

50 KVA UNINTERRUPTIBLE POWER SUPPLY AND INSTALLATION

PART 1 - GENERAL**1.1 SUMMARY:**

This specification describes a three phase, continuous duty, 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 precisely controlled power for critical equipment loads. The system shall consist of a solid state inverter, rectifier/battery charger, static bypass transfer switch, whole system maintenance bypass switch, synchronization control circuitry, connection control circuitry, disconnection control circuitry, system metering, system status indicators, system alarm annunciation circuitry, integrated Power Distribution Unit (PDU), integrated batteries and charging system, with circuit breakers and cord whips as specified below, and accessories as specified herein. The system shall automatically ensure continuity of electric power within specified tolerances, without interruption, upon failure or deterioration of the normal power supply. UPS will be unitized and contained within cabinet(s) connected together either at factory or final placement location. UPS will be able to fit through standard 3 foot doors without removing door jams. System is indoor in remote room, air conditioned, and to be mounted and secured to existing raised flooring system. This project includes installation of new unit to replace existing and line side 480 volt three phase power supply and control wiring. See attached Plan Sheets E-1 and E-2.

1.2 STANDARDS:

A. The UPS shall meet the requirements of the following standards:

1. UL listed under 1778, Standards for Uninterruptible Power Supply Equipment
2. UL Canada (cUL)
3. IEEE 587-1980/ANSI C62.41 1980 Standards for Surge Withstand ability
4. ISO 9001 Quality Standard
5. The UPS shall be designed in accordance with the applicable sections of the documents published by:
 - National Fire Protection Association (NFPA)/National Electric Code (NEC)
 - National Electrical Manufacturer's Association (NEMA)
 - Occupational Safety & Health Administration (OSHA)
6. All components shall be listed by Underwriter's Laboratories, Inc. (UL) whenever such listings have been established.

1.3 SUBMITTALS:

A. Submittals shall contain the following documentation:

1. Installation Package: 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; all cabinet weights; heat rejection and air flow requirements; single-line and three-line diagrams; control, and external wiring.

2. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements. Provide all HAZMAT statements for all materials requiring such and minimum ventilation and alarm requirements for batteries. Provide in detail all equipment sizes, mounting dimensions, seismic requirements for California Zone 4 requirements.
3. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.
4. Manufactures Local and Remote Monitoring System: A full and detailed submittal will accompany the bid for the manufactures local (on machine), on site (local remote building), and remote call in via web or phone capabilities of manufactures total system monitoring package that will accompany the bid. It is expected that all three conditions above will be met in some manner by manufacture specific hardware and software. In addition, remote monitoring system will have an automatic dial out feature to report all programmed alarms or pre-alarms with programmable plain English call out definitions.

1.4 FINAL SUBMITTALS:

Two (2) weeks before delivery of the UPS system, the following submittals shall be included:

- A. Four (4) complete sets of installation drawings showing all the information stated in Section 1.3.
- B. Four (4) complete sets of installation and users manual showing safe and correct operation of all UPS and monitoring functions.

1.5 QUALIFICATIONS AND QUALITY ASSURANCE:

- A. Manufacturer's Certification: The manufacturer shall specialize in manufacturing of on-line, double conversion three phase UPS modules specified in this document with a minimum of twenty years documented experience, and with a nationwide first party service organization. The manufacturer shall be ISO 9001 certified and shall design to noted and IEEE/NEMA accepted standards.
- B. Factory Testing: Prior to shipment the manufacturer shall complete a documented test procedure to test all functions of the UPS module, supplied by the UPS manufacturer, and guarantee compliance with the specification. The manufacturer shall provide a copy of the test report to the Owner and Engineer five (5) working days before shipment with factory certification that entire package is at 100% working order in all respects. Unit will not ship until approval of Owner of factory certification. Owner will be given five (5) working days notice of final factory testing and may on Owners option, attend or be represented at such testing.

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2 C. Materials and Assemblies: All materials and parts comprising the UPS shall be
3 new, of current manufacture, and shall not have been in prior service, except as
4 required during factory testing. All active electronic devices shall be solid state
5 and not exceed the manufacturer's recommended tolerances for temperature or
6 current to ensure maximum reliability. All semiconductor devices shall be sealed.
7 All relays shall be provided with dust covers. The manufacturer shall conduct
8 inspections on incoming parts, modular assemblies and final products.
9

10 1.6 DELIVERY, STORAGE, HANDLING, AND INSTALLATION:
11

- 12 A. All products shall be packaged in a manner to prevent penetration by debris and
13 to allow safe delivery by all modes of ground transportation and air transportation
14 where specified.
15
16 B. Prior to shipping all products shall be inspected at the factory for damage.
17
18 C. Equipment shall be protected against extreme temperature and humidity and
19 shall be stored in a conditioned or protected environment.
20
21 D. Delivery – Bid package includes the date for final completion. All equipment
22 furnished will be installed and functional at 100% acceptance on that date.
23 Bidder will be present with Owner during delivery and supervise all off loading.
24 Any equipment delivered with any visual damage will not be accepted or
25 unloaded for delivery and bidder will arrange for shipment back to origin of
26 pickup.
27
28 E. Installation and wiring of all equipment per plans and specifications shall be the
29 responsibility of Bidder using California Licensed Electrical Contractors using
30 CA-TITLE 24, Part 3, California Electrical Code latest edition for minimum
31 installation requirements.
32

33 1.7 ENVIRONMENTAL REQUIREMENTS:
34

35 The UPS shall be capable of withstanding any combination of the following
36 environmental conditions in which it must operate without mechanical or electrical
37 damage, or degradation of operating characteristics.
38

- 39 A. Temperature:
40
41 UPS Module Operating: 0°C to 40°C
42 Non-operating: -25°C to +45°C (-4° to 113°F)
43
44 B. Relative Humidity (operating and storage): 0 to 95% non-condensing
45
46 C. Barometric Pressure: Up to 1,000 meters above sea level operating / Up to
47 10,000 meters above sea level non-operating
48
49 D. Audible Noise: Maximum 68 dB "A" weighing @ five (5) feet
50

51 1.8 WARRANTY:
52

- 53 A. UPS Module: The UPS shall be covered by a full parts and labor warranty from the
54 manufacturer for a period of twelve (12) months from date of installation and
55 acceptance by Owner. Acceptance equals successful start-up of all components

1 supplied (hardware and software) and package working at 100% specified
2 conditions.
3

4 1.9 SERVICE AND SPARE PARTS:

- 5
6 A. The manufacturer shall, with Bid, provide recommended on site spare parts kits for
7 the UPS module(s) and cost; as well as provide method of access and cost to
8 qualified factory trained first party service personnel to provide preventative
9 maintenance and service on the UPS module when required within a 24 hour
10 response time.
11

12 13 1.10 MAINTENANCE, ACCESSIBILITY AND SELF DIAGNOSTICS:

- 14
15 A. All UPS sub-assemblies shall be accessible from the front. UPS design shall
16 provide maximum reliability and minimum MTTR (mean time to repair). To that
17 end, the UPS shall be equipped with a self-test function to verify correct system
18 operation. The self-test function shall identify the sub-assembly requiring repair
19 in the event of a fault. The electronic UPS control and monitoring assembly shall
20 therefore be fully microprocessor based, thus doing away with all potentiometer
21 settings. This shall allow:
22
23 1. Auto-compensation of component drift;
24 2. Self-adjustment of replaced subassemblies;
25 3. Extensive acquisition of information vital for computer-aided diagnostics
26 (local or remote);
27 4. Socket connection to interface with computer-aided diagnostics system;
28
29 B. The UPS shall be repairable by replacing standard sub-assemblies requiring no
30 adjustments. Communication via a modem in unit with a remote maintenance
31 system shall/will be possible.
32

33 PART 2 - PRODUCT

34 35 2.1 APPROVED MANUFACTURERS AND PRODUCT DESCRIPTION:

- 36
37 A. Approved Manufacturer(s): The specified equipment will be manufactured by
38 MGE UPS Systems, Liebert, Eaton Powerware, Mitsubishi, Toshiba, or other
39 pre-approved manufacturer in compliance with specifications. Pre-approval must
40 be requested no later than ten (10) working days (Monday-Friday) before
41 specified Bid opening.
42
43 B. Product Description: This specification describes a three phases, continuous
44 duty, solid state Uninterruptible Power System, hereafter referred to as the
45 UPS. The UPS shall operate in conjunction with the existing building electrical
46 system to provide precisely controlled power for critical equipment loads. The
47 system shall consist of a solid state inverter, rectifier/battery charger(s), storage
48 batteries, a static bypass transfer switch, synchronization control circuitry,
49 connection control circuitry, disconnection control circuitry, system metering,
50 system status indicators, system alarm annunciation circuitry, and accessories
51 as specified herein. The system shall automatically ensure continuity of electric
52 power within specified tolerances (tolerances must be included with bid), without
53 interruption, upon failure or deterioration of the normal power supply.
54 Continuity of electric power to the load shall be supplied by the batteries, up to
55 the specified maximum protection time or until restoration of the normal input AC

power source, whichever occurs first. Also furnished are all incoming, isolation breaker cabinet, maintenance, and output circuit breakers and associated integral panels all with electrical and/or mechanical interlocks where applicable for machine and end user electrical system protection.

2.2 SYSTEM DESCRIPTION:

A. UPS Design Requirements:

1. Module Type: The UPS system shall be one module system. The individual UPS module will be a minimum of 50 kVA. In the case of failure of module, the static by-pass switch will automatically pick up the load bus without an interruption of power to the load bus. In reverse, when the module is switched back on line it will automatically assume the load on the load bus and open the static by-pass switch without load bus interruption.
 - a. Unit operation is automatic on module fault and communication/monitoring system will send alarms(s) to onsite monitoring/control station(s) and remote site station(s).
2. Output Power Continuous Rating: The continuous output power rating of the UPS shall be 50 kVA at a 0.9 lagging power factor.
3. Input Voltage: 480 VAC, $\pm 15\%$, 3 phase, 4 wire plus ground
4. Output voltage: 208/120 VAC, 3 phase, 4 wire plus ground (adjustable $\pm 5\%$)
5. Battery Type: See below.

B. AC Input Characteristics:

1. Voltage: 480 VAC, $\pm 15\%$, 3 phase, 4 wire plus ground
2. Frequency: 60 Hz ($\pm 10\%$)
3. Power Factor: Up to 0.9 at full load and nominal input voltage
4. Total Harmonic Distortion: Less than 5.0% @ 50 kVA with one third to full load.
5. Power walk-in: 0 to 100% over a 5 second period, no load to full (50kVA).
6. Inrush Current: 100% of nominal input current for less than one cycle
7. Reactive Current: Not to exceed 15% of the UPS nominal input current

C. AC Output Characteristics:

1. Voltage: 208/120 VAC, 3 phase, 3 or 4 wire plus ground (adjustable $\pm 5\%$)
2. Frequency: 60 Hz ± 2.0 Hz synchronized with bypass (selectable in 0.25 Hz increments), 60 Hz ± 0.05 Hz free running

3. Voltage Regulation: $\pm 0.5\%$ from no load to full load for balanced load
 $+1\%$ for 20% unbalanced load
 $\pm 3\%$ for 100% unbalanced load
4. Voltage Distortion: Maximum of 3% THD, and single harmonics of 1% maximum over the entire linear load
5. Voltage Transient (Step Load) Response: $\pm 2\%$ for 100% step load change
6. Voltage Recovery Time: Return to within 0.5% of steady state within 16.67 milliseconds (one cycle).
7. Phase Angle Displacement: $120^\circ \pm 1^\circ$ for balanced load
 $120^\circ \pm 3^\circ$ for 100% unbalanced load
8. Non-Linear Load Capability: Output voltage total harmonic distortion (THD) shall be less than 4% when connected to a 100% non-linear load with a crest factor not to exceed 3.5.
9. Slew Rate: 2 Hz/second maximum (selectable in 0.5 Hz/sec increments)
10. Power Factor: 0.9
11. Inverter Overload Capability: 125% of rated load for 10 minutes
150% for 1 minute
12. Bypass Overload Capability: 212% for 200 milliseconds

D. Battery:

1. Battery Voltage and Battery requirements (Non-Valve Regulated)
 - a. Battery Type: Sealed, Valve Regulated Lead Acid cells.
 - b. Flooded Type: Wet Cell Jars.
2. Protection Time: 15 minute back-up time @ 50 kVA.
3. DC Voltage Range:

UPS Capacity	50 kVA
Nominal Voltage	288 VDC
Alarms Voltage (V low)	252 VDC
Shutdown Voltage (V min)	216 VDC

4. Ripple Voltage: 2% RMS maximum.
5. Supply Battery manufacturer ten (10) years extended warranty to Owner in Owner's name.
6. Batteries shall be contained within one (1) cabinet connected or disconnected in remote placement to main UPS cabinet. Bidder will supply

all wiring between UPS module and battery cabinet and connect such.

2.3 MODES OF OPERATION:

The UPS module shall be designed to operate as an on-line forward/reverse transfer system in the following modes:

- A. Normal: The UPS module shall continuously supply 100% of the power to the critical load bus via the inverter(s) (Total 50kVA). The rectifier/battery charger(s) shall derive power from the utility AC source within the module and supply DC power to the inverter while simultaneously float charging its batteries. The UPS module shall supply uninterrupted power to the total load (50kVA) during normal, emergency, and/or recharge operation.
- B. Emergency: Upon failure of the utility AC power source, the critical load shall be supplied by the inverter(s), which, without any interruption, shall obtain its power from the battery bank. There shall be no interruption to the critical load upon failure or restoration of the utility AC power source.
- C. Recharge: Upon restoration of the utility AC source (prior to complete battery discharge), the rectifier/battery charger(s) shall power the inverter and simultaneously recharge the battery. This shall be an automatic function and shall cause no interruption to the critical load.
- D. Bypass: The static switch shall be used to transfer the load to the system bypass without interruption to the critical power load. This shall be accomplished by turning inverter off or inverter shutting down on fault shut downs. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverter on.
- E. Maintenance: A manual in phase make before break (overlap) system maintenance bypass switch shall be provided to isolate the UPS system output and system static switch for maintenance. This shall allow the UPS unit to be tested or repaired without affecting load operation.
- F. Downgrade: If the battery only is to be taken out of service for maintenance, it shall be disconnected from the rectifier/battery charger(s) and inverter by means of a battery disconnect furnished within UPS system. The UPS shall continue to function as specified herein, except for power outage protection and high transient response characteristics, although the static transfer switch will still function as specified.

2.4 COMPONENT DESCRIPTION:

- A. Rectifier/battery charger(s): Incoming AC power shall be converted to a regulated DC output voltage by the rectifier/battery charger(s). A solid-state IGBT phase-controlled bridge rectifier shall provide regulated DC voltage, which shall be subsequently filtered to provide power for the inverter and battery charging functions. The rectifier/battery charger(s) shall employ input AC current limiting as well as battery charge current limiting for battery protection. The battery charging circuitry shall be capable of being set for automatic battery recharge operation, float service, manual battery charge service and equalizing or commissioning operation.

1. AC Input Protection: The individual rectifier/battery charger(s) shall be protected by means of an AC input switch. The SCRs shall be protected by fuses that shall only open in the event of catastrophic failure to prevent destruction of the semiconductors and shall not operate as an over-current protection system. Overloads in excess of the rectifier/battery charger(s)'s normal rating or sensing of an abnormally high DC voltage condition shall cause the AC input switch to be shunt tripped open.
2. Input Harmonic Current Suppression: The rectifier/battery charger(s) shall be designed to limit the input harmonic current distortion fed back into the input source to less than 5% with nominal input voltage and rated load on the UPS inverter output.
3. Power Walk In: The rectifier/battery charger(s) shall contain a walk in circuit that causes the unit to assume the load gradually after the input voltage is applied. Currents shall increase from 20% to 100% over a 5 second period after the battery open circuit voltage has been reached. Power sharing will divide load evenly between units on-line.
4. Inrush Current: The initial magnetization inrush current shall be limited to 100% of the rectifier/battery charger(s) full load current.
5. Input Reactive Current: The rectifier/battery charger(s) shall limit the reactive current to less than 15% of the nominal input current at no load preventing excessive reactive current from interfering with generation operation. Reactive current shall be inhibited with a 100% solid state system.
6. Overload Protection and Disconnection: An automatic input circuit breaker shall be provided to disconnect the rectifier/battery charger(s) in the event of an overload or abnormally high DC bus voltage. The overload protection system shall not be activated when the rectifier/battery charger(s) is started under any normal operating conditions.
7. Capacity: The rectifier/battery charger(s) shall have sufficient capacity to support a fully loaded inverter and recharge the battery to 95% of its full capacity within 10 times the discharge period when input current limit is set at 125% of the normal full load rating.
8. Current Limiting: Two (2) separate and distinct current limiting schemes shall be employed in the rectifier/battery charger(s).
 - a. Input AC Current Limit: The AC input current limit shall operate such that the total DC output current of the rectifier/battery charger(s) is sufficient to operate the inverter at rated load and recharge a discharged battery to 95% of its original capacity in 10 times the discharge period. Current demands in excess of this setting shall cause a corresponding decrease in the rectifier/battery charger(s) output DC voltage. Input current limit shall be set at 150% of nominal input current. A programmable second step input current limit, allowing a further limit of the input current, shall be activated by a dry contact input.

b. Battery Charging Current Limit: The battery charge current limit shall limit the DC recharge current by reducing the rectifier/battery charger(s) DC output voltage when a set current limit set in the UPS personalization is reached. The charger may apply up to 10% of the nominal DC current to the battery, ensuring a recharge time equal to 10 times the discharge time at full load. A second, lower charge current limit shall be provided and activated by an Owner provided dry contact input.

9. Battery Charger Operation: The battery charger logic circuitry shall be set up to manually accommodate four modes of operation by an internal selector switch.

a. Automatic: In this mode of operation, the battery charge output voltage shall be set at a charge voltage which shall be slightly higher than the normal float voltage after the UPS experiences input AC power outages of a set (selectable between 0-255 seconds) duration. After (0-255 seconds) of operation at the charge voltage, the battery charger output voltage shall automatically revert to the normal float voltage condition. For input AC power outages of less than the selected duration, the normal float voltage level shall be maintained.

b. Float Service: In this mode of operation, the battery charger output voltage shall be capable of providing a float voltage that can be adjusted to the desired value depending on the number and type of cells used in the external battery.

c. Manual Charge Service: In this mode of operation, the battery charger output voltage shall be capable of being set to a voltage slightly higher than the normal float voltage setting. Normally, the charge voltage setting shall be set at the maximum float voltage setting specified by the battery manufacturer.

d. Battery charging current shall not exceed pre-selected maximum DC charge current.

e. Equalize/Commissioning Service: This operation shall be performed with the UPS inverter turned off. The equalize or commissioning operation shall only be performed:

- 1) On an installed battery that has significant voltage differential from cell to cell
- 2) If specified by the battery manufacturer as part of the normal start-up sequence for commissioning the use of this battery

10. Timed Charged Sequence: The battery charger(s) shall be equipped with a manual and selectable timer that can be used periodically to maintain the battery in optimum condition. At the conclusion of the selected charge period, the battery charger output voltage shall revert to the normal float voltage setting.

B. Inverter(s): The UPS output shall be derived from a Pulse Width Modulated (PWM) output signal with active error gain correction, and shall utilize IGBT

(insulated gate bipolar transistors) on the inverter design. The inverter(s) shall be capable of providing the specified precise output power characteristics while operating over the battery voltage range with no deterioration of performance specifications.

The inverter assemblies shall be constructed of modular rack mounted assemblies to facilitate rapid maintenance and inspection.

1. Output: The inverter output voltage and capacity shall be as specified and shall operate in accordance with the following regulation requirements for unit operation:

a. Static Voltage Regulation: The inverter steady state output voltage shall not deviate by more than $\pm 0.5\%$ due to the following conditions:

- 1) 0% to 100% load
- 2) Ambient temperature variations
- 3) Minimum to maximum DC bus voltage
- 4) Balanced load conditions
- 5) Loss or return of main AC input power

For balanced load conditions, the inverter phase displacement shall be $120^\circ \pm 1^\circ$ maximum. For 100% unbalanced loads, phase displacement shall be $120^\circ \pm 3^\circ$ maximum.

b. Voltage Adjustments: The inverter(s) shall have a control to manually adjust the output voltage $\pm 5\%$ from the nominal value and split load evenly.

c. Frequency Control: The output frequency of the inverter shall be controlled by an oscillator, which shall be operated as a free-running unit when not synchronized to the bypass AC input source. The inverter shall track the synchronizing source within ± 2 degrees. If the external synchronizing source deviates from the preset frequency by ± 0.5 Hz, the oscillator shall automatically revert to a free-running mode of operation. An Owner provided contact closure shall be provided to (1) allow the unit to be operated continually on its internal oscillator with the static bypass transfer switch disabled or (2) for normal operation whereby the UPS inverter synchronizes to the bypass AC input source and the static bypass transfer switch is enabled.

d. Frequency Regulation: The inverter free-running (non-synchronized mode of operation) steady state output frequency shall not deviate by more than $\pm 0.1\%$ from the nominal frequency due to the following conditions nor should the inverter output have any frequency transients for the system disturbances:

- 1) 0% to 100% load
- 2) Ambient temperature variation.
- 3) Minimum to maximum DC bus voltage

- e. Harmonic Distortion: The inverter shall provide active output filtering necessary to limit the output voltage waveform distortion (THD) to:
- 1) Total Harmonic Distortion (THD) maximum of 3%, and single harmonics of 1% maximum over the entire linear load
 - 2) Non-Linear Load Capability. Output voltage total harmonic distortion (THD) shall be less than 4% when connected to a 100% non-linear load with a crest factor not to exceed 3.5.
- f. Dynamic Regulation: The inverter dynamic voltage regulation shall not exceed $\pm 5\%$ due when a 100% load step is applied or removed with 0% or 100% initial load.
- g. Transient Recovery: The output voltage shall return to within $\pm 0.5\%$ of the steady state value within 16.67 milliseconds (1 cycle).
- h. Overload: The inverter shall be capable of supplying currents and regulated voltage for overloads up to 125% of full load current for a period of 10 minutes and 150% current for one minute. The static bypass transfer switch shall transfer the load to bypass if the overload exceeds the inverter's instantaneous rating of approximately 167% or the time periods previously stated.
- i. Fault Clearing: The inverter shall electronically current limit to protect against excessive overload conditions. Simultaneous to turning the inverter off, the static bypass transfer switch shall be used to transfer the load to the bypass AC input source, which shall be used to provide the necessary fault clearing current required. If the bypass is not available, the inverter shall current limit at 212% of rated output current for 200 milliseconds. If the fault is not cleared, the inverter shall shut down if bypass is still not available.
- j. Inverter DC Protection: The inverter shall be protected by the following features that shall be independently adjustable for maximum system flexibility.
- 1) Output Protection: The inverter shall immediately current limit to protect against overloads and abnormal load conditions, which exceed the unit's rating without sustaining any damage to any part of the UPS.
 - 2) Over-current Protection: The inverter shall be protected from excessive overloads, including faults and reverse currents, by fast-acting fuses to prevent damage to power semiconductors. The purpose of the inverter output fusing shall be only to clear inverter failure faults. These fuses shall not clear in the event of a load short on the inverter output.
 - 3) Surge Protection: The inverter shall have built-in protection against under voltage, over current, and over-voltage surges

on the output caused by load transfer between the UPS and the bypass AC input source.

4) Output Load Power Factor: The UPS inverter shall be designed to provide the rated kW specified when connected to loads with power factors ranging from 0.8 lagging to unity and shall have a minimum output power factor of 0.9.

5) Thermal Overload Protection: The inverter shall be provided with thermal overload protection to alarm and then protect against fan failures and high internal ambient temperature conditions.

C. Static Bypass Transfer Switch: A static bypass transfer switch shall be provided as an integral part of the system. The control logic shall contain an automatic transfer circuit that senses the status of the individual inverter logic signals and alarm conditions to provide an uninterrupted transfer to the load to the AC bypass input source without exceeding the transient limits specified herein when a malfunction occurs in the UPS or when an external overload condition occurs. The static bypass transfer switch shall be an electronic static type switch, which provides a make before break or seamless overlap type transfer. The static bypass transfer switch shall be 100% rated for continuous duty (50kVA) and shall not rely on any mechanical current carrying components.

1. Uninterrupted Transfer: The static bypass transfer switch shall automatically cause the bypass source to assume the critical load without interruption after the logic senses one of the following conditions:

- a. Inverter overload exceeds module UPS maximum output rating
- b. Battery protection period expired and bypass source is available, module shut down.
- c. Inverter failure

2. Interrupted Transfer: If the bypass source is beyond the conditions stated below, an interrupted transfer (not less than 0.2 seconds in duration) shall be made upon detection of a fault condition.

- a. Bypass voltage greater than $\pm 10\%$ from the UPS rated output voltage
- b. Bypass frequency greater than ± 2 Hz (selectable in 0.25 Hz increments) from the UPS rated output frequency

3. Automatic Uninterrupted Forward Transfer: The static bypass transfer switch shall automatically forward transfer, without interruption, after the UPS inverter is turned "ON", or after an instantaneous overload-induced reverse transfer has occurred and the load current returns to less than the unit's 100%.

4. Manual Transfer: A manual static transfer shall be initiated from the System Status and Control Panel by turning the UPS inverter off.

5. Overload Ratings: The static bypass transfer switch shall have the following overload characteristics:

- a. 1000% of UPS system output rating (50MVA) for 0.1 seconds
- b. 160% of UPS system output rating (50KVA) for 5 minutes

PART 3 – EXECUTION

3.1 MANUFACTURER:

As part of the bid package, each bidder will include a very detailed description of the control and/or system control/monitoring package used with the bidders and/or manufactures UPS complete integrated product covering all parts as contained in the bid package. The Owner as a minimum wishes to have local control for all control and monitoring functions at the location of the UPS system, control and monitoring capabilities at a remote on-site building separate from the UPS housing (expandable to other stations within the building), and off-site access to control and monitoring package as furnished, complete access (monitoring and control via the in-house network) and a minimum of six (6) silver plating dry optically isolated IPDT (mechanical silver plated – one amp (125V DC/AC)) to report summary pre-alarm status for battery system, UPS module system, power in and out status for unit, and bypass switch module. Also minimum of six (6) dry optically isolated IPDT (mechanical silver plated – one amp (125V DC/AC)) to report summary alarm status for battery system, UPS module system, power in and out status, and bypass switch module.

Any software needing licensing will be licensed to the Owner with software to be used on multiple computers, servers, work stations, or main frames with all upgrades without charge.

Since there are multiple approved vendors for the hardware package, the Owner will make a thorough and in-depth analysis of the control and monitoring system as furnished with the bid as to its flexibility to integrate, communicate and monitor and control through other software, ease of use and/or modifying package to be more user friendly as to Owners wishes, and total over all software package offerings to suit the Owners needs.

A. System Status and Control (Local and On-Site and Off-Site Remote) Minimum:

1. Shall be provided with a LCD display and status/control panel for the UPS module and System Bypass. The UPS control panel shall include a day light visible high contrast display for status/alarm, metering and display of operating instructions (in five languages). Approximately a minimum of fifty (50) conditions are monitored and displayed on a combination of LED's and the LCD on the status panel for the total system.
2. The control panel (local and remote) shall include an LED mimic diagram to indicate the power flow and status of the UPS module.
3. UPS operation shall be controlled via a microprocessor controlled logic system. All operations and parameters are firmware controlled and shall not require any manual adjustments or potentiometers.
4. The UPS microprocessor personalization shall be protected by a password structure and electronic key. Bidder to supply password system and levels for password(s) with bid.

1 B. Self Test and Diagnostics: The logic circuitry shall include self-test and
2 diagnostic circuitry such that a fault can be isolated down to the printed circuit
3 assembly or plug-in assembly level. Every printed circuit assembly or plug-in
4 power assembly shall be monitored. Diagnostics shall be performed via a PC
5 through the local diagnostic port on the unit.
6

7 C. Display and Controls: The UPS modules and Bypass Cabinet(s) shall be
8 provided with a system status and a control panel that controls, monitors and
9 displays system operation and parameters. The UPS display shall utilize a
10 combination of front panel steady state and flashing LEDs, a 40-character x 5-
11 line backlit LCD display and mechanical keypad. The display/keypad shall
12 incorporate multiple menus (listed below) which provide step-by-step procedures
13 for system operation, display metering (listed below) functions, and display of
14 more than 50 normal and alarmed conditions (listed below) for unit. The front
15 panel display shall be selectable in five languages (English, French,
16 Spanish, Dutch and Italian).
17

18 **Bid package will enumerate all specific functions of the display and**
19 **controls available at unit location, at on-site remote building, and at off-site**
20 **locations.**
21

22 3.2 MECHANICAL DESIGN AND VENTILATION:

23

24 A. Enclosure: The UPS shall be housed in a freestanding enclosure with a dead
25 front construction. The back of the UPS shall be capable of being mounted as
26 close to a wall as practical. The UPS cabinet shall be designed for top cable
27 entry and bottom entry cabinets. Copper wire or bus shall be exclusively for all
28 internal electrical connections excluding heat sink subassemblies.
29

30 1. Dimensions: All modules and support equipment will fit through a
31 standard 36"W steel door frame including door stops. The bid shall
32 contain all module and support equipment dimensions and weights.
33

34 2. Access: Front access only shall be required for installation and
35 maintenance. All power connections and component removal shall be
36 possible from the front only. Back access may be considered by any
37 bidder and all access points and voltage exposed will be noted with in the
38 bid.
39

40 3. Color: The cabinet(s) shall be painted manufactures standard color with
41 acid etch, primer, and baked powder epoxy finish coat.
42

43 B. Ventilation: Forced air-cooling shall be provided to ensure that all components
44 are operated within their specified temperature ratings. Power component
45 modules shall be cooled by redundant fans located directly above critical power
46 components ensuring that the cooling air path is not obstructed. Internal air
47 baffles shall carry heated air from large magnetic components directly outside of
48 the UPS to minimize the interior cabinet temperature. Redundant fans shall also
49 be located above the air baffles. Fan failures or a thermal overload shall be
50 annunciated by a contact closure. Air inlets shall be provided from the front of
51 the UPS enclosure. Air exhaust shall be from the top portion of the unit. Air filters
52 on the inlets shall be provided as standard and shall be readily replaceable from
53 the front of the unit with out the requirement of opening the UPS module doors.
54

1. Airflow: Airflow shall be up to that specified by UPS module manufacturer. Indicate air flow and heat gain/loss for all equipment furnished in this bid.
2. Heat Rejection: Maximum heat rejection per UPS module at full load shall be as specified by manufacturer at time of bid (480V/480V). Include heat rejection for all other equipment.

- C. The output bus will be 50KVA rated at 208/120V, 3 phase, 4 wire, minimum 32KAIC and contain one (1) 200 amp, 100% rated, 480V, 3 pole breakers with full adjustable electronic trips and LED function read out windows and full function LSIG trips with individual delays and I2T selectable functions on trips output breakers. All system breakers and power bussing will be rated for 50KAIC at 480 volt; 32KAIC at 250 volt. All output and input breakers along with power supply breaker will have a 120 or 480 volt shunt trip coil wired to a terminal block in output cabinet.
- D. The output bus shall be a 200% rated neutral, system ground, and safety ground bus. Included will be an integrated PDU in attached similar cabinet. The PDU will contain 2-42 pole 200 amp panels. Sub-breakers provided will be 30-20/1 circuit breakers 11-20/2 circuit breakers, and 12-30/2 circuit breakers. Cord whips from PDU to under raised floor shall be a minimum of 30 feet long (final length and will be provided as below (SJ0 rubber cord with separate ground wire and Hubbell or equal "Select-Spec" grade connectors furnished loose):
- 10-30 amp, 208 volt whips with NEMA L6-30R connectors attached
 - 20-20 amp, 120 volt whips with NEMA L5-20R connectors attached
 - 5-20 amp, 120 volt whips with standard Quad 20 amp receptacle box attached
 - 10-20 amp, 208 volt whips with NEMA L6-20R connectors attached
- Cord whips will be supplied by Bidder near final UPS location loose.
- E. Adjustable castors shall be provided for leveling unit in final location plus adjustable solid feet with securing method for Zone 4 mounting requirements. Support jacks will be supplied to match existing raised floor under all raised floor junctions under new UPS/Battery/PDU assembly extending one tile out from all outer edges of equipment mounted and supplied.

PART 4 - FIELD QUALITY CONTROL & SERVICE ORGANIZATION AND START-UP

4.1 FIELD SERVICE ENGINEER QUALIFICATIONS:

The manufacturer must employ a 7 days a week X 24 hours a day nationwide (international where applicable) field service organization with rapid access to all regions of the nation. The responding service professionals must be factory-trained engineers with an accredited and proven competence to service three phase UPS. These trained service professionals must be within a four (4) hour response time period from when receiving a service call to responding in person to UPS site.

4.2 SPARE PARTS:

Field Repair Engineers must have immediate access to manufacturer recommended spare parts with additional parts storage located in regional USA depots. Additional

spare parts shall be accessible on a 7 days a week x 24 hours a day basis from the national USA depot and must be expedited on a next available flight basis or via direct courier (whichever mode is quickest). Bidder will include in Bid a complete list of recommended spare parts to be stored on-site and alternate cost of such. Cost to be submitted as alternate to basic bid total, plus tax and freight. These parts will include all necessary to repair machine and accessories using manufacturer's historical records of most common failures. Bidder will submit historical data for parts recommended as to failure frequency.

4.3 MAINTENANCE TRAINING:

The manufacturer shall make available to the Owner various levels of training ranging from basic UPS operation to UPS maintenance. Included with this Bid is a minimum of one (1) training period with one (1) consecutive working day per training periods.

4.4 MAINTENANCE & SERVICE CONTRACTS:

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 all maintenance and service. The manufacturer shall also offer extended warranty contracts and include such and cost in Bid package.

4.5 COMMISSIONING:

Manufacturer of UPS will, after all final connections of incoming and outgoing power is completed, commission entire UPS unit, verify all connections are proper and torqued to manufacturer specifications, all UPS functions and monitoring and central systems are fully functional, and UPS is performing to all specified values. Part of certification will include interruption of incoming normal service and having UPS unit operate entirely on battery with connected load to maximum time required for battery operation. Record battery voltage at start of test and end of test included with commissioning certificate. Furnish Owner written commissioning test copies of all tests and checks performed and "Statement" signed by manufacturer that UPS is 100% certified and functional.

4.6 INSTALLATION:

- A. See Part 1, 1.6-E for General Installation Requirements.
- B. See also attached Plan Sheets E-1 and E-2 for other installation details.
- C. Bidder will be responsible for all off loading of all materials used and all equipment for this project and transporting to final location. Elevators are existing.
- D. At completion of project, remove all unused material, equipment, wiring, and miscellaneous construction equipment. Patch and refinish to existing conditions all penetrations of walls, floors, cabinets, and ceilings. Leave project area clean and neat in as found condition.
- E. All existing equipment and materials removed remain property of Owner.

- 1 F. Final conversion and cutover of existing loads to new UPS will be done by
- 2 Owner.
- 3
- 4 G. Submit with bid an add or alternate cost to connect remote UPS fire shutdown
- 5 switch as described on plans.
- 6
- 7
- 8 END OF SECTION 26 33 13