

# **Schneider Electric**

## **GALAXY VM**

### **Data Center Grade Three Phase Uninterruptible Power Supply Guide Specifications 160-225 kVA UPS**

*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 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 three-phase, on-line, double conversion, solid state UPS. The UPS shall operate in conjunction with the existing building electrical system to provide high quality power conditioning, back-up power protection, and distribution for electronic equipment loads. The system shall consist of a solid state IGBT rectifier/inverter, power factor corrected rectifier, a 100 percent rated for continuous duty static switch, battery plant, graphical status/control panel, and synchronizing circuitry as described herein.

##### **1.2 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 Electrical Manufacturers Association (NEMA):**
  - 1. NEMA PE 1, " Uninterruptible Power Systems (UPS) - Specification and Performance Verification."
- E. **National Fire Protection Association (NFPA):**
  - 1. NFPA 70, "National Electrical Code" (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

- F. **Underwriters Laboratories, Inc. (UL):**
1. UL 1778, "Standard for Uninterruptible Power Supply Equipment" (copyrighted by UL, ANSI approved).

### 1.3 [Parallel] SYSTEM DESCRIPTION

#### A. General Characteristics

1. Double Conversion – Transformerless Design
2. Integrated Parallel capability
  - a. Up to five UPS units for redundancy
  - b. Up to four UPS units for capacity
3. Front access only required for service
4. Top or bottom cable entry
5. High efficiency (96% at low load levels from 25% to 75%)
6. Battery charging in bypass operation

#### B. Design Requirements:

*INSERT APPLICABLE VALUES IN PARAGRAPHS BELOW.*

1. The UPS shall be sized for [ ] kVA load.
2. [The parallel system shall be comprised of [ ] UPSs for N+[ ] system-level redundancy.]
3. [The parallel system shall be sized for [ ] kVA load.]
4. The UPS battery system shall be sized for [ ] kVA at power factor 0.9 for [ ] minutes.

#### C. System Characteristics:

1. **Input:** The system input shall be configurable for either single or dual utility derived from a three phase wye source. The system should facilitate both top and bottom cable entry.
  - a. **Input voltage:** [ ] volts AC, -25 percent +20 percent (+25% for 1 minute), three-phase, 3-wire (3PH + G).
  - b. **Frequency:** 40-70 Hertz
  - c. **Input Power Factor Correction:**
    - 1) 0.97 > 10% load
    - 2) 0.98 > 20% load
    - 3) 0.99 > 40% load
  - d. **Total Harmonic Distortion (THDI):**
    - 1) < 3% @ 100% load
    - 2) < 4% @ 50% load
    - 3) < 6% @ 25% load
  - e. **Short-circuit Withstand Rating:** 65 kAIC capability
  - f. **Protection:** Built-in Backfeed Contactor.
  - g. **Inrush Current:** Less than nominal input current for less than one cycle. Shall not exceed 800% of the rectifier/battery charger full load current.
  - h. **Input Surge Protection:** UPS shall be equipped to withstand surges per ANSI/IEEE C62.41.
2. **UPS Output:**
  - a. **Output Voltage:** [ ] volts AC,  $\pm 1$  percent steady state variation phase-to-phase voltage volts AC, three- phase, 3-wire (3PH + G) or 4 wire (3PH + N + G).
  - b. **Frequency:** 50/60 hertz,  $\pm 1.0$  percent (free running)
  - c. **Output voltage range**
    - 1) **Symmetric load (0-100%):**
      - a)  $\pm 1\%$  static
      - b)  $\pm 5\%$  after 2 ms
      - c)  $\pm 1\%$  after 50 ms
  - d. **Output Voltage Transient Response:** The output voltage returns to within  $\pm 1\%$  of the steady state value within 50ms.
  - e. **Output Power Factor:** 0.9

- f. **Output Voltage Transient Characteristics:**
    - 1) 20% load step change +3%
    - 2) 50% load step change +3%
    - 3) 100% load step change +5%
  - g. **Total Harmonic Distortion (THDU):**
    - 1) < 2% at 100% linear load
    - 2) < 3% at 100% non-linear load
  - h. **Slew Rate (Hz/sec):** Programmable 0.25, 0.5, 1, 2, 4, 6
  - i. **Load Power Factor:** 0.7 leading to 0.5 lagging without derating
  - j. **Overload Rating:**
    - 1) **Normal Operation:**
      - a) 150% for 1 minute at 40°C
      - b) 125% for 10 minutes at 40°C
    - 2) **Battery Operation:**
      - a) 150% for 1 second at 40°C
      - b) 125% for 1 minute at 40°C
    - 3) **Bypass Operation:**
      - a) 1000% for 100 ms
  - k. **System AC-AC Efficiency:**
    - 1) Up to 96.2% in normal operation
    - 2) Up to 99% in ECO mode
3. **Battery:** The battery system should consist of [\_\_\_\_\_] [modular battery cabinets/classic battery cabinets/battery breaker box]
- a. **Battery Voltage:** 480 volts DC nominal
  - b. **Charging Power in % of output power:**
    - 1) 40% charge ≤ 80% load
    - 2) 20% charge ≤ 100% load
  - c. **Battery Test:** Manual or automatic (selectable)
  - d. **Deep Discharge Protection**
  - e. **Recharge according to Battery Temperature**
  - f. **Cold Start**
  - g. **Battery Type:** Valve regulated sealed lead acid (VRLA). Either in traditional top terminal or modular cabinet
  - h. **Maximum DC Current:** Maximum DC current at cutoff voltage shall be [\_\_\_\_\_] amperes.

#### 1.4 SUBMITTALS

- A. **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.
- B. **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.
- C. **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.

D. **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.

**1.5 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. **Safety:** UL 1778 4<sup>th</sup> edition
  - b. **EMC/EMI/RFI:** FCC47 Part 15
  - c. **Markings:** UL1778
  - d. **Transportation:** ISTA 2B
  - e. **Seismic Zone:** IBC Level 2:2006

C. **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.

**1.6 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. The customer shall 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.

## 1.7 PROJECT CONDITIONS

1. The UPS shall operate under the following environmental conditions:
  - a. **Temperature:**
    - 1) **Operating ambient temperature:** 32 °F (0 °C) to 104 °F (40 °C).
    - 2) **Storage ambient temperature with batteries:** 5°F (-15 °C) to 104 °F (40 °C).
    - 3) **Storage ambient temperature without batteries:** -77°F (-25 °C) to 131 °F (55 °C).
  - b. **Relative Humidity (Operating and Storage):** 0 percent to 95 percent non-condensing.
  - c. **Elevation:**
    - 1) **Operating:**
      - a) 3300 feet (1000 m): 1.000
      - b) 5000 feet (1500 m): 0.975
      - c) 6600 feet (2000 m): 0.950
      - d) 8300 feet (2500 m): 0.925
      - e) 10000 feet (3000 m): 0.900
    - 2) **Non-Operating:** 0-15000 m
  - d. **Audible Noise:**
    - 1) 65 dBA at 100% load and 3 feet (1 m) from surface
    - 2) 55 dBA at 70% load and 3 feet (1 m) from surface

## 1.8 WARRANTY

- A. **Factory 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 warranty shall extend the one year period of limitations contained in the General Conditions. The warranty shall be countersigned by the Installer and the manufacturer.
  1. **UPS Cabinets:** 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 Cabinets:** The battery manufacturer's warranty shall be passed through to the final Owner and shall have a minimum period of one year.
- B. **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.

## 1.9 MAINTENANCE

- A. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available from the manufacturer.
- B. 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.
- C. 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. 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.
- D. The UPS shall be repairable by replacing standard subassemblies requiring no adjustments. Communication via a modem with a remote maintenance system shall be possible.

- E. 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 Galaxy VM 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. UPS module shall be designed to operate as a double conversion, on-line reverse transfer system in the following modes.
1. **Normal:** The UPS system shall continuously supply power to the critical load.
  2. **Battery:** Upon failure of the utility AC power source, the critical load shall be supplied by the inverter, which, without any interruption, shall obtain its power from the battery.
  3. **Recharge:** Upon restoration of the utility AC power source (prior to complete battery discharge), the PFC rectifier shall power the inverter and simultaneously recharge the battery.
  4. **Static Bypass:** The static bypass switch shall be used to transfer the load to the bypass without interruption to the critical power load. This shall be accomplished by turning the inverter off. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverter on.
  5. **Maintenance Bypass:** In maintenance bypass the load is supplied with unconditioned power from the bypass input.
  6. **ECO Mode:** The UPS system is configured to use static bypass operation as the preferred mode under predefined. Transfers to battery operation upon utility failure. Efficiency up to 99%.
  7. **ECONversion:** ECONversion allows the system to supply the active part of the load through the bypass. The inverter is kept running in parallel with the bypass source and supplies the reactive part of the load. The input power factor of the UPS is, regardless of the load power factor, maintained close to unity as the reactive part of load is significantly reduced in the UPS input current. In case if an interruption to the utility/mains supply, the inverter immediately maintains the output voltage so that breaks or drops during this transfer are practically eliminated. UPS operates with static bypass in parallel with main inverter. Main inverter actively corrects power factor, and harmonics to provide sinusoidal main input current. Transfer time to double conversion <1milliseconds.
  8. **Parallel Operation:** The system shall have the option to install up to 5 UPSs in parallel. This can be done for capacity (5+0) or for redundancy (4+1) with an external system bypass cabinet. In addition, the UPS can be parallel at 1+1 without a system bypass cabinet.
    - a. The parallel UPSs shall be of the same design, voltage, and frequency.
    - b. **Output Control:** A load sharing circuit shall be incorporated into the parallel control circuits to ensure that under no-load conditions, no circulating current exists between the UPSs. This feature also allows each UPS to share equal amounts of the total critical load bus. The output voltage, output frequency, output phase angle, and output impedance of each UPS shall operate in uniformity to ensure correct load sharing.
    - c. **Parallel System Control:** The UPS shall have no single dedicated control system designed to control of the parallel system.
    - d. **Communication:** Communication between the UPSs shall be connected so that the removal of any single cable shall not jeopardize the integrity of the parallel communication system. Load sharing communications shall be galvanically isolated for purposes of fault tolerances between UPSs. A UPS's influence over load sharing shall be inhibited in any mode where the UPS inverter is not supporting its output bus. Transfer to and from bypass can be initiated from any online UPS.
    - e. **Battery Runtime:** Each UPS shall have its own battery solution

- f. **Switchgear:** Either a Galaxy VM System Bypass Cabinet or a custom switchgear shall be required for parallel operation.
- 9. **External Synchronization:** Synchronization of the output of the UPS with any other independent source for use with downstream transfer switches. The synchronization at the UPS is controlled from an input on the interface boards.

## 2.3 COMPONENT DESCRIPTION

- A. **PFC Rectifier and Battery Charger:** Incoming AC power shall be converted to a regulated DC output voltage by an IGBT (insulated gate bipolar transistor) power factor correction (PFC) rectifier. The PFC rectifier shall provide high quality DC power to charge the batteries and power the inverter and shall have the following characteristics:
  - 1. **Input Power Factor Correction (PFC):** The PFC rectifier shall be power factor corrected so as to maintain an input power factor of 0.99 @ loads > 40% to unity to ensure generator compatibility and avoid reflected harmonics from disturbing loads sharing the utility power. The rectifier output shall be filtered with a ripple current not exceeding 1% rms over the allowable continuous input voltage range.
  - 2. **Input Harmonic Current Suppression:** The PFC rectifier shall produce a sinusoidal input AC current on each phase with low harmonic content, limiting THD on the UPS input to below 3 percent @ 100% load.
  - 3. **Battery Charger Current Limiting:** The UPS shall be equipped with a system designed to limit the battery recharge current.
    - a. 40% charger up to 80% load
    - b. 20% charger 80% - 100% load
- B. **Inverter:** The UPS output shall be derived from a variable frequency Pulse Width Modulated (PWM) IGBT inverter design. The inverter shall be capable of providing the specified precise output power characteristics while operating over the battery voltage range. Inverter shall be individually fused with fast-acting fuses. UPS display shall indicate inoperable fuses.
  - 1. **Transient Response**
    - a. The inverter transient voltage shall not exceed the following parameters:
      - 1)  $\pm 5\%$  for a 10% to 100% step load application and removal with 10% initial load or 100% initial load.
      - 2)  $\pm 5\%$  for transfer of rated load from the bypass source to the UPS inverter output during automatic forward transfer of the static bypass transfer switch.
      - 3) 0% for loss of or return of main AC input.
  - 2. **Transient Recovery**
    - a. The output voltage returns to within  $\pm 1\%$  of the steady state value within 50ms.
  - 3. **Fault Clearing**
    - a. The inverter shall electronically be turned off to protect against excessive overload conditions which exceed the parameters defined.
    - b. UPS systems shall sense an overload condition and automatically transfer to the bypass input source which shall be used to provide the necessary fault clearing current required.
  - 4. **Inverter DC Protection**
    - a. The inverter shall be protected by the following features that shall be independently adjustable for maximum system flexibility.
      - 1) DC Over-voltage Trip.
      - 2) DC Under-voltage Shutdown.
      - 3) DC Under-voltage Disconnect annunciated by an internal visual alarm and relay contact closure.
  - 5. **Output Protection**
    - a. The inverter shall be electronically turned off to protect against overloads and abnormal load conditions which exceed the units rating.
    - b. UPS systems shall sense an overload condition and automatically transfer to the bypass input source which shall be used to provide the necessary current required.
  - 6. **Over-current Protection**
    - a. The inverter shall be protected from excessive overloads, including reverse currents, by fast acting fuses to prevent damage to power semiconductors. All fuses shall be provided with a blown fuse indicator with alarm indication on the control panel.
- C. **Static Bypass - 100 Percent Rated, Continuous Duty:** The static bypass transfer switch shall be solid state, rated for 100 percent continuous duty without mechanical contactor device

in parallel for higher reliability and consistent response time and shall operate under the following conditions:

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. Inverter overload exceeds unit's rating.
  - b. Battery protection period expired and bypass current is available.
  - c. Inoperable inverter.
2. **Interrupted Transfer:** If the bypass source is beyond the conditions stated below, the UPS shall make an interrupted transfer (not less than 100 milliseconds in duration).
  - a. Bypass voltage greater than +10 percent, -10 percent from the UPS rated output voltage.
  - b. Bypass frequency tolerance is user selectable to  $\pm 0.1\text{Hz}$ ,  $\pm 3\text{Hz}$ , and  $\pm 10\text{Hz}$ .
3. **Automatic Uninterrupted Forward Transfer:** The static bypass transfer switch shall automatically forward transfer power, without interruption, after the UPS inverter is turned on after an instantaneous overload induced reverse transfer has occurred and the load current returns the UPS's nominal rating or less.
4. **Manual Transfer:** A manual static transfer shall be initiated from the UPS control panel by turning the UPS inverter off.
5. **Overload Ratings:** Each static bypass transfer switch shall have the following overload characteristics:
  - a. 1,000% of UPS output rating for 100 milliseconds.
  - b. 150% of UPS output rating for one (1) minute.
  - c. 100% of UPS output rating indefinitely.
  - d. Each switch shall be suitable for all load conditions permitted by the upstream protective devices such that no damage is sustained during operation.

## 2.4 SYSTEM CONTROLS AND INDICATORS

### A. Microprocessor Controlled Logic:

1. The full UPS operation shall be provided through the use of microprocessor controlled logic. Operation 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. 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 UPS. UPS shall be microprocessor controlled.
2. The UPS shall include, but shall not be limited to, a standard easy to use control and indicator panel. Included shall be a backlit, color graphic animated LCD display and LED indicators. The UPS panel shall include UPS on and UPS off pushbuttons that shall permit the Owner to command the UPS on or off.

### B. Front Panel 7" Color Graphical Display: The UPS control panel shall provide a backlit, color graphic display with choice of 18 operating languages for indication of UPS status, metering, battery status, alarm/event log, and advanced operational features.

1. **Access:** The display shall provide access to:
  - a. Mimic diagram indicating UPS power flow.
  - b. Measurements, status indications, and events.
  - c. Personalization menu protected by a password, used to make specific settings.
  - d. Event log with time stamping.
  - e. Access to measurements.
2. **System Parameters Monitored:** The visual display shall include, but shall not be limited to, the following system parameters based on true RMS metering:
  - a. **Measurements:**
    - 1) Input voltage (Ph-Ph and Ph-N).
    - 2) Input current per phase.
    - 3) Bypass voltage.
    - 4) Bypass input frequency.
    - 5) UPS output voltage (Ph-Ph and Ph-N).
    - 6) UPS output current per phase.
    - 7) UPS output frequency.
    - 8) UPS output percent load.
    - 9) UPS output kVA.

- 10) UPS output power factor.
  - 11) Battery voltage.
  - 12) Crest factor.
  - 13) Battery current.
  - 14) Battery backup time and remaining service life.
  - b. **Status Indications and Events:**
    - 1) Load on battery.
    - 2) Load on UPS.
    - 3) Load on bypass.
    - 4) Low battery warning.
    - 5) General alarm.
    - 6) Battery fault.
    - 7) Remaining back-up time during operation on battery power.
    - 8) Bypass source outside tolerances.
    - 9) Additional indications shall provide maintenance assistance.
  - 3. **Time-Stamped Historical Events:** This function shall time stamp and store important status changes, anomalies, and faults.
- C. **LED Status Indicators:** The UPS control panel shall provide three LEDs that shall signal the following status conditions:
- 1. **Green:** The Load is protected.
  - 2. **Green + Orange:** The load is protected, but the system reports a warning alarm.
  - 3. **Orange + Red:** The load is unprotected and the system reports a warning and a critical alarm
  - 4. **Red:** The load is unprotected and the system reports a critical alarm.
- D. **Buttons:**
- 1. Inverter off
  - 2. Inverter on
- B. **Audible Alarm Reset:** The UPS shall provide an audible alarm that can be stopped using the user interface.
- C. **Emergency Power Off (EPO):** The UPS shall be equipped with provisions for remote emergency power off and dry contact input that shall be used to command UPS shutdown remotely.
- D. **USB port:** shall be provided for field diagnostics.
- E. **Dry Contacts:** The UPS shall be provided standard with a programmable input/output relay board. This board shall have six dry contacts for inputs and six relays for output.
- 1. Input Contacts: Programmable as:
    - a. Custom Input 1
    - b. Custom Input 2
    - c. Ground Fault
    - d. External Battery Monitor Fault
    - e. Battery Room Ventilation Fault
    - f. Supplied By Genset
  - 2. Output Relays: Programmable as:
    - a. Common Alarm
    - b. Normal Operation
    - c. Battery Operation
    - d. Maintenance Bypass
    - e. Static Bypass
    - f. ECO Mode
    - g. Output Overload
    - h. Fan Fault
    - i. Battery Fault
    - j. Battery Disconnected
    - k. Battery Voltage Low
    - l. Input Out of Tolerance
    - m. Bypass Out of Tolerance
    - n. Output Out of Tolerance

- o. UPS Warning
  - p. UPS Critical
  - q. Parallel Redundancy Lost
  - r. External Fault
  - s. UPS Maintenance Mode
  - t. System Critical
  - u. System Warning
  - v. System Common Alarm
3. The contacts shall be normally open and shall change state to indicate the operating status. The contacts shall be rated at 2.0 amperes (250 volts AC/30 volts DC).

## 2.5 MECHANICAL DESIGN AND VENTILATION

- A. **Cabinet:** The UPS shall be housed in two freestanding cabinets with dead front construction. The mechanical structure of the UPS shall be sufficiently strong and rigid to withstand handling and installation operations. The sheet metal elements in the structure shall be protected against corrosion by a suitable treatment, such as zinc electroplating, bi-chromating, epoxy paint, or an equivalent.
- B. **Cable Access:** The standard UPS available shall accommodate top or bottom cable entry in standard cabinet..
- C. **Cabinet Weights and Dimensions:** The width of the UPS shall be [\_\_\_\_\_] inches ([\_\_\_\_\_] mm) and shall have a maximum weight of [\_\_\_\_\_] pounds ([\_\_\_\_\_] kg).

*INSERT WIDTH AND WEIGHT IN PARAGRAPH ABOVE. INSERT BTUs PER HOUR IN PARAGRAPH BELOW.*

- D. **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 portion of the unit. Full load heat rejection shall be [\_\_\_\_\_] BTUs per hour.

## 2.6 BATTERY

- A. **General:** The UPS module shall use a valve-regulated sealed lead acid heavy duty industrial battery, designed for auxiliary power service in an UPS application. The primary battery shall be furnished with impact-resistant plastic cases and housed in a matching cabinet(s) next to the UPS module.
- B. **Protection against Deep Discharge and Self-Discharge:** The UPS shall be equipped with a device designed to protect the battery against deep discharge, depending on discharge conditions, with isolation of the battery by a circuit breaker. In particular, a monitoring device shall adjust the battery shutdown voltage as a function of a discharge coefficient to avoid excessive discharge at less than the rated output. A second device shall avoid self-discharge of the battery into the UPS control circuits during an extended shutdown of the UPS (over two hours).
- C. **Battery Self-Tests:**
1. **Battery Test:** This feature performs a number of tests on the batteries, such as fuse-blown check, weak battery detection, and symmetry error. The battery self-test can be setup to run automatically in different time intervals between weekly and up to a year.
  2. **Runtime calibration:** This feature is used for re-calibrating the estimated remaining runtime value.

## 2.7 OPTIONAL ACCESSORIES

- A. **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 system 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.
  4. **Public Network Monitoring:** Data Center Expert shall also be capable of monitoring other Schneider Electric devices that are connected to the client's public network.
- B. **Battery Cabinets:** Modular or classic battery cabinets are available.
1. **Modular battery cabinets:**
    - a. The modular battery cabinet shall be matching and adjacent to UPS cabinet.
    - b. Modular construction made up of redundant strings per cabinet.
    - c. Modular battery shall allow trained-user to quickly replace, swap, battery modules during maintenance operation.
    - d. Each battery string is monitored for voltage and temperature for use by the UPS battery diagnostic.
    - e. UPS shall alarm user when redundant battery string needs replacement.
    - f. The UPS shall incorporate a battery capacity test that will be capable of determining available runtimes.
  2. **Classic battery cabinet:**
    - a. The classic battery cabinet shall feature valve regulated, high-rate discharge, lead-acid batteries which provide energy to the support the load during a momentary loss of input power to the rectifier.
    - b. Non-redundant construction - one battery string per cabinet.
    - c. The classic battery cabinet shall be matching and adjacent to UPS cabinet (remote available upon request).
    - d. Each battery cabinet shall require front access only for installation, service and maintenance.
    - e. Each battery cabinet shall feature a DC rated circuit breaker. The circuit breaker within the battery cabinet shall only provide protection to the battery string within that battery cabinet.
    - f. The UPS shall incorporate a battery capacity test that will be capable of determining available runtimes.
- C. **External Control and Communications Devices:** The UPS shall contain two smart slots for the following optional control and communications devices:
1. **Dry Contacts/I/O accessory (AP9810+ AP9631orAP9635):** Customizable input and output contacts for the UPS network management card 2 with environmental monitoring (2 inputs/ 1 output)..
  2. **Temperature Sensor (AP9631 or AP9635):** The temperature Sensor enables the UPS environment to be monitored by taking regular measurements of temperature. Its connection to the Network Management Card enables monitoring or notification of alarms via your computer network. If an additional temperature sensor is needed, procure (AP9335T)
  3. **Temperature and humidity Sensor(AP9335TH + AP9631 or AP9635):** The temperature and humidity Sensor enables the UPS environment to be monitored by taking regular measurements of temperature and humidity. Its connection to the Network Management Card enables monitoring or notification of alarms via your computer network.
  4. **Network Management Card (AP9630):** The UPS NMC display has possibility to connect to SNMP, Web, Data Center Expert, Modbus, RMS over ethernet. But in the standard display NMC it is not possible to connect sensors.
- D. **Seismic Anchors:** ship included with the system.
- E. **Dual Input:** Provide dual input to accommodate a separate input source.

- F. **Transformers:** 208 V and 600 V.
- G. **DC Flywheel.**
- H. **Wall-mount battery breaker box.**
- I. **Parallel system bypass cabinets:** 450 kVA and 675 kVA standard. 900 kVA and above available upon request.
- J. **UPS output distribution cabinets:** Customizable 100 A to 400 A sub feed breakers.

### **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.

#### **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**