Schneider Electric

GALAXY VX 300/500/750/1000/1250/1500kW N+1
Scalable from 300kW to 1500kW N+1 Internal Redundancy
Data Center Grade Three Phase Uninterruptible Power Supply
Guide Specifications

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.

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 and 4 level inverter, power factor corrected rectifier, a 100 percent rated, continuous-duty static switch, graphical status/control panel, and synchronizing circuitry as described herein.

1. The UPS shall utilize a scalable architecture with the ability to provide N+1 redundancy at full capacity. The system power train shall be comprised of 250 kVA/250 kW power cabinets. These power cabinets can be added after initial installation to provide increased capacity or redundancy.
2. The UPS control logic shall incorporate state of the art digital signal processing.
3. The inverters shall utilize high speed pulse width modulation.
4. The power cabinets shall include fan redundancy, with variable speed fans that are field-replaceable. Each power cabinet shall be capable of full rated performance continuously even with a single fan malfunction.
5. Each power cabinet shall be furnished with its own core controller. Each power cabinet controller shall report to the master controller in the I/O cabinet.
6. UPS redundancy at the power cabinet level: Upon individual power cabinet inoperability, system shall isolate the power cabinet and continue to operate in the online mode.
7. **300/400/500kW/750kW/1000kW UPS:** UPS shall be capable of integrated parallel operation up to 4+1. Individual module redundancy is maintained.
   1100/1250kW/1500kW UPS: The UPS shall be capable of integrated parallel operation up to 3+1. Individual module redundancy is maintained.
8. The UPS shall require no rear or side access for maintenance or repair.
9. Cooling shall require air intake from the front and air exhaust from the top of the UPS.
10. Removable and replaceable air filters shall be included.
11. The UPS shall be capable of software defined power (peak shaving operation).
12. The UPS shall support frequency conversion.
13. In addition, this Section describes the performance, functionality, and design of the optional maintenance bypass cabinet with output distribution, hereafter referred to as the maintenance bypass.

14. For UPSs in parallel configuration, an optional system bypass cabinet shall be available.

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."
2. ISO 14001, “Environmental Management Systems - Requirements With Guidance for Use.”

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) - hereafter referred to as NEC.

F. **Underwriters Laboratories, Inc. (UL):**
1. UL 1778, 5th edition, "Standard for Uninterruptible Power Supply Equipment" (copyrighted by UL, ANSI approved).
2. UL 891, "Standard for Dead-Front Switchboards" (copyrighted by UL, ANSI approved).
3. UL 1558, "Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear”.

G. International Electrical Commission (IEC):
1. EC 62040-1: 2008-06, 1st edition Uninterruptible Power Systems (UPS) - Part 1: General and safety requirements for UPS
2. EN 62040-1: 2013-01, 1st edition amendment 1
3. IEC 62040-2: 2005-10, 2nd edition Uninterruptible Power Systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements
4. IEC 62040-3, “Uninterruptible Power Systems - Method of Specifying the Performance and Test Requirements.”
5. IEC 62040-4: 2013-04, 1st edition Uninterruptible Power Systems (UPS) - Part 4: Environmental aspects – Requirements and reporting

1.3 [Parallel] SYSTEM DESCRIPTION

A. **General Characteristics**
1. Double Conversion – Transformer-less Design
2. Unity Power Factor – output
3. Scalable Architecture
4. N+1 Redundant capability
5. Integrated Parallel capability
   a. 300/400/500kW or 300/400/500kW scalable to 750kW or 300/400/500kW scalable to 1000KW N+1 UPS:
      1) Up to five UPS units in N+1 configuration, where N is 4, **1** for redundancy
      2) Up to four UPS units for capacity
   b. 750kW scalable to 1000kW UPS
      1) Up to five UPS units in N+1 configuration, where N is 4, **1** for redundancy
      2) Up to four UPS units for capacity
   c. 500kW scalable to 1250kVA or 1250kW or 1500kVA UPS:
      1) Up to four UPS units in N+1 configuration, where N is 3, **1** for redundancy
      2) Up to two UPS units for capacity

6. Only front access required for service
7. Top or bottom cable entry without increase in dimensions or configuration
8. High efficiency in double conversion mode (96% efficiency at 30% load)
9. Higher efficiency modes of operations such as ECOnversion / ECO mode with power factor correction, harmonic filtering, battery charging and IEC62040-3 Class I output performance
10. 4-level inverter technology

B. **Design Requirements:**

INSERT APPLICABLE VALUES IN PARAGRAPHS BELOW.

1. The UPS shall be sized for [___] kW load.
2. The UPS shall include [___] power modules for N+ [___] unit internal redundancy.
3. [The parallel system shall be comprised of [___] UPSs for N+ [___] system-level redundancy.]
4. [The parallel system shall be sized for [___] kW load.
5. The UPS battery system shall be sized for [___] kW at power factor 1.0 for [___] minutes.

C. **System Characteristics**:

1. **Input**: The system input shall be configurable for either single or dual inputs derived from a three phase wye source.
   a. **Input voltage:** 480 volts AC, 60Hz three-phase, 3-wire (3PH+G) or 4-wire (3PH+G+N) **(NOTE:** 4-wire installation is limited to 1MW utilizing GVX 1MW IOC)
      1) -15 percent to +20 percent continuous @ 100% Load
      2) -25 percent to +20 percent continuous @ 75% Load
      3) -35 percent to +20 percent continuous @ 50% Load
   b. **Frequency:** 40 to 70 Hz
   c. **Input Power Factor Correction:**
      1) 0.97 @ 10% load
      2) 0.98 @ 20% load
      3) 0.99 @ greater than 40% load
   d. **Walk in duration:** Each UPS module shall have programmable and adaptive walk in duration 1-300 sec
   e. **Input Current Total Harmonic Distortion (THDI):**
      1) < 3% @ 100% load
   f. **Short-circuit Withstand Rating**:
      1) **Galaxy VX UPS Module**: 100 kAIC capability
      2) **Galaxy VX 750kW Maintenance Bypass Panel (Remote)**: 65kAIC
   g. **Backfeed Protection**:
      1) Bypass backfeed protection provided via molded switch; inverter path protection via contactor
   h. **Magnetization Inrush Current:** The UPS shall exhibit 0 inrush current as a standard product.
   i. **Input Surge Protection:** UPS shall be equipped to withstand surges per ANSI/IEEE C62.41.
2. **UPS Output:**
   a. **Output Voltage:** 480 volts AC, ±1 percent steady state variation phase-to-phase voltage volts AC, three- phase, 3-wire (3PH + G) or 4-wire (3PH + G + N) **(NOTE:** 4-wire installation is limited to 1MW utilizing GVX 1MW IOC)
   b. **Frequency:** 60 hertz, ±0.1% (free running)
   c. **Output voltage regulation:**
      a) ±1% for 100% balanced linear load.
      b) ±3% for 100% unbalanced linear load
   d. **Output Voltage Transient Response:** The output voltage returns to within ±1% of the steady state value within 50ms.
   e. **Output Power Factor:** 1.0
   f. **Output Voltage Transient Characteristics:**
      1) 20% load step change +3%
      2) 50% load step change +3%
      3) 100% load step change +5%

g. **Output Voltage Total Harmonic Distortion (V-THD):**
   1) < 2% at 100% linear load
   2) < 3% at 100% non-linear load
h. **Crest Factor**: 3:1 with THD <5%
i. **Slew Rate (Hz/sec):** Programmable 0.25, 0.5, 1, 2, 4, 6
j. **Load Power Factor:** 0.7 leading to 0.5 lagging without derating
k. **Overload Rating:**
   1) Normal Operation:
      a) 110% continuously (**NOTE**: For continuous overload operations, UPS requires to be at nominal voltage input and maximum 30C ambient temperature)
      b) 125% for 10 minutes
      c) 150% for 1 minute
   2) **Battery Operation**:
      a) 115% for 1 minute
   3) **Bypass Operation**:
      a) 1000% for 100 ms
      b) 150% for 1 minute
      c) 125% continuous
l. **System AC-AC Efficiency**:
   1) Up to 96.4% in normal operation
   2) Up to 98.8% in ECONversion Mode
   3) Up to 99% in ECO mode

3. **DC Bus:** Battery system should consist of [____] [classic battery cabinets][battery breaker box (cabinet)].
   a. **Battery Voltage:** 480 volts DC nominal
   b. **Charge current:**
      1) 40% of UPS Output Power @ ≤ 80% load
      2) 15% of UPS Output Power @ 100% load
      3) Charge current is adjustable from 1% to 35% of nominal power
   c. **Battery Test**: Manual or automatic (selectable)
   d. **Deep Discharge Protection**
      1) Battery Protection: The inverter shall be provided with monitoring and control circuits to limit the level of discharge on the battery system. These control circuits shall be capable of varying the shutdown level to accommodate any type of battery recommended for UPS application. These logic and control circuits shall automatically adjust shutdown level to 1.75 volts per cell for any discharge lasting longer than 60 minutes.
   e. **Recharge according to Battery Temperature**
   f. **Cold Start:** Cold start is possible if the DC trip board is set up as a shunt trip.
   g. **Energy Storage Options:** Valve regulated sealed lead acid (VRLA), Lead Acid, Nickel-Cadmium (NiCad), Lithium-ion (Li-Ion), or Flywheel
   h. **Maximum DC Current:** Maximum DC current at cutoff voltage shall be [____] amperes.
   i. **End of discharge voltage:** 384V

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 including, but not limited to, 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**:
      1) IEC 62040-1: 2008-06, 1st edition Uninterruptible Power Systems (UPS) - Part 1: General and safety requirements for UPS
      2) EN 62040-1: 2013-01, 1st edition amendment 1
      3) UL 1778 5th edition, cUL / CSA C22.2 NO.107.3
   b. **EMC/EMI/RFI**: FCC 15B, class A
   c. **Performance**:
      1) IEC 62040-3: 2011-03, 2nd edition Uninterruptible Power Systems (UPS) - Part 3: Method of specifying the performance and test requirements
   d. **Environmental**:
      1) IEC 62040-4: 2013-04, 1st edition Uninterruptible Power Systems (UPS) - Part 4: Environmental aspects – Requirements and reporting
   e. **Markings**: UL1778
   f. **Transportation**: IEC60721-4-2 Level 2M2
   g. **Seismic Rating**: IBC2012 and CBC2013
   h. **OSHPD compliant**

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 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 to 104°F (0 to 40°C).
      2) **Storage ambient temperature with batteries:** 5 to 104 °F (-15 to 40°C).
      3) Storage ambient temperature without batteries: -13 to 131 °F (-25 to 55°C).
   b. **Relative Humidity (Operating and Storage):** 0 percent to 95 percent non-condensing.
   c. **Elevation:**
      1) **Operating**:
         a) Maximum installation with no derating of the UPS output shall be 3300 feet (1000 m) above sea level.
         b) Altitude derating according to ANSI C57.96-1999
            (i) 1500 m (5000 ft): 0.975
            (ii) 2000 m (6600 ft): 0.950
            (iii) 2500 m (8300 ft): 0.925
            (iv) 3000 m (10000 ft): 0.900
      2) **Non-Operating**: 0-15000 m
   d. **Audible Noise:** 68 dB at 100% load

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 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 or as provided by the battery vendor.

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. The UPS shall include condition-based life cycle monitoring, which shall use predictive analytics to monitor the life expectancy of critical components.

B. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available from the manufacturer.
C. 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.
D. 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.

E. The UPS shall be repairable by replacing standard subassemblies requiring no adjustments.
F. 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 VX 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.
        a. **Software defined power (Peak shaving):** The peak shaving feature allows external control of the UPS input power that is supplied from the utility grid. During peak shaving, the load on the utility grid is kept at a constant level or below a certain limit, by supplying load power peaks using the batteries in addition to the utility grid itself. The batteries are then recharged when the load power demand is lower. An external software running on an external server is required to set the UPS input power.
        b. Frequency conversion: The UPS shall be able to generate 50 or 60Hz output voltage with a different input voltage.
    2. **Battery:** Upon interruption 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%. The typical transfer time shall be 4 ms.
    7. **ECOnversion**:

a. In ultra-high efficiency ECOnversion mode, an advanced method of bypass operation shall be used to avoid reversal of power from the inverter to utility mains in case of interruption of upstream utility.
b. The UPS system shall ensure a class 1 output voltage regulation according to IEC62040-3.
c. In case if an interruption to the utility/mains supply, the inverter immediately maintains the output voltage so that output breaks or drops during this transfer are practically eliminated. UPS operates with static bypass in parallel with main inverter.
d. It shall be possible to schedule the high efficiency mode up to seven different time intervals, each with start day, start time, stop day and stop time.
e. The suppression of harmonic content shall be able to enable/disable via UPS display as per user need.
f. 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.
g. While on ECOnversion mode, UPS shall have the ability to recharge batteries.
h. During downstream faults, UPS shall remain in ECOnversion mode initially, to allow fault to clear. If output voltage is not stable, UPS shall transfer to double conversion mode.
i. If an overload occurs while in ECOnversion, the UPS will transfer to normal mode. Overload behavior will then follow the rules defined under normal mode.

8. **Parallel Operation**:

a. 500kW Expandable to 750kW N+1: The system shall have the option to install up to 5 UPSs in parallel. This can be done for capacity (4+0) or for redundancy (4+1) with an external system bypass cabinet.
b. 500kW Expandable to 1000kW N+1: The system shall have the option to install up to 5 UPSs in parallel. This can be done for capacity (4+0) or for redundancy (4+1) with an external system bypass cabinet.
c. 500kW Expandable to 1500kW N+1: The system shall have the option to install up to 4 UPSs in parallel. This can be done for capacity (3+0) or for redundancy (3+1) with an external system bypass cabinet.
    1) The parallel UPSs shall be of the same kVA rating, voltage, and frequency.
    2) **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.
    3) **Parallel System Control**: To avoid single points of failure, the UPS system shall have no single dedicated control system designed to control the operation of the parallel UPS system. Control of and direction of parallel UPSs shall take place via a master/slave relationship, where the first UPS to receive logic power asserts itself as a master. In the event of a master failure, a slave UPS shall take the role of master and assume the responsibility of the previous master UPS.
    4) **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.
    5) **Battery Runtime**: Each UPS shall have its own battery solution. Each UPS battery solution shall consist of multiple battery strings with a nominal bus voltage of 480VDC.
    6) **Switchboard**: Either a Galaxy VX System Bypass Cabinet or a custom switchgear cabinet shall be required for parallel operation following Schneider Electric system control guidelines.

9. **Critical Bus Sync of single module**: 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, and is included as a standard feature of the UPS, eliminating the need for a wall-mounted CBS or Sync Box.

10. **Synchronization of Parallel UPS modules:** Critical Bus Sync controller is required to assign preferred master UPS.
    a. Synchronization shall be required to keep the outputs of all separate and independent UPS systems in sync during all operating conditions including when:
        1) Bypass power of one or both UPS systems is not available.
        2) Bypass power is available but they are out-of-sync.
        3) UPS systems are operating on battery.
    b. The Synchronization 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 shall not affect the standard and specified performance of the UPS system detailed in this Section.
    c. The External Synchronization (Critical Bus Sync) Mode shall operate under the following conditions:
        1) **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 UPSs 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.
        2) **Bypass source out of tolerance**: When the common bypass source disappears or is out of tolerance, the function initiates and controls one of the UPS system to re-establish synchronization with the other UPS system. The position of the reference source shall be configured as ("PREFERRED MASTER") determines which source is controlled.
        3) **Both bypass sources in tolerance**: If the Synchronization 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 reference source ("PREFERRED MASTER") determines which source is controlled.
        4) **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.
        5) **Both UPS bypass sources out of tolerance**: When the bypass sources of both UPS systems disappear or go out of tolerance, the Synchronization function initiates and controls one of the UPS systems to re-establish synchronization with the other. The position of the reference source ("PREFERRED MASTER") determines which source is controlled.

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%. The rectifier input 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 to ensure generator compatibility and avoid reflected harmonics from disturbing loads sharing utility power.
    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. 15% charger at 100% load

4. **Dry Contact Operation:** When signaled by a dry contact, this shall signal the UPS to turn off battery charging. This option is useful if the UPS is auxiliary powered from a restricted or minimally sized on-site generator.

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) 20% load step change +3%
      2) 50% load step change +3%
      3) 100% load step change +5%
2. **Transient Recovery**
   a. The output voltage returns to within ±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 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.
7. **Smart Power (SPoT) Test:** The Smart Power Test in normal operation is conducted by circulating power from the inverter back through the static bypass switch and into the power factor correction module. By circulating the power, each of the UPS converters is energized and loaded in the same way as though a UPS was feeding a load bank. The test shall be configurable for 100% rated power continuously or 120% of rated power for 10 minutes. During Smart Power Test, the UPS shall draw only enough power from utility to make up for system losses during the test procedure.
8. **Battery Discharge Smart Power (SPoT) Test:** Battery Discharge Smart Power Test adds the possibility to run a discharge test of the battery and validate runtime without load bank. During the discharge SPoT, the inverter is turned on while UPS is in Requested Static Bypass. During Battery Spot Mode, the PFC is supporting the DC bus with power from the battery. The inverter is considered as current generator, which transfers the inverter current back to the static bypass switch and finally to the input power grid. As the battery voltage decreases due to decreasing battery capacity, the battery current increases to deliver a constant power to the grid. (Warning: This test involves discharging batteries back into the power grid. Please be sure to have onsite and utility company approval before starting Battery SPoT.)

C. **Static Bypass - 110 Percent Rated, Continuous Duty:** The static bypass transfer switch shall be solid state, rated for 110 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 ±0.1Hz, ±3Hz, and ±10Hz.
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. **Single Module**: A manual static transfer shall be initiated from the UPS control panel by turning the UPS inverter off.
   b. **Parallel Module**: A manual static transfer shall be initiated from control panel of UPS or System Bypass cabinet that will upon user command shall simultaneously transfer all modules static bypass switches or back to inverters.
5. **Overload Ratings:** Each static bypass transfer switch shall have the following overload characteristics:
   a. 1000% of UPS output rating for 100 milliseconds.
   b. 150% of UPS output rating for one (1) minute.
   c. 110% 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 operator 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 for indication of UPS status, metering, battery status, alarm/event log, and advanced operational features.
1. **Built-in communication**
   a. Web interface
   b. SNMP
   c. Modbus over TCP/IP
      1) Modbus RS-485: Requires optional Modbus card
2. **Monitoring**:
   a. E-mail notification
   b. StruxureWare
   c. Remote monitoring service
3. **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.
4. **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-G).

2) Input current per phase.
3) Bypass voltage.
4) Bypass input frequency.
5) UPS output voltage (Ph-Ph and Ph-G).
6) UPS output current per phase.
7) UPS output frequency.
8) UPS output percent load.
9) UPS output (kVA and kW).
10) UPS output power factor.
11) Crest factor.
12) Battery current.
13) 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.

5. **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 alarm and a Critical alarm
4. **Red**: The load is unprotected, and the system reports a Critical alarm.

D. **Buttons:**
1. Inverter off (or transfer to bypass)
2. Inverter on (or transfer to UPS)

E. **Audible Alarm Reset:** The UPS shall provide an audible alarm that can be stopped using the user interface.

F. **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.

G. **USB port:** Shall be provided for field diagnostics.

H. **Dry Contacts:** The UPS shall be provided standard with a programmable input/output relay board. This board shall have five 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 (ie, input for an external ground fault detector)
d. Inhibit Transfer from Static Bypass
e. External energy storage monitoring major alarm
f. Flywheel inoperable
g. External Battery Monitor Detected Fault
h. Battery Room Ventilation Inoperable
i. Supplied by Genset
j. External energy storage monitoring minor alarm
k. Charger off (turn charger off)
2. Output Relays: Programmable as:

a. Common Alarm
b. Normal Operation
c. Battery Operation
d. Maintenance Bypass operation
e. Static Bypass standby
f. High Efficiency Mode
g. Output Overload
h. Fan Inoperable
i. Battery is not Working Correctly
j. Battery Disconnected
k. Battery Voltage Low
l. Input Out of Tolerance
m. Bypass Out of Tolerance
n. UPS Warning alarm
o. UPS Critical alarm
p. Parallel Redundancy Lost
q. External Fault
r. UPS Maintenance Mode
s. System Critical alarm
t. System Warning alarm
u. System Common Alarm
v. Emergency power off activated
w. Transfer to static bypass disabled
x. UPS informational alarm
y. System informational 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).

I. **Alarms:** The following alarms shall be available through the 7-inch touchscreen display. The display unit shall allow the Owner to display a log of active alarms. The following minimum set of alarm conditions shall be available:

1. Abnormal state at input contact zone A
2. Abnormal state at input contact zone B
3. Air Filter technical check recommended
4. Ambient temperature high
5. Ambient temperature out of tolerance
6. Batteries are discharging
7. Battery breaker BB1 open
8. Battery breaker BB2 open
9. Battery capacity is below minimum acceptable level
10. Battery breakers tripped
11. Battery condition is poor
12. Battery condition is weak
13. Battery is below minimum acceptable runtime
14. Battery is not working correctly
15. Battery room ventilation inoperable
16. Breaker MBB closed
17. Breaker SIB open
18. Breaker SSIB open
19. Breaker UIB open
20. Breaker UOB open
21. Bypass frequency out of tolerance
22. Bypass phase missing
23. Bypass phase sequence incorrect
24. Bypass voltage out of tolerance
25. Charge power is reduced
26. Communication cable termination missing or damaged
27. Confirm redundancy lost and/or transfer to Forced Static Bypass
28. Confirm Turn Load Off
29. Customer Input 1 activated
30. Customer Input 2 activated
31. Display communication is lost

32. Display firmware incompatibility detected
33. EPO Switch Activated
34. External battery monitoring detected fault
35. External sync frequency out of tolerance
36. External sync phase missing
37. External sync phase sequence incorrect
38. External sync temporarily disabled
39. External sync voltage out of tolerance
40. Fan inoperable
41. Firmware update - Incorrect UPS operation mode
42. Firmware versions in parallel UPS units are not identical
43. Flywheel inoperable
44. General parallel system event
45. Ground fault detected
46. High Battery Temperature Level
47. High humidity threshold violation at remote sensor
48. High temperature threshold violation at remote sensor
49. Input frequency out of tolerance
50. Input phase missing
51. Input phase sequence incorrect
52. Input voltage out of tolerance
53. Inverter is Off due to a request by the user
54. Inverter output is not in phase with bypass input
55. Lost communication to remote sensor
56. Lost parallel redundancy
57. Low Battery Temperature Level
58. Low humidity threshold violation at remote sensor
59. Low temperature threshold violation at remote sensor
60. Maximum humidity threshold violation at remote sensor
61. Maximum temperature threshold violation at remote sensor
62. Minimum humidity threshold violation at remote sensor
63. Minimum temperature threshold violation at remote sensor
64. NMC 1 firmware incompatibility detected
65. NMC 2 firmware incompatibility detected
66. Not enough UPS units ready to turn on inverter
67. Output frequency out of tolerance
68. Output voltage out of tolerance
69. Overload on UPS due to high ambient temperature
70. Overload or short circuit on UPS
71. Parallel communication lost on PBUS cable 1
72. Parallel communication lost on PBUS cable 2
73. Parallel mixed operation mode
74. Parallel unit not present
75. Restricted air flow
76. Self-test - Did not pass
77. Startup recommended
78. Static bypass switch inoperable
79. Static bypass switch warning
80. Surveillance detected fault
81. Synchronization unavailable - system is free-running
82. System locked in bypass operation
83. System operation mode - Forced Static Bypass
84. System operation mode - Maintenance Bypass
85. System operation mode - Off
86. System operation mode - Requested Static Bypass
87. System operation mode - Static Bypass Standby
88. Technical Check recommended
89. UPS configuration incorrect
90. UPS operation mode - Battery
91. UPS operation mode - Battery Test
92. UPS operation mode - Forced Static Bypass
93. UPS operation mode - Initialize

94. UPS operation mode - Inverter Standby
95. UPS operation mode - Maintenance Bypass
96. UPS operation mode - Off
97. UPS operation mode - Requested Static Bypass
98. UPS operation mode - Static Bypass Standby
99. UPS settings reset to default
100. Warranty expiring soon

2.5 MECHANICAL DESIGN AND VENTILATION

A. **Cabinet:** The UPS shall be housed in [two][three][_____] 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:**
1. The height of the UPS shall be 77.6 in (1970mm).
2. The width of the UPS shall be [_____] inches ([_____] mm)
3. The depth of the UPS shall be 35.4in (900mm).
4. The UPS 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. **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).

B. **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 displacement. 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.
3. **Charger Power Test:** The Charger Power Test will test the functionality of the UPS charger. During the charger power test, the charger is forcing a DC current to the batteries. The PFC module draws a similar current from the batteries, with the addition of the related losses in the system. The result is a full charger test with only a small current drawn from the batteries covering the losses.

2.7 OPTIONAL ACCESSORIES

A. **BATTERY**

1. **General:** The UPS module shall use a valve-regulated sealed lead acid heavy duty industrial battery or lithium-ion battery, designed for auxiliary power service in an UPS application. The primary battery shall be furnished with impact-resistant plastic cases.

B. **Valve-Regulated Lead-Acid (VRLA) Battery Cabinets:** Available in either remote or remote adjacent configurations.

1. **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 match the UPS cabinet.
   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.
   g. The battery cabinets shall come in a remote configuration and an optional remote adjacent configuration.
   h. Remote configuration will support top entry only. Remote adjacent configuration supports top and bottom entry.
   i. Common battery bank shall be supported for parallel installations (VRLA only).

C. **Lithium Ion Battery Solution:** Available in either remote or remote adjacent configurations.

1. **Battery cabinet:**
   a. The battery cabinet shall feature lightweight, compact, long-life lithium ion (Li-ion) batteries which provide energy to support the load during a momentary loss of input power to the rectifier.
   b. The Li-ion battery cabinet shall be white.
   c. Each battery cabinet shall require front access only for installation, service and maintenance.
   d. 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.
   e. The battery cabinet will support top entry only.
   f. The Li-ion battery solution operating temperature rating shall be 0-45ºC (32-113ºF).

2. **Battery monitoring:**
   a. Battery monitoring shall be provided at the module, rack, and system level. A switched-mode power supply shall be included and shall provide power for the battery monitoring system.
   b. The lithium ion battery solution shall communicate with the UPS via dry contact.
   c. The battery warranty shall be 3 years, and can optionally be extended to a total of 10 years.

3. Safety Device and Level of Protection

The battery system shall be designed with highest level of protection built into the battery system against 2 potential safety risk – over voltage and short circuit. It shall consist of a 3 level of protection namely, cell, module and rack level.

   a. **1st Level Protection – Battery Management System (BMS) & Switch Gear:** Each battery rack shall be installed with main switch gear to isolate the affected battery rack in the event of a fault. BMS shall also be included in each rack to provide continuous monitoring of the voltage and temperature of each cell within the rack. BMS gathers and analyses the rack current. In the event of over voltage or short circuit, the BMS will trip the MCCB at rack level.
   b. **2nd Level Protection – Fuse:** Fuses are built into the main switch gear at rack level. In the event of a fault current (caused by short circuit) which the MCCB cannot be activated in the shortest time, fuses will be activated to clear the fault current without damaging the cells.
   c. **Protection – Cell:** Several protection features shall be incorporated into the cell namely, safety function layer (SFL), Multi-layers Separator, Safety Vent, Safety

Fuse and Overcharged Safety Device. These safety features are to protect the cell from overcharging and thermal runaway.

D. **Battery Breaker Cabinet**: Optional. For valve-regulated lead-acid (VRLA) battery solutions only.
   1. Floor-mount battery breaker cabinet available. Cabinet will include DC breaker rated for specific UPS maximum current draw. Battery Breaker Cabinet shall support top or bottom entry. Battery breaker shall include UVR and Aux contacts to support monitoring by UPS modules.

E. **Maintenance Bypass Cabinet**
   1. Maintenance Bypass Cabinet available for purchase separately.
   2. Short circuit withstand of the optional MBC is 65kAIC.
   3. MBC shall include Kirk Key interlocks (Scheme 39).
   4. MBC shall be top or bottom entry.
   5. MBC shall support an optional load bank breaker with optional Kirk Key interlocks (scheme 29).

F. **System Bypass Cabinet**
   1. Common parallel configurations shall be supported by an available system bypass cabinet.
   2. System bypass cabinet shall come with integrated 10-inch display that provides system-level overview and single command transfers to and from bypass.
   3. Circuit breakers in SBC shall come with AUX contacts to support UPS monitoring.
   4. 10-inch display shall support the monitoring of up to 5 distribution breakers and one load bank breaker. Display shall allow unique naming of each breaker being monitored.

G. **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+ AP9631 or AP9635):** 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.

H. **Seismic Anchors:** Shipped with modules and included with the system.

I. **Wall Mount 10" System Level Graphical Display**: Wall Mount 10" System Level Graphical Display option shall be available when using non-Schneider Electric Parallel System Bypass Cabinets.

J. **Software-defined power server**: A server running external software defined power software shall be required for when this application is enable in the Galaxy VX UPS. This software monitors data (like voltage, current, load, etc.) from various devices, calculates the load and its behavior based on historical data (measurements) and derives the peak shaving actions and set points.

K. **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 UPS.
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.

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. **Field Service Engineer Qualifications:** The manufacturer shall employ a 7 x 24 nationwide 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 UPSs.

B. **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