection:** At a pre-set battery voltage value or two hours after the UPS has shut down on a DC under voltage condition (battery cut off voltage), the battery circuit breaker shall open in order to prevent excessive battery discharge.

1.5 SUBMITTALS

- A. **General:** See [Section 01 33 00 - SUBMITTAL PROCEDURES] [Section 01300 - SUBMITTALS].
- B. **Product Data:** Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, the following:
 1. Catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product inspecting and testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of the product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.
- C. **Shop Drawings:** Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data, including, but not limited to, complete electrical characteristics and connection requirements. Provide detailed equipment outlines with cabinet dimensions and spacing requirements; location of conduit entry/exit paths; location of floor/seismic mounting; available battery types/sizes; cabinet weights; heat rejection and air flow requirements; single-line diagram; and control and external wiring.
- D. **Wiring Diagrams:** Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.
- E. **Contract Closeout Submittals:**
 1. **Project Record Documents:** Submit a complete set of installation drawings showing all the information specified elsewhere in this Section.
 2. **Operation and Maintenance Data:** Submit operation and maintenance data to include in operation and maintenance manuals specified in [Division 01 - GENERAL REQUIREMENTS] [Division 1 - GENERAL REQUIREMENTS], including, but not limited to, safe and correct operation of UPS functions.

1.6 QUALITY ASSURANCE

- A. **Qualifications:**

1. **Manufacturer Qualifications:** Manufacturer shall be a firm engaged in the manufacture of solid state UPS of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
 - a. The manufacturer shall be ISO 9001 certified and shall be designed to internationally accepted standards.
 2. **Installer Qualifications:** Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing solid state UPS similar in type and scope to that required for this Project.
- B. **Regulatory Requirements:** Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
1. The UPS shall meet the requirements of the following standards:
 - a. UL-listed under UL 1778.
 - b. UL Canada (cUL).
 - c. FCC rules and regulations of Part 15, Subpart B, Class A.
 - d. ANSI/IEEE C62.41.
 - e. ISO 9001.
 2. The UPS shall be designed in accordance with the applicable sections of the documents published by:
 - a. National Fire Protection Association (NFPA), NEC.
 - b. National Electrical Manufacturer's Association (NEMA).
 - c. Occupational Safety and Health Administration (OSHA).
- C. **Factory Testing:** Prior to shipment the manufacturer shall complete a documented test procedure to test functions of the UPS module and batteries (via a discharge test), when supplied by the UPS manufacturer, and warrant compliance with this Section. The factory test shall be performed in the presence of the Owner providing the manufacturer receives adequate prior notice. The manufacturer shall provide a copy of the test report upon request.
- D. **Pre-Installation Conference:** Conduct pre-installation conference in accordance with [Section 01 31 19 - PROJECT MEETINGS] [Section 01200 - PROJECT MEETINGS]. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect/Engineer.
- E. **Source Responsibility:** Materials and parts comprising the UPS shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. Active electronic devices shall be solid state and shall not exceed the manufacturer's recommended tolerances for temperature or current to ensure maximum reliability. Semiconductor devices shall be sealed. Relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies, and final products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
- C. Products shall be packaged in a manner to prevent penetration by debris and to allow safe delivery by modes of ground transportation and air transportation where specified.
- D. Prior to shipping, products shall be inspected at the factory for damage.

- E. Equipment shall be protected against extreme temperature and humidity and shall be stored in a conditioned or protected environment.
- F. Equipment containing batteries shall not be stored for a period exceeding three months without powering up the equipment for a period of eight hours to recharge the batteries.

1.8 PROJECT CONDITIONS

- A. **Environmental Requirements:** Do not install solid state UPS until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
 - 1. The UPS shall operate under the following environmental conditions:
 - a. **Temperature:**
 - 1) **UPS Module Operating:** 32 °F (0 °C) to 104 °F (40 °C).
 - 2) **Non-Operating:** -4 °F (-20 °C) to 113 °F (45 °C).
 - 3) **Battery System:** -4 °F (-20 °C) to 113 °F (45 °C).
 - b. **Relative Humidity (Operating):** 0 percent to 90 percent non-condensing.
 - c. **Barometric Pressure:** Up to 3281 feet (1000 meters) above sea level (up to 6562 feet [2000 meters] with ambient temperature less than 82 °F [28 °C]).
 - 1) **Non-Operating:** Up to 39,370 feet (12,000 meters) above sea level.
 - d. **Audible Noise:** 75 dBA weighing when measured 5 feet (1524 mm) in front of the unit.

1.9 WARRANTY

- A. **General:** See [Section 01 77 00 - CLOSEOUT PROCEDURES] [Section 01770 - CLOSEOUT PROCEDURES].
- B. **Special Warranty:** The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for period indicated below. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the Installer and the manufacturer.
 - 1. **UPS Module:** The UPS shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from date of installation or acceptance by the Owner or 18 months from date of shipment from the manufacturer, whichever occurs first.
 - 2. **Battery:** The battery manufacturer's warranty shall be passed through to the final Owner and shall have a minimum period of one year.
- C. **Additional Owner Rights:** The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.10 MAINTENANCE

- A. The manufacturer shall, upon request, provide spare parts kits for the UPS module in a timely manner as well as provide access to qualified factory-trained first party service personnel to provide preventative maintenance and service on the UPS module when required.
- B. UPS subassemblies, as well as the battery, shall be accessible from the front. UPS design shall provide maximum reliability and minimum MTTR (mean time to repair). To that end, the UPS shall

be equipped with a self-test function to verify correct system operation. The self-test function shall identify the subassembly requiring repair in the event of a fault. The electronic UPS control and monitoring assembly shall therefore be fully microprocessor-based, thus doing away with potentiometer settings. This shall allow:

1. Auto-compensation of component drift.
 2. Self-adjustment of replaced subassemblies.
 3. Extensive acquisition of information vital for computer-aided diagnostics (local or remote).
 4. Socket connection to interface with computer-aided diagnostics system.
- C. The UPS shall be repairable by replacing standard subassemblies requiring no adjustments. Communication via a modem with a remote maintenance system shall be possible.
- D. The manufacturer shall offer additional preventative maintenance and service contracts covering both the UPS and the battery bank. Accredited professional service engineers employed exclusively in the field of critical power systems service shall perform maintenance and service. The manufacturer shall also offer extended warranty contracts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis of Design:** Product specified is "MGE EPS 8000 Integrated Parallel Module UPS; as manufactured by APC by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.

2.2 MODES OF OPERATION

- A. The UPS module shall be designed to operate as an on-line reverse transfer system in the following modes.
1. **Normal:** The UPS module shall continuously supply power to the critical load. The rectifier/battery charger shall derive power from the utility AC source and supply DC power to the inverter while simultaneously float charging the battery.
 2. **Emergency:** Upon failure of the utility AC power source, the critical load shall be supplied by the inverter, which, without any switching, shall obtain its power from the battery.
 3. **Recharge:** Upon restoration of the utility AC source (prior to complete battery discharge), the rectifier/battery charger shall power the inverter and simultaneously recharge the battery.
 4. **Parallel Operation:** Each UPS module shall support an equal share of the total load during normal, emergency, or recharge operation. Each UPS module will automatically disconnect and isolate from the system load in the event of a module failure with no interruption to the critical load. For a non-redundant system, the remaining UPS modules will support the critical load until the defined overload period has expired, at which point the system will transfer to bypass.
 5. **Bypass Mode:** The static bypass transfer switch shall be used to transfer the load to the bypass without interruption to the critical power load. Each module bypass transfer switch shall support an equal share of the total load during this mode. This shall be accomplished by turning the inverters off. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverters on.
 6. **Maintenance Bypass/Test Mode:** An optional manual make before break maintenance bypass switch shall be provided to isolate the UPS system output for maintenance. This shall allow each UPS module to be tested or repaired without affecting load operation

2.3 COMPONENT DESCRIPTION

- A. **Rectifier/Battery Charger:** A 12-pulse, solid state, full-wave bridge rectifier shall convert the incoming AC power to regulated DC voltage, which shall be subsequently filtered to provide power

for the inverter and battery charging functions. The rectifier/battery charger shall have sufficient capacity to support a fully loaded inverter and recharge the battery to 95 percent of its full capacity within 10 times the discharge time. The rectifier/battery charger assembly shall be constructed of modular plug-ins to facilitate maintenance.

1. **Input Protection:** The rectifier/battery charger shall be protected by an AC input circuit breaker and input fuses.
 2. **Input Current Limiting:** Input current limit shall be set at 150 percent of nominal input current. A programmable second step input current limit, allowing a further limit of the input current, shall be activated by a dry contact input.
 3. **Battery Charge Current Limiting:** Maximum recharge current shall be limited to 10 percent of maximum DC discharge current. DC current limit settings shall be Owner-programmable up to 1000 amperes. A second step battery charge current limit shall be provided, activated by an Owner-provided dry contact input.
 4. **Operating Modes:**
 - a. **Automatic Charge Sequence:** The rectifier/battery charger shall automatically charge the batteries at an elevated voltage after an outage of a set (selectable between 0 second and 255 seconds) duration.
 - b. **Float Service:** Nominal DC bus voltage (programmable) shall be provided under nominal operating conditions.
 - c. **Manual Charge Service:** The rectifier/battery charger output voltage shall be selectable to a voltage slightly higher than the normal float voltage setting, normally the maximum float voltage setting specified by the battery manufacturer.
 - d. **Equalize/Commissioning Service:** A high charge rate of DC voltage capable of being set at 2.5 volts per cell at an Owner-selected time period.
- B. **Inverter:** The UPS module output shall be derived from an IGBT pulse width modulated (PWM) variable frequency and variable pulse width, transistorized type inverter design. The inverter shall be capable of providing the specified precise output power characteristics (specified elsewhere in this Section) while operating over the battery voltage range. The inverter assembly shall be constructed of modular rack out assemblies to facilitate maintenance.
- C. **Static Bypass:** The static bypass transfer switch shall be an electronic static type switch, 100 percent rated for continuous duty, and shall not rely on any mechanical current carrying components.
1. **Uninterrupted Transfer:** The static bypass transfer switch shall automatically cause the bypass source to assume the critical load without interruption after the logic senses one of the following conditions:
 - a) Overload that exceeds the sum of connected modules overload capabilities
 - b) Battery protection period expired and bypass available
 - c) Failure or shutdown of all connected modules
 2. **Interrupted Transfer:** If the bypass source is beyond the conditions stated below, an interrupted transfer (not less than 0.2 seconds in duration) shall be made upon detection of a fault condition.
 - a. Bypass voltage greater than ± 10 percent from the UPS rated output voltage.
 - b. Bypass frequency greater than ± 2 hertz (selectable in 0.25 hertz increments) from the UPS rated output frequency.
 3. **Automatic Uninterrupted Forward Transfer:** The static bypass transfer switch shall automatically forward transfer, without interruption, after either scenario (1) the UPS inverters have been turned on, or (2) after an instantaneous overload-induced reverse transfer has occurred and the load current returns to less than the unit's 100 percent rating.
 4. **Manual Transfer:** A manual static transfer shall be initiated by user from the remote wall mount SIT Box (Simultaneous Inverter Transfer).
 5. **Overload Ratings:** The static bypass transfer switch shall have the following overload characteristics:
 - a. 1000 percent of UPS system output rating for 0.016 seconds (one cycle).
 - b. 160 percent of UPS system output rating for 5 minutes.

- D. **Microprocessor-Controlled Logic:** The full UPS operation shall be provided through the use of microprocessor-controlled logic. Operations and parameters shall be firmware-controlled, thus eliminating the need for manual adjustments or potentiometers. The logic shall include, but shall not be limited to, a self-test and diagnostic circuitry such that a fault can be isolated down to the printed circuit assembly or plug-in power assembly level. Every printed circuit assembly or plug-in power assembly shall be monitored. Diagnostics shall be performed via a PC through the local diagnostics port on the unit, or via a modem through the RS-232 communication port.

2.4 SYSTEM CONTROLS AND INDICATORS

- A. **Graphical User Interface (GUI):** Each UPS module shall be equipped with a graphical command center/graphical user interface (GUI) with 12.0 inch (305 mm) daylight viewable TFT LCD color monitor with touch screen operation. The GUI shall utilize an industrial operating system with a static flash disk drive storage medium. The GUI shall provide detailed system level and module level operating information. An animated, color-coded single-line diagram shall illustrate module and system level current flow, major UPS component status, breaker position, and module and system operating status. Individual screens shall indicate operating conditions and electrical measurements for specific UPS module(s), including, but not limited to, the rectifier and bypass input, inverter, rectifier, individual battery banks, and the critical load output.
1. Alarms and events shall be recorded and time and date stamped and stored on a rolling log capable of recording in excess of 1500 records. Major alarms shall be indicated on any screen that the operator may be browsing at the time. The GUI shall also have the capability to trend key parameters on a variable scale graph.
 2. The GUI shall facilitate the unique naming of circuit breakers. Software updates to the GUI shall be possible via exchange of flash chips or over the network but shall not require the removal of the device. Failure of the GUI shall not compromise UPS operation. Key status and operating information shall remain visible on the primary UPS display regardless of the GUI operating status. GUI screens shall be accessible and navigable using a conventional browser. No additional network or server hardware shall be required.
- B. **General:** The UPS module shall be provided with a system status and control panel which shall control, monitor, and display system operation and parameters. The display shall utilize a combination of front panel steady state and flashing LEDs, a 40-character by 2-line liquid crystal display (LCD), and keypad. The display/keypad shall incorporate multiple menus (listed below) which shall provide step-by-step procedures for system operation, display metering functions (listed below), and display more than 40 normal and alarmed conditions (listed below). The front panel LCD shall be selectable in five languages (English, French, Spanish, Dutch, and Italian).
1. The LCD display shall provide the following menus and instructions:
 - a. Inverter on/off commands.
 - b. Language selection.
 - c. Alarm display.
 - d. Battery capacity.
 - e. Display contrast.
 - f. Frequency and power measurements.
 - g. Voltage measurements.
 - h. Current measurements.
 - i. Communication options.
 2. The following controls shall be provided:
 - a. Internal input circuit breaker.
 - b. Control circuitry.
 - c. Inverter output contactor.
 - d. Output circuit breaker.
 - e. UPS isolation circuit breaker.
 - f. Maintenance bypass circuit breaker.
 3. Front panel (pushbuttons) shall include, but shall not be limited to, the following:
 - a. Inverter on.
 - b. Inverter off.

- c. Emergency power off (EPO) (note, the EPO pushbutton shall include a protective cover to prevent unintentional operation).
4. Hidden panel (pushbuttons) shall include, but shall not be limited to, the following:
 - a. Settings.
 - b. > (scroll arrow).
 - c. Volts.
 - d. Amperes.
 - e. Watt/hertz.
 - f. Battery.
 - g. Alarms.
 - h. On/off.
 - i. * (asterisk).
 - j. Clear fault.
 - k. Battery charge cycle.
 - l. Return to float.
 - m. Security key.
 - n. Bypass AC input non-synchronization.
 - o. Forced inverter to bypass.
 - p. Forced bypass to inverter.
 - q. Audible alarm reset.
 5. The LCD display shall display the following system parameters based on true RMS metering. Meter accuracy shall be ± 1 percent, true RMS (at nominal calibration setting). All three-phase readings shall be displayed simultaneously.
 - a. Input voltage (LL) (three-phase simultaneously).
 - b. Input current/phase (three-phase simultaneously).
 - c. Input frequency.
 - d. Bypass input voltage (LL and LN) (three-phase simultaneously).
 - e. Bypass input frequency.
 - f. UPS module output voltage (LL and LN) (three-phase simultaneously).
 - g. UPS module output current/phase (three-phase simultaneously).
 - h. UPS module output frequency.
 - i. UPS module output percent of load.
 - j. UPS module output power factor (PF).
 - k. UPS module output kVA and kW.
 - l. System output voltage (LL and LN) (three-phase simultaneously).
 - m. System output current/phase (three-phase simultaneously).
 - n. System output frequency.
 - o. System output percent of load.
 - p. System output power factor (PF).
 - q. System output kVA and kW.
 - r. DC voltage.
 - s. Crest factor per phase.
 - t. Battery current (charge/discharge).
 - u. Time remaining on battery and available battery time.
 - v. Battery cabinet temperature (on optional purchase and matching battery cabinets).
 6. Alarm/status conditions displayed on LEDs shall indicate:
 - a. **Front Panel LEDs:**
 - 1) Load protected.
 - 2) Battery operation.
 - 3) Operating problem.
 - 4) Load not protected.
 - b. **Hidden Panel LEDs:**
 - 1) Emergency shutdown.
 - 2) Main AC input outside tolerance.
 - 3) Rectifier/charger on.
 - 4) Rectifier/charger fault.
 - 5) Inverter fault.
 - 6) Inverter desynchronized.

- 7) Transfer function fault.
 - 8) Bypass AC input outside.
 - 9) Overload.
 - 10) Battery charging (vented type).
 - 11) Maintenance position.
 - 12) Battery cabinet temperature outside.
 - 13) Battery discharged.
7. UPS status and operating instructions displayed on the LCD shall include, but shall not be limited to, the following:
- a. UPS operation is normal.
 - b. Load on UPS (UPS is on-line).
 - c. Load is protected.
 - d. Load on battery.
 - e. Load on bypass.
 - f. Load on maintenance bypass (MBS).
 - g. UPS on overload.
 - h. UPS overload shutdown.
 - i. Circuit breakers in open position.
 - j. Contactor in open position.
 - k. Buzzer on.
 - l. Fan failure.
 - m. Electronic power supply fault.
 - n. Environmental problem.
 - o. Emergency shutdown, REPO on.
 - p. UPS alarm, call.
 - q. UPS input failure.
 - r. Input problem, check voltage.
 - s. Input problem, check frequency.
 - t. Input has wrong phase rotation.
 - u. Input has single-phase condition.
 - v. Input circuit breaker tripped.
 - w. Input fuse blown.
 - x. Charger off.
 - y. Charger module alarm.
 - z. Charger shutdown.
 - aa. Charger fault, call service.
 - bb. Charger current sensor fault.
 - cc. Input over/under voltage.
 - dd. Input over/under frequency.
 - ee. Charger over-temperature.
 - ff. Maximum battery voltage.
 - gg. UPS low battery, shutdown imminent.
 - hh. Battery under voltage shutdown.
 - ii. Available battery time.
 - jj. Remaining battery time.
 - kk. Battery circuit breaker open.
 - ll. Static switch over-temperature.
 - mm. Bypass input wrong phase rotation.
 - nn. Bypass input has single-phase.
 - oo. Bypass and inverter are out-of-sync.
 - pp. Bypass input RC filter fuse blown.
 - qq. Bypass problem, check voltage.
 - rr. Bypass problem, check frequency.
 - ss. Bypass input over/under voltage.
 - tt. Bypass input over/under-frequency.
 - uu. Phase shift problem, check bypass.
 - vv. Transfer problem, call.
 - ww. Static switch overload, emergency off.

- xx. Bypass transfer.
- yy. Start inverter.
- zz. Stop inverter.
- aaa. Inverter fault, call service.
- bbb. Inverter overload (check PF/kW).
- ccc. Inverter off.
- ddd. Inverter output contactor.
- eee. Inverter fuse blown.
- fff. Inverter output over/under.
- ggg. Inverter current limit.
- hhh. Inverter current sensor fault.
- iii. UPS overload shutdown.
- jjj. Operating on internal.
- kkk. Inverter leg 1 over-temperature.
- lll. Inverter leg 2 over-temperature.
- mmm. Inverter leg 3 over-temperature.
- nnn. Inverter transformer over-temperature.
- ooo. Inverter leg 1 transformer out of saturation.
- ppp. Inverter leg 1 power supply fault.
- qqq. Inverter leg 2 transformer out of saturation.
- rrr. Inverter leg 2 power supply fault.
- sss. Inverter leg 3 transformer out of saturation.
- ttt. Inverter leg 3 power supply fault.

- C. **Audible Alarm Reset Touch Pad:** The audible alarm reset touch pad shall be used to silence the audible alarm. If a new alarm is sensed after the original alarm has been silenced, it shall reactivate the audible alarm.
- D. **Emergency Power Off (EPO):** When EPO is pressed it shall cause the AC input, bypass input, and battery circuit breaker to open, thereby shutting down the UPS and the load. The EPO function shall be capable of being initiated by an externally provided isolated dry contact (REPO).
- E. **Dry Contacts:** Alarm dry contacts shall be available for external connection. Each alarm shall include two Form C contacts rated 5 amperes at 250 volts. These contacts shall indicate:
 - 1. UPS on-line.
 - 2. Inverter fault.
 - 3. Overload.
 - 4. Rectifier/charger on.
 - 5. UPS on battery.
 - 6. Rectifier/charger fault.
 - 7. Low battery shutdown imminent.
 - 8. Bypass out of tolerance.
 - 9. Summary alarm.
 - 10. Static switch fault.
 - 11. UPS on maintenance.
- F. **Owner-Provided Dry Contacts:** Nine inputs shall be available to control UPS operation. Upon receipt of a closed dry contact the UPS shall perform the operations listed below (inputs shall be normally open unless noted):
 - 1. Remote UPS on.
 - 2. Remote UPS off.
 - 3. Inverter non-sync with bypass.
 - 4. Remote EPO.
 - 5. Second step input current limit.
 - 6. Bypass transfer prohibited.
 - 7. Second step battery charge limit.
 - 8. Break transfer prohibited.
 - 9. Progressive stop of rectifier/charger.

- G. **Serial Communications:** A standard serial communication port shall be provided to remotely monitor the UPS (see note below). Alarms, messages, and standard measurements shall be available on the local port. The port shall be configurable for RS-232 or RS-485 communications. The port shall use an open J-BUS (subset of ModBus) protocol with all UPS status information (86 parameters) available remotely.
1. Note, if purchased, the graphical command center (GCC) option shall occupy this port. Purchase Serial Port Adder (Comm+2) option to add additional ports.

2.5 MECHANICAL DESIGN AND VENTILATION

- A. **Enclosure:** The UPS shall be housed in freestanding enclosures with dead-front construction. The cabinet shall be painted an off-white (RAL 9002) color. The UPS cabinet shall be designed for top cable entry, with optional bottom entry cabinets available. Front access only shall be required for installation and maintenance.

INSERT WIDTH AND WEIGHT BELOW.

1. The UPS module enclosure dimensions shall be 82 inches (2083 mm) high by 39 inches (991 mm) deep by [____] inches ([____] mm) wide. The weight of each individual UPS module shall be [____] pounds ([____] kg).
- B. **Ventilation and Heat Rejection:** The UPS shall be designed for forced air cooling. Air inlets shall be provided from the front bottom of the UPS enclosure. Air exhaust shall be from the top rear portion of the unit. Air filters shall be provided as standard. Fans shall be redundant.
1. **Airflow:** Airflow shall be up to 8,275 cfm per UPS module.
 2. **Heat Rejection:** See table on last page for all kVA models.

2.6 ACCESSORIES (OPTIONS)

- A. **External Control and Communications Devices:** Two communication slots shall be provided for Owner use. The communication port options are listed as follows:
1. **RS-232 U-Talk or Dry Contacts (66060):** The U-Talk protocol shall be used with Solution-Pac 2 for remote monitoring or graceful shutdown for most popular file servers. The dry contacts shall close on predefined conditions to monitor UPS operations. A Multi-Slot shall be required.
 - a. The dry contacts shall close on the conditions listed below, but shall be Owner-programmable to close on preset thresholds of other Owner UPS parameters:
 - 1) UPS on-line.
 - 2) Load on bypass.
 - 3) UPS on battery.
 - 4) Low battery warning.
 - 5) Battery fault.
 - 6) General alarm.
 - b. Two dry contact inputs shall also be provided to turn the UPS inverter on and off remotely upon closure of the contacts. This feature may also be disabled if required.
 2. **High Voltage 6 Alarm Relays Card (66069):** Six normally open dry contact outputs rated at 2.0 amperes (250 volts DC/30 volts DC) shall be available to monitor UPS operation. A Multi-Slot shall be required.
 - a. The dry contacts shall close on the conditions listed below, but shall be Owner-programmable to close on preset thresholds of other Owner UPS parameters:
 - 1) UPS on-line.
 - 2) Load on bypass.
 - 3) UPS on battery.
 - 4) Low battery warning.
 - 5) Battery fault.
 - 6) General alarm.

- b. Two dry contact inputs shall also be provided to turn the UPS inverter on and off remotely upon closure of the contacts. This feature may also be disabled if required.
 - 3. **Network Management Card (66074):** The network management card (NMC) shall provide a web interface, SNMP (simple network management protocol), logging, and email capabilities. The NMC shall be used for remote monitoring or graceful shutdown for most popular file servers. A Multi-Slot shall be required.
 - 4. **IBM AS/400 Volt-Free Contact/Remote Power Off Card (66068):** The UPS shall interface with an IBM AS400-UPS signal interface providing the following signals via dry contacts (a Multi-Slot shall be required):
 - a. Load on battery.
 - b. Load on bypass.
 - c. Low battery shutdown warning.
 - d. Load powered by UPS.
 - 5. **Network Management Link:** The Multi-Slot shall provide three additional communication slots. The network management card (NMC) shall be installed in one or all three slots for monitoring and graceful shutdown for most popular file servers. The NMC shall provide a web interface, SNMP, logging, and email capabilities. The NMC shall require one communication slot and network cabling (provided by the Owner). The basic network connection shall require the Multi-Slot (66071), U-Talk Acquisition Card (66063), Network Management Card (66074), and RS-232 U-Talk or JBus/Modbus board configured for U-Talk.
 - 6. **Serial Port Adder (COMM+2):** The standard UPS shall have one available serial port, which may be used by the GCC. The COMM+2 option shall add two additional serial ports for use as RS-232 or RS-485, allowing the UPS to have a total of three serial ports (one port may be used by GCC). GT2Z card and cable shall be included.
 - 7. **Multi-Slot Communications Card Expander (66071):** The Multi-Slot shall provide three additional communication slots. The U-Talk Acquisition Card (66063) shall be included.
- B. **Network Based Power Management Software:**
- 1. Solution-Pac 2 software shall facilitate the management of the UPS over any point in a wide area network (WAN) or local area network (LAN). The software shall use a distributed, TCP/IP based architecture and shall be SNMP manageable. To reduce the volume of network traffic, the software shall employ trap reception acknowledgement. The software shall be capable of graceful server shutdown of individual or multiple servers from any point on the network for up to 50 servers per card.
 - 2. Enterprise power manager software shall facilitate the management of the UPS and servers over any point in a wide area network (WAN) or local area network (LAN). The software shall provide an overall, consolidated view of the main operating parameters of all power devices on the network. The information shall be accessible from any workstation using a standard web browser. The software shall use secure sockets layer (SSL) and several levels of password protection for complete security. MGE network device shall be required.
- C. **UPS Synchronization Box (Sync Box):**
- 1. Sync Box shall be required to keep the outputs of all separate and independent UPS systems in sync during all operating conditions including when:
 - a. Bypass power of one or both UPS systems is not available.
 - b. Bypass power is available but they are out-of-sync.
 - c. UPS systems are operating on battery.
 - 2. The Sync Box shall be a parallel connected circuit that shall monitor the bypass and system output of UPS systems and it shall activate a sync signal under pre-determined and specific conditions. The Sync Box shall not affect the standard and specified performance of the UPS system detailed in this Section.
 - 3. The Sync Box shall be a wall-mounted enclosure.
 - 4. The Sync Box shall operate under the following conditions:
 - a. **Bypass source in tolerance:** When a common bypass source (utility or generator set) is used for both UPS systems supplying the static transfer switch and when this source is present and within frequency and amplitude tolerances, both UPS automatically synchronize with it and are therefore normally synchronized between themselves. The

Sync Box simply checks that this is the case and the external synchronization function remains in sleep mode.

- b. **Bypass source out of tolerance:** When the common bypass source disappears or is out of tolerance, the Sync Box function initiates and controls one of the UPS system to re-establish synchronization with the other UPS system. The position of the reference source switch ("PREFERRED MASTER") determines which source is controlled.
 - c. **Both bypass sources in tolerance:** If the Sync Box function detects any phase deviation between the UPS outputs, it steps in and controls one of the UPS systems to re-establish synchronization with the other. If information on the type of UPS bypass source (utility or generator) is available, the UPS with the generator-supplied bypass will be controlled. If this information is not available, the position of the of the reference source switch ("PREFERRED MASTER") determines which source is controlled.
 - d. **One of the two UPS bypass sources out of tolerance:** When the bypass source of one UPS system disappears or goes out of tolerance, the synchronization function steps in and controls that UPS to re-establish synchronization with the other UPS.
 - e. **Both UPS bypass sources out of tolerance:** When the bypass sources of both UPS systems disappear or go out of tolerance, the Sync Box function initiates and controls one of the UPS systems to re-establish synchronization with the other. The position of the reference source switch ("PREFERRED MASTER") determines which source is controlled
- D. **System Bypass Cabinet (SBC):** The System Bypass Cabinet shall be equipped with two manually operated circuit breakers with keyed interlocks for safe operation. The System Bypass Cabinet shall be capable of routing the utility or bypass source completely around up to four UPS modules, and effectively isolating the UPS modules. The bussing shall accommodate landing space for up to four UPS modules and input and out sources.
- E. **StruxureWare Data Center Expert:** A centralized infrastructure management platform hereafter referred to as Data Center Expert shall be available for purposes of complete system monitoring and management of all components outlined in this specification used as a single solution for small IT or part of the StruxureWare software stack providing data to systems such as Data Center Operation.
1. **Monitoring** - Data Center Expert shall be capable of monitoring a PDU through a network of Cat 5 cable and a switch supplied by the user. This switch shall relay information to Data Center Expert, which in turn shall allow access to this information via the user's public network via a single IP address.
 2. **Monitored Values:** Data Center Expert shall be capable of monitoring alarms, general status parameters, voltage and current of the PDU.
 3. **Thresholds:** For individualized customer needs, Data Center Expert shall allow for user configurable thresholds for alarm notification. With this feature, Data Center Expert can notify clients of reaching thresholds for PDU capacity, or branch circuit breaker capacity. Other custom programmable alarm points for non- APC products shall also be available via dry contact input signal.
 4. **Public Network Monitoring:** Data Center Expert shall also be capable of monitoring other APC devices that are connected to the client's public network.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Verification of Conditions:** Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

- A. Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

3.3 FIELD QUALITY CONTROL

- A. **General:** See [Section 01 45 23 - INSPECTING AND TESTING SERVICES] [Section 01410 - INSPECTING AND TESTING SERVICES].
- B. **Field Service Engineer Qualifications:** The manufacturer shall employ a 7 x 24 nationwide (international where applicable) field service organization with rapid access to all regions of the nation. The responding service professionals shall be factory-trained engineers with an accredited and proven competence to service three-phase UPS.
- C. **Spare Parts:** Field Engineers shall have immediate access to recommended spare parts with additional parts storage located in regional depots. Additional spare parts shall be accessible on a 7 x 24 basis from the national depot and shall be expedited on a next available flight basis or via direct courier (whichever mode is quickest).

3.4 DEMONSTRATION

- A. Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner's personnel.
 - 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - 2. Train the Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 3. Review data in operation and maintenance manuals with the Owner's personnel.
 - 4. Schedule training with the Owner, through the Architect/Engineer, with at least seven day's advanced notice.
- B. The manufacturer shall make available to the Owner various levels of training ranging from basic UPS operation to UPS maintenance.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the solid state UPS shall be without damage at time of Substantial Completion.

END OF SECTION

INTEGRATED PARALLEL - SPECIFICATION KEY

Refer to battery matrix for available battery times.

Technical Specifications	555kVA	625kVA	750kVA	800kVA
Input/Output Voltage (V)*	480/480	480/480	480/480	480/480
Nominal Input Current (A)	719	817	1034	1103
Max Input Current (A)	822	920	1141	1236
Input CB (KAIC)	100	100	100	100
Frame Size/Trip (A)	2000/1600	2000/1600	2000/1600	2000/1600
Nominal Bypass Current (A)	668	752	900	960
Bypass CB ² (KAIC)	65	65	65	65
Trip (A)	1200/1200	1200/1200	1200/1200	1200/1200
Optional : UPS Output Isolation CB ² (KAIC)	65	65	65	65
Frame Size/Trip (A)	1200/1200	1200/1200	1200/1200	1200/1200
UPS Output Current (A)	668	752	900	960
DC Current – Maximum (A)	1364	1533	1766	1884
DC Breaker				
Frame Size/Trip (A)	2000/2000	2000/2000	2000/2000	2000/2000
UPS Efficiency with input/output isolation transformer (full load)	93.1%	92.3%	93.9%	94%
Core Unit Full Load Heat Rejection (BTUs)	125,970	158,000	144,000	160,000
555/625kVA UPS Module Width (39"Dx82"H)	121"	121"	---	---
555/625kVA UPS Module + Q5N Aux Width (39"Dx82"H)	135"	135"	---	---
750/800kVA UPS Module + Q4S Aux Width (39"Dx82"H)	---	---	135"	135"
750/800kVA UPS Module + Q4S/Q5N Aux Width (39"Dx82"H)	--	---	144"	144"
Bottom Entry Cabinet – All KVA Width (39"Dx82"H)	36"	36"	36"	36"
Battery Disconnect Width (28"Dx90H)	36"	36"	36"	36"
Max. Shipping Split Width	61"	61"	61"	61"
UPS Cabinet Weight ⁴ (lbs)	11,528	11,528	14,014	14,014