PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install a three-phase continuous duty, on-line, double conversion, solid-state uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the existing building electrical system to provide power conditioning, back-up and distribution for critical electrical loads. The UPS shall consist of, as required by the project, the UPS module, battery cabinet(s), and accessory or “option” cabinet(s) for transformers, maintenance bypass, parallel tie, and distribution applications, and other features as described in this specification.

1.02 RELATED SECTIONS

1.03 UPS DESCRIPTION

Standard UPS will include a minimum of (1) rectifier, (1) inverter, (1) static bypass, and (1) battery system.

A. Components:

1. Rectifier
2. Inverter
3. Sealed Lead Acid Batteries
4. Battery Charger
5. Automatic Bypass
6. User Interface Panel
7. Serial (RS-232)/USB Communication Interface for service use
8. Communication Card Slots (2)
10. Environmental (Building Alarm) Inputs (3)
11. Hardwired Input, Output
12. (Optional) Internal Back-feed contactor
13. (Optional) Internal Maintenance Bypass Switchgear (80-120kVA)
14. (Optional) Input circuit breaker (160-400kVA)
15. External Battery Cabinets (or racks)
16. Maintenance Bypass Module
17. Communications Options
   1. SNMP/Web adapter
   2. RS-232 and relay contact interface
   3. Modbus RTU interface
B. Modes of Operation: The UPS shall operate as an online, double-conversion UPS with the following modes:

1. Normal: During the Normal or Double-conversion Mode the rectifier shall derive power as needed from the commercial AC utility or generator source and supply filtered and regulated DC power to the online inverter. The inverter shall convert the DC power to highly regulated and filtered AC power for the critical loads.

2. Battery: Upon failure of the AC input source, the critical load must continue to be supplied by the inverter without switching. The inverter must obtain its power from the battery. There must be no interruption in power to the critical load upon failure or restoration of the AC input source.

3. Recharge: Upon restoration of the AC input source, the rectifier/battery charger must recharge the battery. The inverter shall, without interruption of power, regulate the power to the critical load.

4. High Efficiency: The static bypass switch will conduct, and the UPS rectifier and inverter will be operated in a “suspended” mode, unless incoming power conditions require conventional double conversion operation. In High Efficiency mode the UPS input and output filters shall remain in-circuit to provide surge suppression. Transfer time from HE mode to Double Conversion mode, and vice versa, shall be typically less than 4ms (80-200kVA); 2ms (300-400kVA).

5. Bypass: The static bypass switch must be used for transferring the critical load to the AC utility supply without interruption, and shall be rated for continuous operation. Automatic re-transfer to normal operation must also be accomplished without interruption of power to the critical load. The static bypass switch must be capable of manual operation via the front panel controls. An optional integrated bypass back-feed protection contactor, in series with the static switch, shall prevent system voltages from bleeding backwards through the static switch and rectifier snubber components to the utility source in the event of a utility failure and shall also open upon detection of a short circuit static bypass SCR.

6. Maintenance bypass: A wall-mountable maintenance bypass switch is available; however, in the absence of this feature, the (optional) integral maintenance bypass switch (80-120kVA) may be used. The maintenance bypass is used for supplying the load directly from the AC utility supply, while the UPS is isolated for maintenance or repair.

7. Optional internal load testing: The UPS system will be capable of utilising the Easy Capacity Test (ECT) function, including internally adjustable load testing at the customer site, without the need for a load bank. Testing shall only be initiated using the Eaton Engineer's Software Service Tool. This testing is not intended to be performed while the UPS is servicing the critical load.
1.04 REFERENCES
A. The UPS and all components shall be designed, manufactured and tested in accordance with the latest applicable standards as follows. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

Safety
a. IEC 62040 or EN 62040
b. EN 60950

Emission and Immunity:
c. IEC62040-2-C3 (conducted and radiated)
d. EN61000-4,-5, level 4 – 4 kV L-PE, 2kV L- Electrostatic discharge (ESD): 8 kV air discharge, 4 kV contact discharge (IEC 61000-4-2, level 4) - Electromagnetic field: IEC 61000-4-8 level 3.

1.05 SUBMITTALS – FOR REVIEW/APPROVAL
A. Submit one copy of a concise operation and maintenance manual.

1.06 SUBMITTALS – FOR CONSTRUCTION
A. Submit one copy of a concise operation and maintenance manual.

1.07 QUALIFICATIONS
A. The manufacturer of the unit shall have a minimum of forty years' experience in the design, manufacture and testing of Uninterruptible Power Supplies.
B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified for engineering/R&D and manufacturing facilities.

1.08 REGULATORY REQUIREMENTS
A. The UPS shall be CE marked.

1.09 DELIVERY, STORAGE AND HANDLING
A. Equipment shall be handled and stored in accordance with manufacturer's instructions. The UPS and accessory cabinets meet structural requirements of ASTM D4169. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.10 OPERATION AND MAINTENANCE MANUALS
A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component products.
1.11 MANUFACTURERS
   A. Eaton

1.12 RATINGS
   A. System Rating
      1. The UPS module(s) shall have an output rating of:
         a. 80kVA/72kW (scalable to 100kVA/72kW)
         b. 100kVA/90kW
         c. 120kVA/108kW
         d. 160kVA/144kW (scalable to 200kVA/180kW)
         e. 200kVA/180kW
         f. 300kVA/270kW
         g. 400kVA/360kW

   B. System Input
      1. Input Voltage Operation Range
         a. Nominal 400/230 (or 380/220 or 415/240 adjustable) VAC, 4-wire plus ground
         b. -15% to +20% from nominal at 100% load
            -50% to +20% from nominal at 50% load
         2. Input Frequency
            a. 42 to 70 Hz auto-sensing
         3. Input Power Factor: 0.99 typical
         4. Input Current Distortion: 5% THD maximum at full rated linear load
         5. Inrush Current:
            a. ≤120% of rated current for ≤2 cycles

   C. System Output, Normal Mode -Nominal Output Voltage, UPS on Utility
      1. 400/230, or 380/230 or 415/240VAC, Selectable through front panel or through serial port
         connection with power management software
      2. Output power factor rating: 0.7 lagging to 0.9 leading without de-rating.
      3. Voltage regulation: +/-1% of selected output voltage in steady state
         Transient Voltage Response: Meets Class 1 performance of IEC62040-3 and VFI-SS-111; +/-5%
         for 100% step load change; recovery in <20ms.
      2. Voltage THD:
         a. 2% Total Harmonic Distortion (THD) maximum phase to neutral into a maximum rated linear
            load (5% phase to phase)
         b. 5% THD maximum phase to neutral and phase to phase into a non-linear load
      3. Nominal Frequency: 50 or 60 Hz selectable
      4. Frequency Regulation:
STATIC UNINTERRUPTIBLE POWER SUPPLY-THREE PHASE (80-400KVA)
EATON 93E UPS

5. Slew rate:
   a. 0.5 Hz per second as default (0.8 Hz per second for 300/400kVA)
   b. Selectable up to 7 Hz/s for single units, <0.5 Hz/s for parallel units
c. Generator Mode (6 / 7 Hz/s) for single units selectable through software parameters that can be configured via LCD and service PC interface

6. Output Current: Full load output current (at nominal output voltage) for the UPS shall be:
   a. 80 kVA system: 115 A @ 400 V
   b. 100 kVA system: 144 A @ 400 V
   c. 120 kVA system: 173 A @ 400 V
   d. 160 kVA system: 231 A @ 400 V
   e. 200 kVA system: 289 A @ 400 V
   f. 300 kVA system: 433 A @ 400 V
   g. 400 kVA system: 577 A @ 400V

7. Current Overload Capability without Bypass:
   a. 102-125% for 10 min
   b. 126-150% for 1 min
   c. >151% for 150 ms

8. Short Circuit conditions: current limit at 2.5x nominal FL current for 300 ms.

9. Current Overload Capability with Bypass enabled:
   a. 102-125% for 10 min
   b. 126-150% for 1 min
   c. >151% for 150 ms
d. Short Circuit conditions: immediate transfer to bypass; then 115% continuous, with transient capability of 10x nominal for 20 ms.

10. Bypass:
    a. Automatic bypass shall provide an alternate path to power in the case of overload, inverter failure or other UPS failure
    b. Optional External or Internal Maintenance Bypass (80-120kVA) can be utilised with the UPS to allow servicing of the UPS
    c. Transfer time to and from any internal bypass shall be no-break, when UPS and Utility are in sync
d. Unit shall be able to detect bypass module failure.

11. Efficiency:
    a. In Normal Mode, 100% linear load, with nominal line condition: ≥94.0%
    b. In Normal Mode, 75% linear load, with nominal line condition: 80-200kVA ≥93.8%; 300kVA ≥93.5%, 400kVA ≥94.0%
c. In Normal Mode, 50% linear load, with nominal line condition: 80-200kVA ≥93.0%; 300-400kVA ≥92.5%
d. In High Efficiency mode: ≥98% at 100% linear load; ≥97% at 50% linear load

12. System Output, Battery Mode
   a. Nominal Output Voltage: This shall be the user-selected output voltage
   b. Voltage Regulation: +/-1% phase to neutral of selected nominal voltage (+/-2% phase to phase)
   c. Transient Voltage Response
   d. Meets Class 1 performance of IEC62040-3
   e. +/-5% for 100% step load change; recovery in <20ms
   f. Voltage THD:
   g. 2% Total Harmonic Distortion (THD) maximum into a maximum rated linear load
   h. 5% THD maximum phase to neutral into a maximum rated non-linear load (7.5% phase to phase)
   i. Frequency Regulation: +/-0.1 Hz of selected nominal frequency
   j. Current Overload Capability
   k. 102-125% for 1 min
   l. 126-150% for 30 sec
   m. >151% for 150 ms

1.13 CONSTRUCTION

A. The UPS system is initially provided as a single-module, non-redundant system. The UPS shall be field-upgradeable with additional parallel capacity up to 3+0 modules, or for redundant operation, up to 3+1 modules.

Single UPS modules shall be capable of parallel operation and shall not require any hardware modifications in order to be paralleled with other modules in future.

The system can be configured with numerous options, including:
   1. External Matching Battery Cabinets (EBCs)
   2. Several plug-in Connectivity Options
   3. Wall-mounted Maintenance Bypass Cabinet
   4. Accessory Cabinet, or Tie Cabinet with:
      a. Maintenance Bypass Switch
      b. Breaker panel and/or Sub-feed breaker(s)
      c. Two, (or four)-Module paralleling tie, with or without a Maintenance Bypass Switch

B. Converter (rectifier): Incoming power shall be filtered and converted to DC by a sine-wave rectifier. The rectifier utilises IGBT technology to correct the input power factor to 0.99 and draws sinusoidal current (with less than 5% THD) from the utility. In the event of utility failure, the DC-DC converter shall be supplied power without interruption from the external batteries. In the event of utility sag
down to -50% of nominal voltage the UPS shall continue to operate at up to 100% load in a power share mode that draws power from the utility and the battery.

C. Inverter: The inverter utilises IGBT technology and Digital Signal Processing to convert the DC power from the rectifier or converter to regulated AC power for output to critical loads.
   1. Output Voltage: The inverter output voltage is specified in section 1.12.B.
   2. Voltage Regulation: The inverter steady state voltage regulation is +/- 1% phase to neutral, 2% phase to phase. Dynamic regulation meets Class 1 performance of IEC62040-3.
   3. Frequency Control: The inverter steady state frequency regulation is +/-0.1 Hz, free running in steady state. UPS is synchronised to the Utility bypass in normal operation.

D. Mechanical Construction
   1. All materials and components of the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.
   2. The UPS unit is comprised of an input rectifier, battery charger, inverter, bypass, and battery consisting of the appropriate number of sealed battery modules, and shall be housed in a single freestanding enclosure. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Wheels and leveling feet shall be provided as standard on systems up to 200kVA.
   3. The UPS cabinet shall have a rating of IP20.
   4. The UPS shall be designed for forced-air cooling. Air inlets shall be on the front of the unit and shall be fitted with washable dust filters. Air outlets shall be at the rear. A minimum of 150mm rear clearance for ventilation shall be provided for 80-120kVA systems and a minimum of 600mm rear clearance shall be provided for 160-200kVA systems, a minimum of 300mm rear clearance shall be provided for 300-400kVA systems.
   5. Cable access shall be through the bottom or rear of the UPS cabinet (top or bottom for 300-400kVA). Optional top cable entry cabinets for 80-120kVA systems shall facilitate top cable entry if required.
   6. Dimensions of standard UPS cabinets:

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Dimensions (H x W x D)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 kVA UPS:</td>
<td>1880 x 600 x 800 mm</td>
<td>283 kg</td>
</tr>
<tr>
<td>100 kVA UPS:</td>
<td>1880 x 600 x 800 mm</td>
<td>283 kg</td>
</tr>
<tr>
<td>120 kVA UPS:</td>
<td>1880 x 600 x 800 mm</td>
<td>311 kg</td>
</tr>
<tr>
<td>160 kVA UPS:</td>
<td>1880 x 600 x 800 mm</td>
<td>457 kg</td>
</tr>
<tr>
<td>200 kVA UPS:</td>
<td>1880 x 600 x 800 mm</td>
<td>457 kg</td>
</tr>
<tr>
<td>300 kVA UPS:</td>
<td>1880 x 1600 x 820 mm</td>
<td>860 kg</td>
</tr>
<tr>
<td>400 kVA UPS:</td>
<td>1880 x 1600 x 820 mm</td>
<td>970 kg</td>
</tr>
</tbody>
</table>

1.14 UPS IN PARALLEL CONFIGURATIONS

A. UPS modules shall be capable of being paralleled to increase system power levels or to provide redundant power. The UPS shall be field-upgradeable with additional parallel capacity up to 3+0 modules, or for redundant operation, up to 3+1 modules. It shall be possible to convert a single module to a parallel module without any hardware modification. The parallel system shall have intelligence to automatically recognise the need for capacity and/or redundancy. Parallel systems shall utilise autonomous UPS power modules that do not rely on any control interconnections for synchronised operation. The individual
modules shall operate in a peer-to-peer manner to provide automatic load sharing, synchronisation, and selective tripping capabilities. "Master-slave" configurations are not acceptable.

B. The parallel system shall utilise a communications network to provide system information and status, such as operating mode and meter data. This network shall provide individual module information as well as total system information, and individual module information shall be available from any module's front panel display. The loss of this system information network shall not cause the parallel units to transfer to bypass or drop the critical load.

1.15 MULTI-MODULE PARALLEL SYSTEM CONFIGURATION (DELETE IF NOT APPLICABLE)

A. System Configuration:
   1. The multi-module system shall consist of X (Choose 1 to 4) XXkVA/XXkW UPS modules to form a X + 1 system with a rating of XXkVA/XXkW.
   2. The outputs of the XX parallel UPS modules shall be connected to the critical bus within the UPS output distribution switchboard or an optional System Bypass Module.
   3. An external maintenance bypass switch shall be located either in a separate enclosure or shall be incorporated in the UPS Output distribution board or System Bypass Module.

B. System Parallel Module Configuration:
   1. The System Bypass Module (SBM) cabinet shall provide either UPS module with the ability to be completely isolated from the critical bus for service, while the critical load remains energised and protected by the other UPS module.
   2. The SBM cabinet shall feature a system manual bypass switch with interlocks to facilitate a make before break transfer to transfer to static bypass on all modules before the maintenance bypass switch is closed.
   3. The SBM cabinet shall have multiple power wire routes to permit top, bottom, or side power or control wire entry.

C. Module Interconnections:
   1. No inter-UPS module signals or control connections shall be required for balanced UPS module load sharing.
   2. No inter-UPS module signals or control connections shall be required for UPS module selective tripping.
   3. This wireless paralleling method shall not rely on information to be shared between the UPS modules, thereby eliminating the need for inter-UPS module communications.
   4. This wireless selective tripping method shall not rely on information to be shared between the UPS modules.
   5. The external maintenance bypass switch shall include an interlock arrangement with auxiliary contacts for each UPS module to ensure that each module is operating on static bypass before the external maintenance bypass switch is closed.

D. UPS Performance During Normal Operation:
1. The UPS modules shall not have a master/slave relationship.

2. Wireless selective tripping and load sharing shall eliminate a controls single point of failure.

3. UPS modules shall share load equally to within <5% when operating normally.

4. The UPS shall feature constraints which do not permit it to be continuously operated in a configuration where one UPS module is in bypass mode while other UPS modules are in inverter mode and all UPS modules are connected to the critical bus.

5. It shall be possible to continuously load all the UPS modules at 100% of the individual UPS module ratings. UPS module redundancy shall be lost when the load exceeds the rating of N-1 modules.

E. UPS Performance with a Faulty UPS Module:

1. In the event of a UPS module failure, the failed UPS module shall remove itself from the critical bus. The remaining UPS modules shall immediately assume the entire critical load.

2. The UPS shall not interrupt the flow of conditioned power to the critical load, if one UPS module fails.

3. The UPS shall not interrupt the supply of power to the critical load, if a fuse in the bypass circuit blows.

F. Load Sharing:

1. The UPS shall share the critical load between the UPS modules equally so that each UPS module’s load is always within 5% of the others.

2. The UPS shall be capable of providing balanced load sharing without any inter-UPS module connections.

3. Each UPS module shall need to monitor only its own input and output power in order to remain phase locked with the other UPS modules. This wireless paralleling method shall not rely on information to be shared between the UPS modules.

G. Selective Tripping:

1. The UPS shall be able to selectively trip a failed UPS module off-line without any inter-UPS module connections.

2. Each UPS module shall look only at itself to determine if a UPS module failure has occurred. If a UPS module failure does occur, the faulty UPS module shall identify its own internal failure and subsequently remove itself from the critical bus by instantaneously shutting off the inverter and subsequently opening an output contactor internal to the UPS module. This wireless selective tripping method shall not rely on information to be shared between the UPS modules.

3. The selective trip method each UPS module employs to identify an internal failure, shall require the UPS module to look for changes in UPS module output voltage and output current data relative to recent output current and voltage data.

4. If a UPS module does isolate itself from the critical bus, due to an identified internal failure, the UPS module shall try three times to restart. If the UPS module successfully restarts and its output is stable and remains within specification limits, it shall resynchronise with the critical bus and automatically reconnect itself to the critical bus. The reconnected UPS module shall resume load sharing with the other UPS modules and UPS level redundancy shall once again be available.
5. The selective trip controls within each UPS module shall be independent of the inverter controls. The inverter controls within each UPS module shall also provide selective tripping capability for removing a faulty UPS module from the critical bus.

6. The selective trip controls within each UPS module shall be continuously monitored to assure they are functioning properly. Failure of a UPS module's selective trip controls shall not impair its ability to parallel its output and share the critical load with the other UPS module. A UPS module shall alarm if it determines its selective trip controls have failed.

1.16 SYSTEM INPUT & OUTPUT CONNECTIONS

A. AC Input:
   1. All UPS units shall be capable of utilising hardwired input. Input, Bypass, and/or output terminals may be placed in Option cabinets as determined by system configuration. Wiring between Option or external battery cabinets and UPS to be supplied by others.
   2. The building/Utility input neutral is required for proper UPS operation unless input transformer option is used.

B. AC Output:
   1. All UPS units shall be capable of utilising hardwired output

C. Extended Battery Connection: UPS module will include terminations for External battery cabinets, if used.

D. Remote Emergency Power Off (REPO) Connection: The UPS shall provide a built-in landing for field connection of a Remote Emergency Power Off circuit. Upon initiation of the REPO circuit, the UPS shall open its input relays, and disengage the battery converter, preventing power from being delivered to the attached loads.

E. Serial (RS-232) Communication Interface: A 9-pin sub-D connector and USB connector shall provide capability for communicating with manufacturer's servicing software package. The UPS shall also provide plug-in communication options to provide signals for remote indication of UPS alarm status.

F. (2) Communication Card Slots: The UPS shall provide (2) communication mini-slots in the front of the UPS allowing for optional plug-in connectivity options, including SNMP/Web interface, 4x relay contacts & RS232 port, and Modbus capabilities.

G. (3) Programmable Input Connections: The UPS shall provide built-in inputs for field connection (environmental input). The inputs shall be parameter programmable to suit the needs of the application.

1.17 USER INTERFACE

A. Front Panel Display: The UPS shall include a front panel display consisting of a graphical LCD display with backlight, four status LED's, and a six-key keypad.
   1. Graphical LCD display: Includes basic language (English and local selectable language), display of unit function and operating parameters. It shall be used to signify the operating state of the UPS, for indicating alarms, for changing operations control parameters and set points.
   2. Four status LED's, which indicate:
      a. Alarms, with a red LED
 STATIC UNINTERRUPTIBLE POWER SUPPLY-THREE PHASE (80-400KVA)
EATON 93E UPS

b. On Battery, with a yellow LED
c. On Bypass, with a yellow LED
d. Power On, with a green LED

3. Six-Key Multifunction Keypad: UPS shall have keypad to allow user to adjust UPS parameters, view alarm and inverter logs, change UPS operational modes, and turn the UPS on and off. Keys will be marked as UP, DOWN, LEFT, RIGHT, ESC and ENTER

4. Meters: When selected, the front display shall show individual screens of input parameters, output parameters or bypass parameters including: voltage, current, frequency, true power, apparent power and power factor. The display shall also show DC Voltage and current.

B. Power Management Software Package: The UPS shall offer optional communications interface that provides the following communication capabilities:

1. Monitor and graphically display input and output voltage and other operating characteristics
2. Notify end-users in the event of a power anomaly via network, E-mail or page.
3. Communication Ports:
   a. Communication Card Slots: The UPS shall provide (2) communication mini-slots in the back of the UPS allowing for additional connectivity options, including SNMP/Web interface, 4x relay contacts, and RS-232 capabilities.
   b. Serial communications (via RS-232 or USB) with manufacturer’s service software package

1.18 BATTERIES

A. Battery Type: Valve Regulated Lead Acid (VRLA), 10 year standby design life at 25°C with minimum two-year warranted.

B. Holdover Time (Runtime): Each UPS system shall have the option of capability for matching battery cabinets to increase the holdover time. Please refer to datasheet for a list of runtimes. The battery times listed there are approximate and may vary depending on load configuration, temperature, battery age, and state of battery charge.

C. Battery Recharge Time: UPS system will have a typical recharge time of 10 times the length of the outage to 90% usable capacity @ nominal line voltage.

D. Bus Voltage: Nominal bus voltage is 480 VDC, adjustable to 432VDC.

E. Battery Protection:
   1. Short Circuit Protection: Over-current protection shall protect the batteries from all short circuit fault conditions
   2. Battery Module Protection: Internal battery contactor shall be provided
3. Under-voltage Protection: Battery operation shall be terminated when the battery voltage drops to the 1.67 VPC set point

4. Over-voltage Protection: If the UPS system's battery bus voltage exceeds the predetermined set point then the UPS will disable the charger and alarm a “check battery” condition

F. Battery Management System:

The UPS shall contain a battery management system which has the following features:

1. The battery management system shall charge the batteries using an intermittent charging cycle. The active battery charger states are constant-current (charge mode), constant-voltage (float mode) and no-charge (rest mode). The charge mode shall equalise and charge the batteries to near full capacity before entering into float mode. In float mode a constant voltage float charge shall charge the batteries for a minimum of 48 hours or until the batteries are fully charged. The batteries are then put into rest mode. The battery shall be monitored whilst in rest mode and the charge cycle shall automatically re-start should the battery voltage drop below pre-determined levels. The charging control system shall activate an alarm should the battery capacity drop below the pre-determined levels. The charge cycle will automatically restart after a utility disturbance. The batteries shall not be physically disconnected from the UPS DC bus during the charge cycle and shall be available at all times to supply the inverter.

2. Battery Runtime Monitoring: UPS shall monitor batteries and provide status to end user of battery remaining capacity via front panel icon, remote communications, or both. Runtime calculations to be based on load demand and analysis of battery health.

3. Battery Health Monitoring: UPS shall periodically test and monitor battery health and provide warnings visually, audibly and/or remotely when battery capacity falls below 80% of original capacity. Battery testing may also be user initiated via front panel or serial communications.

1.19 NAMEPLATES

A. Provide a printed nameplate for each UPS.

1.20 ENVIRONMENTAL CONDITIONS

A. The UPS shall meet IEC 61000-4-6 Level 3, and IEC 62040-2 C3, and FCC A15J for Emissions

B. Audible Noise:

1. 80-120 kVA: Less than or equal to 65 dB (A weighted) at one (1) metre from all sides in normal mode at less than or equal to 75% load

2. 160-200 kVA: Less than or equal to 70 dB (A weighted) at one (1) metre from all sides in normal mode at less than or equal to 75% load.

3. 300-400 kVA: Less than or equal to 73 dB (A weighted) at one (1) metre from all sides in normal mode at less than or equal to 75% load.

C. Ambient Temperature
1. Operating: UPS: 0 deg C to +40 deg C, (preferred temperature for batteries: 15 to 25 deg C.
2. Storage: UPS -25 deg C to +55 deg C.
3. Transportation: -25 to 60 deg C

D. Relative Humidity
1. Operating: 5 to 95% non-condensing.
2. Storage: 5 to 95% non-condensing.
3. Transportation: 5 to 95% non-condensing

E. Altitude
1. Operating: To 1000 metres, de-rating or reducing operating temperature range may be required for higher altitudes
2. Transit: To 10,000 metres

F. Electrostatic Discharge: The UPS shall be able to withstand a minimum 8 kV without damage and without affecting the critical load

PART 2  EXECUTION

2.01 FACTORY TESTING
A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.
   1. Standard Computer-automated UPS system test
   2. Hipot test

2.02 INSTALLATION
A. The Contractors shall install all equipment per the manufacturer's recommendations.

2.03 FIELD QUALITY CONTROL
A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section for a period of XX working days. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.
B. The Contractor shall provide three (3) copies of the manufacturer's field start-up report.