SECTION 26 33 53

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

PART 2 -
~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
SELECT EQUIPMENT TYPES AND ACCESSORIES TO BE INTEGRATED FOR SCOPE OF PROJECT.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

2.01 SECTION INCLUDES

A. Charger/rectifier unit.

B. Inverter unit.

C. Batteries.

2.02 REFERENCE STANDARDS

A. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.

B. IEEE 519 - IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems; 2014.

C. NEMA PE 1 - Uninterruptible Power Systems (UPS) - Specification and Performance Verification; 2012 (Reaffirmed 2017).

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NFPA 101 - Life Safety Code; 2017.

F. NFPA 75 - Standard for the Fire Protection of Information Technology Equipment; 2017.

2.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Provide battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and air flow requirements.
1. Power, signal, and control wiring diagrams.
2. Detailed layouts of customer power and control connections.
3. Detailed installation drawings including all terminal locations.

C. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.

D. 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.

E. Manufacturer Certificates: For each product, signed by manufacturers.

F. Qualification Data: For Installer and power quality specialist.

G. Operation and Maintenance Data: For UPS units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 00 - Closeout Submittals, include the following:
1. Lists of spare parts and replacement components recommended being stored at Project site for ready access.
2. Intended operation narrative with detailed operating instructions covering operation under both normal and abnormal conditions.
3. Tools Required.
4. Recommended maintenance practices.
5. Manufacturer service department contact information.
6. Submittal Data.

H. Warranties: Provide complete manufacturer's warranty information on all products provided.

2.04 QUALITY ASSURANCE

A. Comply with NFPA 101 and the Chicago Electrical Code.

B. Power Quality Specialist Qualifications: A factory-trained registered professional electrical engineer or engineering technician, currently certified by the National Institute for Certification in Engineering Technologies, NICET Level 4, minimum, experienced in performance testing UPS installations and in performing power quality surveys similar to that required in "Performance Testing" Article.

C. Manufacturer Qualifications: A minimum of twenty years' experience in the design, manufacture, and testing of solid-state UPS systems is required. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified. Maintain, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs with four hours maximum on-site service response time.

D. Manufacturer Service Qualifications:
1. The UPS manufacturer shall directly employ a nationwide service organization. The service personal shall be the manufacturers employees and consisting of factory trained field service personnel dedicated to the start-up, maintenance, and repair of UPS and power equipment. Third party or non-manufacturer employees are not allowed. The organization shall consist of regional and local manufacturer offices. A minimum of 5 dedicated manufacturer field service employees trained in three phase UPS service shall be based within 50 miles of the site.
2. The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24hours/day, 7days/week, and 365 days/year. If emergency service is required, response time shall be 20 minutes or less with 4 hours on site service response.
3. An automated procedure shall be in place to insure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.
4. Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.
5. Recommended spare parts shall be fully stocked by local field service personnel with back-up available from national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on-call 24 hours/day, 7 days/week, and 365 days/year for immediate parts availability. Parts from the national parts center shall be shipped within 4 hours on the next available flight out and delivered to the customer’s site within 24 hours.

E. Source Limitations: Obtain the UPS and associated components specified in this Section from a single manufacturer with responsibility for entire UPS installation.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. UL Compliance: Listed and labeled under UL 1778.

H. NFPA Compliance: Mark UPS components as suitable for installation in computer rooms according to NFPA 75, NFPA 101, and the Chicago Electrical Code.

2.05 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from extreme temperature and humidity by storing in a conditioned space.

B. Protect equipment from dust and debris by wrapping unit in dust tight cover and storing away from construction activity.

C. Deliver batteries no sooner than seven (7) days before charging.

D. Storage/Transport Ambient Temperature for Electrical Components: -4 to 158 degrees F.

E. Storage/Transport Ambient Temperature for Battery: -4 to 92 degrees F.

2.06 FIELD CONDITIONS

A. Do not store or install unless temperature is maintained between 32 degrees F and 104 degrees F, at a relative humidity less than 95 percent (non-condensing).

B. Maintain conditions during and after installation of products.

2.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Board.
1. Fuses: One for every 10 of each type and rating, but no less than 1 of each.
2. Cabinet Ventilation Filters: One complete set.

2.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
THIS WARRANTY OPTION IS STANDARD FOR STATIC UPS SYSTEMS. IF THIS OPTION IS NOT REQUIRED BY PROJECT SCOPE, CHOOSE PARAGRAPH "UPS WARRANTIES" BELOW IN LIEU OF FIVE YEAR WARRANTY OPTION.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

C. Provide five year warranty including coverage for batteries.

D. UPS Warranties: The UPS manufacturer shall warrant the UPS module against defects in materials and workmanship for 12-months after initial start-up or 18-months after ship date, whichever period expires first.

PART 3 - PRODUCTS

3.01 MANUFACTURERS

A. Uninterruptible Power Supply (UPS) System:
1. Liebert Corporation: www.emerson.com.
2. MGE UPS Systems: www.power-solutions.com.
3. Powerware: www.eaton.com.

B. Battery
1. C&D Dynasty: www.cdtechno.com.
2. Enersys Datasafe: www.enersys.com.
3. GNB Absolyte IIP: www.gnb-network-power.com.

3.02 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEMS

A. System Configuration: Non-redundant type with reverse transfer. Designed for capacity expansion by addition of parallel modules in field with minimum downtime.

B.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

COMPONENTS REQUIRED FOR SCOPE OF PROJECT TO BE COORDINATED WITH UPS MANUFACTURER.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~

C. Components:
   1. Battery.
   2. Rectifier/charger to maintain battery charge and to provide input to inverter when utility power is available.
   3. Inverter to provide power to load during normal operation.
   4. Static switch to transfer load automatically and without disturbance between inverter and utility power.
   5. Manual switch to bypass static switch for maintenance.
   6. Input and output isolation transformers and filters to provide appropriate isolation and disturbance attenuation.
   7. Monitors, sensors, and control circuits.

D. Design Standards: IEEE 519 and NEMA PE 1.

E. Performance Description:
   1. Normal Conditions: Supply the load with ac power flowing from the normal ac power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
   2. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter ac power output to the load without switching or disturbance.
   3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated ac power to the load without switching or disturbance.
   4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
   5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
   6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
   7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
   8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
   9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.
   10. Maintenance Bypass/Isolation Switch Operation: Switch is interlocked so it cannot be operated unless the static bypass transfer switch is in the bypass mode. Device provides manual selection between the following three conditions without interrupting supply to the load during switching:
      a. Full Isolation: Load is supplied, bypassing the UPS. Normal UPS ac input circuit, static bypass transfer switch, and UPS load terminals are completely disconnected from external circuits.
      b. Maintenance Bypass: Load is supplied, bypassing the UPS. UPS ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.

c. Normal UPS ac supply terminals are energized and the load is supplied through either the static bypass transfer switch and the UPS rectifier-charger and inverter, or the battery and the inverter.

d.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
VERIFY SYSTEM RATINGS AND OPERATING CHARACTERISTICS WITH UP-TO-DATE MANUFACTURER DATA
~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~

3.03 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

A. System Continuous Rating: As indicated on drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from full load to no-load.

B.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
NUMBER OF HOURS FOR BATTERY CAPACITY TO BE COORDINATED WITH EQUIPMENT SELECTION AND MANUFACTURER.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~

C. Battery Capacity: Capable of operating at full load for X hours.

D. Voltage Rating: 120/208 volts, 1 phase.

E. Input Voltage Operating Range: Plus or minus 10 percent.

F. Input Frequency Operating Range: 60 Hz. Plus or minus 3 Hz.

G. Input Current Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.

H. Current Walk-in: 25 to 100 percent in fifteen seconds.

I. UPS Power Factor Over Full Range of Loads and Input Voltages: 74 to 100 percent, lagging.

J. Harmonic Distortion of Input Current Wave Form: 10 percent maximum at full load.

K. Output Voltage regulation:
1. Plus or minus 1 percent for balanced load, full range of DC input and no load to full load variations.
2. Plus or minus 5 percent for 50 percent unbalanced load, full range of DC input and no load to full load variations.
3. Plus or minus 2.5 percent during maximum overload of the system.
4. Restoration of AC Input Power: Plus or minus 1 percent.
5. Manual transfer of 100% load: Plus or minus 3 percent.

L. Maximum AC Output Voltage Distortion:
1. 1 percent total harmonic distortion (THD) for linear loads.
2. 2.5 percent THD for 100 percent nonlinear loads (3:1) crest factor) without kVA/kW derating.

M. Output Free Running Frequency: 60 Hz Plus or minus 0.1 percent over the full range of input voltage, load, and battery voltage.

N. Frequency Adjustment: Plus or minus 0.1 Hz.

O. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into a linear load.

P. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer To and From Bypass Line:
1. Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
2. Plus or minus 5 percent for maximum of 25 milliseconds.
3. Plus or minus 3 percent for maximum of 50 milliseconds.
4. Recovery to steady state within 100 milliseconds after any out-of-tolerance variation.

Q. Phase Displacement:
1. 120 plus or minus 1 degrees for balanced loads.
2. 120 plus or minus 4 degrees for 50 percent unbalanced loads.

R. Three-phase Overload Ratings:
1. 200 percent for 10 cycles; via static switch.
2. 150 percent for 60 seconds.
3. 125 percent of rated full load for 10 minutes.

S. Output Current Limit: 150 percent of rated output current.

T. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.

U. Maximum Acoustical Noise: Noise generated by the UPS under any condition of normal operation shall not exceed 65 dBA measured (three) 3 feet from the nearest surface of the UPS.

V. Efficiency:

SIZE RANGE OF UPS UNITS	EFFICIENCY AT 100% RATED LOAD	EFFICIENCY AT 75% RATED LOAD	EFFICIENCY AT 50% RATED LOAD
30 kVA and smaller	**86**	**85**	**84**
37.5 to 74 kVA	**89**	**88**	**87**
75 to 124 kVA	**90**	**88**	**87**
125 to 224 kVA	**90**	**89**	**88**
225 kVA and larger	**90**	**89**	**88**

3.04 SERVICE CONDITIONS

A. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.
1. Operating Ambient Temperature for Electronic Components: 32 to 104 deg F.
2. Storage/Transport Ambient Temperature for Electronic Components: -4 to 158 deg F.
3. Operating Ambient Temperature for Battery: 77 +/- 9 deg F.
4. Storage/Transport Ambient Temperature for Battery: -4 to 92 deg F.
5. Relative Humidity: 0 to 95 percent, noncondensing.
6. Operating Altitude: Mean Sea level to 6,600 feet. Derated for higher altitude applications.
7. Storage/Transport Altitude: Mean Sea level to 40,000 feet.

3.05 DESIGN

A. Inverter Type: Pulse-width modulated.

B. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within the input current limits specified.
   1. General: The rectifier/charger shall be a phase-controlled, solid-state SCR type with constant voltage/current limiting control circuitry.
   2. Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within ten (10) times the rated discharge time for duration of supply under battery power at full load.
   3. AC Input Current Limiting: The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 115 percent of the full input current rating. The rectifier/charger shall operate at a reduced current limit mode whenever the critical load is powered from the UPS static bypass circuit such that the maximum UPS input current will not exceed 115 percent of full load input current. In addition, the rectifier/charger shall have a separate battery current limit, adjustable from 0 to 15 percent of the full load input current. An optional second circuit shall limit the battery recharge current to zero when activated by a customer-supplied contact closure to signal a customer function such as generator operation.
   4. Input Current Walk-In: The rectifier/charger shall contain a timed walk-in circuit that causes the unit to gradually assume the load over a 15-second time interval after input voltage is applied. Walk-in time shall be field selectable for 5 through 20 seconds. If applicable, coordinate this time for maximum compatibility with local generator-set power source.
   5. Output Ripple: The rectifier/charger shall have an output filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 1% RMS. The filter shall be adequate to insure that the DC output of the rectifier/charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier/charger with the battery disconnected.
   6. Fuse Failure Protection: Power semiconductors in the rectifier/charger shall be fused with fast-acting fuses, so that loss of any one power semiconductor shall not cause cascading failures.
   7. Rectifier-Charger Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.
   8. Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.
   9. Automatic Rectifier Restart: Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.
   10. Over-voltage Protection: There shall be DC over-voltage protection so that if the DC voltage rises to the pre-set limit, the UPS is to shut down automatically and initiate an uninterrupted load transfer to the static bypass line.
   11. Input Filter: The rectifier/charger shall include an input filter to reduce reflected input current distortion to 10% THD at full load with nominal input voltage. The input filter shall maintain the input power factor at 0.90 0 0.96 lagging minimum from full load to half load with nominal input voltage. The input filter shall have a disconnect that automatically disconnects the filter under low load conditions.

C. Provide means for on-line testing of UPS, including test points to allow adjusting and servicing. Provide means for testing static switch while load is bypassed to utility.

D. Mean Time Between Failures: 60,000 hours, minimum.

E. Cooling: Natural convection.

F. Forced Air Cooled Unit: Provide with redundant cooling so that failure of any one cabinet cooling fan or fan circuit will not affect continued operation at full load and ambient temperature of 77 degrees F or lower.

G. Operate battery floating, isolated from the UPS AC input and AC output. The battery may be resistance grounded through 5,000 to 10,000 ohms for the purpose of ground fault sensing.

H. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.

I. Construct equipment so each power component can be replaced without a soldering iron or special tools.

J. Use front-panel removable plug-in control modules.

3.06 FABRICATION

A. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.

B. Identify internal wiring at each end of conductor. Provide cabinet grounding lug.

C. Conversion Equipment Enclosure: NEMA 250, Type 1 enclosure allowing access from front for servicing adjustments and connections. Access through hinged door equipped with tumbler lock and latch handle. Equip cabinet for fork truck lifting.

D. Equip air inlet with permanent type filters and pressurize cabinet, or use gaskets around door and panel openings to prevent entry of dirt.

E. Cabinet finish: Primed and painted inside and outside with suitable semi-gloss enamel.

3.07 BATTERY

A. Storage Battery: Sealed, lead calcium heavy duty industrial battery, designed for auxiliary power service. Provide battery with impact resistant plastic case. Provide cells with explosion proof vents, clear containers, and ample space for plate growth without stressing container and cover.

B. Electrolyte Specific Gravity: No greater than 1.250 when full charged and measured at 77 degrees F.

C. Ampere-Hour Rating: Sufficient to supply direct current to inverter for outage period specified, with inverter operating at full rated output, to a discharge limit of not less than 1.65 volts per cell.

D. Battery Racks: Maximum of three-tier, all steel construction, with plastic insulating rails at all points of contact with the battery case. Paint racks with acid resistant paint.

E. The battery power pack shall be housed in a separate cabinet that matches the UPS cabinet styling to form an integral system line-up.

F. Battery cells shall be mounted on slide-out trays for ease of maintenance.

G. A battery disconnect circuit breaker with undervoltage release (UVR) shall be included for isolation of the battery pack from the UPS module. The UPS shall automatically be disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level.

H. Casters and leveling feet shall also be provided with the battery power pack cabinet for ease of installation.

I. When the application calls for the battery cabinet to be bolted to the UPS cabinet, the interconnecting cables are to be provided, precut and prelugged.

J. Battery Reserve Time: The reserve time shall be as shown on the drawings and based on full load, 0.8 power factor, with ambient temperature between 68 to 86 deg F.

K. Battery Recharge Time: Recharge to 95 percent capacity within ten (10) times discharge time.

L.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ADJUST CONTROLS AND INDICATORS FOR PROJECT SCOPE.
~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

3.08 CONTROLS AND INDICATORS

A. Description: The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. A graphical display shall be used to show a single-line diagram of the UPS, and shall be provided as part of the monitoring and controls sections of the UPS. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD display.

B. Controls: UPS start-up, shutdown, and bypass operations shall be accomplished through the front-panel pushbutton controls. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD screen to depict a single-line diagram of the UPS, with switch positions and power flow.
1. AC input circuit breaker.
2. Inverter operate switch to initiate inverter operation.
3. Inverter standby switch to cause inverter to cease operation.
4. Static switch transfer switch to permit manual actuation of static transfer switch.
5. Static switch lock-out switch to inhibit automatic retransfer of load to inverter.
6. Battery charge timer.
7. Indicator test switch.
8. Static switch preferred input circuit breaker.
9. Static switch output circuit breaker.
10. Static switch bypass circuit breaker.
11. Controls for maintenance bypass switch.

C. Indicators:
1. Inverter synchronized to utility.
2. Load connected to utility.
3. Static transfer switch inhibited.
4. High/low DC voltage.
5. Over-temperature.
6. Inverter output overload.

D. Meters: Use 1 percent accuracy meters to indicate the following:
1. Rectifier/charger DC voltage and current.
2. Utility, inverter output, and load AC voltage.
3. Load AC current.
4. Inverter output and utility frequency.
5. UPS output watts.
6. Percent of rated load being supplied by the UPS.
7. Battery time left during battery operation.
8.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
MODIFY WALL-MOUNTED ALARM PANEL TO BE SURFACE OR FLUSH MOUNTED DUE TO SPACE AVAILABILITY.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

E. Wall-mounted Alarm Panel: Surface mounted annunciator panel with the following monitoring and alarm functions:
1. Utility power available.
2. Utility bypass power available.
3. Inverter output available.
4. Inverter synchronized to utility.
5. Load connected to inverter output.
6. Load connected to utility bypass power (alarm).
7. Static transfer switch inhibited (alarm).
8. High/low DC voltage (alarm).
9. Over-temperature (alarm).
10. Inverter output overload (alarm).
11. Audible alarm (sounds when any of the above alarm conditions occur).
12. Alarm/indicator silence/test switch.

F. Status Messages: The following UPS status messages shall be displayed:
1. Normal operation.
2. On Static Bypass Transfer Switch.
3. Load on UPS.
4. Load on bypass.
5. User Shutdown.
6. Battery Discharging.

G. Alarm Messages: The following alarm messages shall be displayed and an audible alarm shall be provided and activated by any of the following alarm conditions:
1. Input Line Fault.
2. Input Phase Rotation Error.
3. Input Over/Under Frequency.
4. Input Current Limit.
5. Rectifier Fail.
6. Battery Test Failed.
7. Battery Low Warning (Adjustable 1 to 99 Minutes).
8. Battery Low Transfer.
9. DC Overvoltage Steady State.
10. Bypass Frequency Error.
11. Load On Bypass.
12. Excessive Auto Retransfers.
13. Static Bypass Transfer Switch SCR Shorted.
14. Bypass Sync Error.
15. Input Phase Loss.
16. DC Current Peak.

17. Output Undervoltage Transfer.
18. Output Overvoltage Transfer.
19. Inverter Overload.
20. Static Bypass Transfer Switch Overload.
21. Inverter Overload Transfer.
22. Transfer Failed Shutdown.
23. Hardware Shutdown.
24. Output Power Supply Fail.
25. Inverter Control Fault Transfer.
26. System Fan Fail.
27. Ambient Overtemperature Limit.
28. Over-temperature Timeout Shutdown.

H. Programmable Relay Board: Eight sets of isolated Form C contacts shall be provided to indicate a change of status of any of the alarm conditions. Any of the UPS alarms can be programmed onto any channel of the programmable relay board.

I. On-Line Battery Test:
1. The UPS shall be provided with a menu-driven On-Line Battery Test Feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode. If the battery fails the test, the system shall automatically do the following:
   a. Maintain the load through the UPS.
   b. Display a warning message.
   c. Sound an audible alarm.
2. The battery test feature shall have the following user selectable options:
   a. Interval between tests (2 to 9 weeks).
   b. Date and time of initial test.
   c. Enable/disable test.

J. Emergency Power Off Switch: Capable of local operation and operation by means of activation by external dry contacts.

3.09 BATTERY CIRCUIT BREAKER

A. A battery circuit breaker shall be provided to isolate the battery from the UPS. This breaker shall have an undervoltage release (UVR) and auxiliary contacts, and shall be in the battery cabinet. The battery breaker provides a manual disconnecting means, short circuit protection, and overcurrent protection for the battery system. When opened, there shall be no battery voltage in the UPS enclosure. The UPS shall be automatically disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level.

3.10 EXTERNAL MAINTENANCE BYPASS CABINET

A. A matching external maintenance bypass cabinet shall be provided to enable the UPS module to be completely isolated from the electrical system while the critical load is powered through the external maintenance bypass line. This optional cabinet shall provide make-before-break operation for transfers to and from the external maintenance bypass line with a single rotary switch. This matching cabinet shall bolt to the side of the UPS module with a barrier shield to separate the two cabinets. Only front access shall be required for installation and service.

B. The following components shall be standard:
1. Single rotary switch with auxiliary contacts.
2. Inter-cabinet wiring.
3. Casters.
4. Leveling feet.

C. The following components shall be optional:
   1. Input circuit breaker.
   2. Shielded isolation transformer.
   3. Load (output) circuit breaker.

D. Switch Rating: Continuous duty at rated full UPS load current.

E. Maintenance Capability: With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static transfer switch.

3.11 INTERNAL MODEM

A. The UPS shall come with an internal modem capable of dialing out from the UPS to notify up to two remote computers, terminals, PC's, or pocket pagers when important events occur. The modem will also be capable of accepting incoming calls, with the appropriate security, and connecting to a remote terminal, computer or PC, to perform all those functions normally available on the front panel including viewing monitoring screens.

3.12 SNMP

A. The UPS shall come equipped with an internal Simple Network Management Protocol (SNMP) adapter, which will connect the UPS directly to any I.P. based network using Ethernet communications. The UPS will become a managed device on the network. From a network management station the system administrator shall be capable of monitoring important system measurements, alarm status and alarm history data. In the event of a utility failure the SNMP shall continue with live communication without the requirement of additional or separate UPS equipment until such time as the UPS shuts down for Low battery. On resumption of Utility power the SNMP shall resume full SNMP communication automatically.

3.13 OUTPUT ISOLATION TRANSFORMER

A. Description: Unit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:
   1. Comply with applicable portions of , including requirements for nonlinear load current-handling capability for a K-factor as specified on the drawings.
   2. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
   3. Regulation: 5 percent, maximum, at rated nonlinear load current.
   4. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
   5. Electrostatic Shielding of Windings: Independent for each winding.
   6. Coil Leads: Physically arranged for minimum interlead capacitance.
   7. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
   8. Capacitive Coupling between Primary and Secondary: 33 picofarads, maximum, over a frequency range of 20 Hz to 1 MHz.

3.14 OUTPUT DISTRIBUTION SECTION

A. Panelboards: Comply with Section 26 24 16 - Panelboards, except provide assembly integral to UPS cabinet.

3.15 SOURCE QUALITY CONTROL

A. Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:

1. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
2. Full-load test.
3. Transient-load response test.
4. Overload test.
5. Power failure test.

B. Observation of Test: Give fourteen (14) days' advance notice of tests and provide opportunity for Board's representative to observe tests at Board's option.

C. Report test results. Include the following data:
1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
3. List of instruments and equipment used in factory tests.

PART 4 - EXECUTION

4.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Identify components and wiring according to Section 26 05 53 - Identification for Electrical Systems.

C. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

4.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.
1. Visual Inspection
   a. Inspect equipment for signs of damage.
   b. Verify installation per drawings.
   c. Inspect cabinets for foreign objects.
   d. Verify neutral and ground conductors are properly sized and configured.
   e. Inspect battery cases.
   f. Inspect battery for proper polarity.
   g. Verify all printed circuit boards are configured properly.
2. Mechanical Inspection.
   a. Check all control wiring connections for tightness.
   b. Check all power wiring connections for tightness.
   c. Check all terminal screws, nuts, and/or spade lugs for tightness.
3. Electrical Inspection.
   a. Check all fuses for continuity.
   b. Confirm input voltage and phase rotation is correct.
   c. Verify control transformer connections are correct for voltages being used.
   d. Assure connection and voltage of the battery string(s).

C. Provide the services of the manufacturer's field technician to supervise adjustments, final connections, and system testing.

D. Verify specification performance criteria.

E. Measure battery discharge and recharge times.

F. Simulate fault in each system component and utility power.

G. Perform other tests as recommended by manufacturer.

H. Load Bank Testing: A 4-hour full load, load bank test shall be performed at the site. The resistive load bank shall be supplied by the contractor at no additional cost. Correct deficiencies and retest until specified requirements are met.

I. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

4.03 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate operation uninterruptible power supply by simulating an outage.

D. Contractor shall prepare and submit a complete set of record drawings, test results, operation and maintenance data and certificates as outlined in this Section.

E.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ADJUST TRAINING REQUIREMENT FOR PROJECT SCOPE AND COORDINATE REQUIREMENT WITH BOARD'S PERSONNEL.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~

F. Training: Provide ten (10) hours of instruction each for two (2) persons.
1. Instruction to be conducted at project site with manufacturer's representative.
2. Include travel and living expenses for Board personnel.

4.04 CLEANING

A. The contractor shall remove all paint spatters and other spots, dirt and debris from the equipment. Clean equipment and devices internally and externally using methods and materials recommended by the manufacturer.

4.05 CONTRACTOR STARTUP AND REPORTING

A. Contractor shall prepare and submit a complete set of record drawings, test results, operation and maintenance data and certificates as outlined in this Section.

4.06 COMMISSIONING AND DEMONSTRATION

A. Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain the UPS. Refer to Section 01 79 00 - Demonstration and Training.

B. Engage a factory-trained field service personnel to perform field quality control tests as outlined in this Section.

C. After system checkout and adjustment, the contractor shall operate the system for the review of the Board and architect. Necessary adjustments or modifications shall be made as required by the Board or architect.

4.07 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service for both the UPS system and battery system shall be available. An extended warranty and preventative maintenance package shall be available. Warranty and preventative maintenance service shall be performed by factory-trained service personnel.

C. Provide service and maintenance of uninterruptible power supply for one year from date of Preliminary Acceptance.

D. Include all costs, including labor, parts, and travel.

END OF SECTION 26 33 53