PART 1   GENERAL

1.01   SCOPE

A.  This specification defines the electrical and mechanical characteristics and requirements for continuous duty split-phase, solid-state, uninterruptible power supply system. The uninterruptible power supply system, hereafter referred to as the UPS, shall provide high quality AC power for sensitive electronic equipment loads with battery power to maintain uptime. The UPS shall operate in conjunction with the existing building electrical system to protect electronic equipment from power disturbances with may occur with utility power, such as voltage fluctuations, frequency variations, brownouts, power surges and sags.

1.02   RELATED SECTIONS

1.03   SYSTEM DESCRIPTION

A.  Components:

1.  Rectifier/Charger
2.  Inverter
3.  Battery Charger
4.  User Interface Panel
5.  Sealed Lead Acid Batteries
6.  Automatic Bypass
7.  Serial (RS-232) Communication Interface
8.  Communication Card Slots (2)
10.  Relay Output Contacts (1)
11.  Environmental Inputs (2)
12.  Hardware Input, Output
13.  Input Transformer
14.  External Matching Battery Cabinets
15.  Maintenance Bypass Module
16.  Maintenance Bypass with Power Distribution Module
17.  SNMP/Web Adapter
18.  Relay Card
19.  Modbus/Jbus Card

* Note to Spec. Writer – Optional
B. Modes of Operation: The UPS shall operate as an online, double-conversion UPS with the following modes:

1. Normal 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 at its input to highly regulated and filtered AC power for the critical loads.

2. Battery Mode: Upon complete failure of utility power, the UPS shall provide power to the critical loads through the inverter, from the UPS' internal or extended batteries. 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 power interruption, regulate the power to the critical load.

4. Bypass Mode: The static bypass switch must be used for transferring the critical load to mains supply without interruption. 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.

5. External maintenance Bypass: The external maintenance bypass switch is preferred; however, in the absence of this feature, integral maintenance bypass may be used. The external maintenance bypass is used for supplying the load directly from the mains supply, while the UPS is isolated for maintenance.

1.04 REFERENCES

A. The UPS and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. IEC 62040-1-1
2. EN 62040-1-1
3. EN 60950
4. EN 50091-2 (Emissions Class A and Harmonics)
5. EN61000-4-2,-3,-4,-5

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 assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of
installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, IBC: a peak of 2.45g's (3.2-11 Hz), and a ZPA of 0.98g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

   -- OR --

1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's, and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

   -- OR --

1. The manufacturer may certify the equipment based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment

2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

   a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

   b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

   c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.08 REGULATORY REQUIREMENTS

A. The UPS shall be marked CE

* Note to Spec. Writer – Optional
* Note to Spec. Writer – Select one
1.09 DELIVERY, STORAGE AND HANDLING
   A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Eaton / Powerware
   B. *__________
   C. *__________

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS
   A. System input
      1. Input Voltage Operation range: *[100/200, 110/220, 120/240 Vac 180 degree phase displacement] [120/208, 127/220 Vac 120 degree phase displacement]
      2. Input Frequency
         a. 45 to 65 Hz
         b. auto-sensing
         c. capable of 50 to 60 Hz or 60 to 50 Hz frequency conversion
      3. Input Power Factor is .99
      4. Input Current Distortion: 2% THD maximum at full rated linear load
      5. Inrush Current
         a. <2X branch rating without input transformer
         b. <5X branch rating with input transformer
      6. Surge Protection:
         a. Line to Line 180J
         b. Line to Ground 450J
   B. System Output, Normal Mode

* Note to Spec. Writer – Insert data in blanks
* Note to Spec. Writer – Select one
1. Nominal Output Voltage: [200/100, 200/110, 240/120 VAC, 180 degree phase displacement] [208/120, 208/127 VAC, 120 degree phase displacement] [Selectable through front panel or through serial port connection with power management software]

2. Voltage regulation: ±3% of selected nominal voltage

3. Transient Voltage Response: Class 1 performance in accordance with IEC62040-3

4. Voltage THD:
   a. 2% Total Harmonic Distortion (THD) maximum phase to neutral into a maximum rated linear load (5% phase to phase)
   b. 5% Total Harmonic Distortion (THD) maximum phase to neutral into a maximum rated non-linear load (7% phase to phase)

5. Nominal Frequency: 50 or 60 Hz Auto selectable

6. Frequency Regulation:
   a. 50/60 Hz +/-0.5 to +/- 3.0 Hz selectable, synchronized to mains, +/- 0.005 Hz free running single units
   b. +/- 0.15 Hz parallel units
   c. Slew rate selectable to 1.0, 2.0, 3.0 Hz/s for single units, 0.5 Hz/s parallel units; Generator Mode (6/7.5 Hz/s) for single units selectable through software parameters that can be configured via LCD and service PC interface.

7. Output Current: Maximum output rating (at nominal output voltage) for the UPS shall be: [8KVA system: 33A @240V] [10KVA system: 42A @240V] [12KVA system: 50A @240V] [15KVA system: 63A @240V]

8. Current Overload Capability:
   a. 150% for 5 seconds
   b. 220% for 300 ms

9. Bypass:
   a. Automatic bypass shall provide an alternate path to utility power in the case of overload, or internal failure
   b. External Maintenance Bypass can be utilized with the UPS to allow servicing of the UPS
   c. Transfer time to and from any internal bypass shall be no-break

10. Efficiency
    a. Typical of <89% while in normal mode

C. System Output, Battery mode
1. Nominal Output voltage: This shall be the user selected output voltage
2. Voltage regulation: ±1% phase to neutral of selected nominal voltage (±2% phase to phase)
3. Transient Voltage Response: Class 1 performance in accordance with IEC62040-3
4. Voltage THD:
   a. <2% THD maximum into a maximum rated linear load

* Note to Spec. Writer – Select one
b. <5% THD maximum into a maximum rated non-linear load (7% phase to phase)

5. Frequency regulation: ± 0.005 Hz of selected nominal frequency.

6. Overload Capacity (load based on delivered Watts/VA compared to rated Watts/VA)
   a. 150% for 5 seconds
   b. 220% for 300 ms

2.03 CONSTRUCTION

A. UPS shall be provided as a single-module, non-redundant system. The UPS shall be field upgradeable for additional parallel capacity or for redundant operation. The system can be configured with following options:
   1. External matching bypass cabinets
   2. Several connectivity options
   3. Maintenance bypass cabinets
   4. Power distribution module with receptacles
   5. Wall mounted hot tie cabinet with bypass
   6. Input transformer

B. Rectifier: Incoming power shall be filtered and converted to DC by a full-wave rectifier. The DC power shall then be processed by a high-frequency converter to supply power to the inverter. The converter corrects 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 converter shall be supplied power without interruption from internal or external batteries.
   1. Overload Capacity: The rectifier shall be capable of supplying 150% of the rated load for at least 5 seconds if no bypass is available.

C. Inverter: The inverter shall convert the DC power at its input to regulated AC power. The regulated output shall supply power to the critical load.
   1. Frequency Control: The inverter shall synch to the line within the defined frequency limit. Outside of the defined input frequency limit, the inverter shall take over and regulate the output to within +/- 0.2 Hz.

D. Batteries: The batteries shall be sealed, lead acid, maintenance-free, high-rate discharge cells. They will be kept fully charged by the battery charger and have a three year float service life @ 25 degree C.

E. Battery Charger: The battery charger is responsible for charging the battery and maintaining full battery charge when AC is applied to the UPS.

F. Automatic Bypass: The UPS shall provide an alternate path to the commercial AC or generator source in the case of an overload, load fault or internal failure. The input must match the output in voltage, frequency, and grounding in order to use this feature.

G. User Interface Panel: The UPS shall provide a user-friendly interface panel, which allows the user to: change operating modes, set system parameters, check alarm logs, etc. This LCD display should have backlight and languages consisting of English and a number of optional local languages.
H. Serial (RS-232_ Communicating Interface: A 9-pon sub-D connector shall provide capability for communicating with manufacturer-supplied power management software package. The UPS shall also provide signals for indication of UPS general alarms.

I. (2) Communication Card Slots: The UPS shall provide (2) communication card slots in the front of the UPS allowing for additional connectivity options, including SNMP/Web AS400 relays, and Modbus/Jbus capabilities, etc.

J. 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 output will be de-energized and battery will be disconnected, preventing power from being delivered to the attached loads.

K. Disabled Bypass Operation Connection: If active, the automatic transfer to the static bypass is prevented. Synchronization to bypass is not carried out (default)

L. ABM Resting Connection: If active, the batteries are disconnected from the UPS unit. The discharge of batteries is not prevented but charging will not commence.

M. Remote ON/OFF Connection: If active, the UPS output turns off regardless of mode of operation. Auxiliary power, communications and rectifier/battery charger shall remain functional.

N. External Bypass Connection: If active, the UPS is forced to static bypass operation regardless of the bypass status.

O. External Battery Breaker Status: If active, the UPS detects that the batteries are connected.

P. Remote Go To Bypass Connection: If active, the UPS transfers to bypass if bypass voltage, frequency and synchronization are adequate.

Q. Remote Go To Normal Connection: If active, the UPS transfers to inverter operation is not prohibited by EPO or alarm condition.

R. ‘Input Transformer: Can be ordered to provide a split-phase input for installation in locations where only a single phase is available.

S. ‘External Matching Battery Cabinets: 64 and 96 block (7 Ah 12 V) matching battery cabinets can be ordered for extended runtime requirements.

T. ‘Rear Mounted Maintenance Bypass Module: Make Before Break Bypass Module can be ordered as needed for use with the UPS.

U. ‘Rear Mounted Power Distribution Module with maintenance bypass can be ordered with a variety of receptacles.

V. ‘SNMP/Web Adaptor: Internal communication card providing network communication via SNMP protocol.

W. ‘Modbus/Jbus Adaptor: Internal communication card providing network communication via Modbus protocol.

X. ‘Relay Card: Internal card providing dry contacts for operation with AS400 systems, etc.

2.04 BATTERIES

A. Battery type: Valve Regulated Lead Acid (VRLA), minimum 3 year float service life at 25°C.

* Note to Spec. Writer – Optional
B. UPS holdover time: Each UPS system consisting of a minimum of two battery strings (32 battery blocks) for each power module shall have a minimum holdover time of 4.6 minutes, depending on KVA rating. See product manual for detailed information.

C. Extended Run Time: Each UPS system shall have capability of addition of extra matching battery cabinets (in two cabinet sizes) to increase the total holdover time. Please refer to datasheet for a list of runtimes. The battery times listed are approximate and may vary depending on load configuration and battery charge.

D. Battery recharge time:
   1. Base UPS system consisting of two (2) battery strings will have a recharge time of max 1.45 hours to 95% usable capacity at nominal line after a full load discharge.

E. Bus Voltage: Nominal bus voltage is 192 Vdc. This consists of 16 battery blocks in series with 9Ah capacity.

F. Battery protection: Short circuit protection. Internal and Extended battery module output shall be protected by either a fuse or circuit breaker. Negative battery terminal will be grounded at the UPS Electronics module only.

G. 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 string circuit breaker shall be provided
   3. Over-Voltage Protection: If the UPS system's battery bus voltage exceeds the predetermined set point then the UPS will disable charger and alarm a high battery condition.
   4. Under Voltage Protection:
      a. Inverter cutoff voltage: battery operation shall be terminated when the battery voltage drops to 1.7 VPC set point
      b. Protective shutdown voltage: Inverter shall shutdown after 1 min when the battery voltage drops below 1.7 VPC volts-per-cell typical.

H. Advanced Battery Management:
   1. Battery recharge: After recharging batteries to full capacity, the charger will enter the rest mode to increase the battery lifetime according to the ABM cycle. Hence, continuous float charging of the battery shall not be allowed.
   2. Battery Run Time Monitoring: UPS shall monitor battery and provide status to end user of battery run time via front panel, serial communications, or both. Run time calculation to be based on load demand and analysis of battery health.
   3. Battery Health Monitoring: UPS shall periodically test and monitor battery health and the UPS will provide warnings either visually, audibly and/or via serial communications when battery capacity falls below 80% of original capacity. Battery testing may also be user initiated via the front panel or serial communications.

2.05 NAMEPLATES
   A. Provide an engraved nameplate for each UPS.
PART 3 EXECUTION

3.01 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.

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