SECTION 263354 – STATIC UPS – TESTING AND COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. System start-up services.
   2. Battery charging.
   3. Load bank testing.
   4. Battery load testing.
   5. Integral system testing.

B. All equipment, including load banks, measuring instruments, cables, connectors, etc. required for the site testing of the complete UPS system installation shall be provided by the UPS manufacturer’s factory authorized firm. The electrical contractor shall assist and coordinate with the UPS manufacturer's factory authorized firm in the administration and performance of the site testing.

1.2 SUBMITTALS

A. Factory test reports.

B. Field test reports and other documentation including a description of the test procedures and inspections with results listed for each test performed in a type-written format. Include results of tests, inspections and retests.

C. Battery test results including resistance measurements, voltage and temperature readings, specific gravity readings, load values and discharge times and other tests and inspections required in this specification.

D. Infrared scanning reports with pictures printed in a final report with any deficiencies and actions taken to rectify.

1.3 QUALITY ASSURANCE

A. Provide a list of testing equipment with make and model numbers. Test Equipment shall have current calibration validation.

B. PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION
3.1 SITE TESTING

A. System Start-Up:

1. After completion of the UPS system installation and battery system certification; the following inspections and test procedures, as a minimum, shall be performed by the UPS manufacturer’s Field Engineers.

      1) Compare equipment nameplate data with drawings and specifications.
      2) Inspect equipment for signs of damage incurred during delivery.
      3) Inspect anchorage, alignment, grounding and required clearances.
      4) Verify installation per drawings, including proper termination of all cables.
      5) Inspect cabinets for foreign objects and remove any if present.
      6) Verify phase, neutral and ground conductors are properly sized and configured.
      7) Verify date code on batteries to insure batteries have been manufactured within the past 12 months. Return batteries to manufacturer with a date code indicating batteries are older than 12 months.
      8) Verify battery racks and cabinets are seismically rated for the geographical location and installed as specified.
      9) Verify battery support rack and cabinet grounding and clearances.
     10) Verify battery systems are clean.
     11) Verify and inspect battery spill containment installation.
     12) Verify application of oxide inhibitor on battery terminal connections.

   b. Mechanical Inspection.
      1) Check all control wiring connections for tightness.
      2) Check all power wiring connections for tightness.
      3) Check all terminal screws, nuts, and/or spade lugs for tightness.
      4) Verify filters are in place and vents are clear.
      5) Verify battery area ventilation is operable.
      6) Verify existence of eyewash equipment as required by drawings.

   c. Electrical Inspection.
      1) Check all fuses for continuity.
      2) Confirm input and bypass voltage and phase rotation is correct.
      3) Verify control transformer connections are correct for voltages being used.
      4) Assure connection and voltage of the battery string(s).
      5) Verify battery electrolyte levels and measure electrolyte specific gravity and temperature where applicable.
      6) Verify all alarm indicating lamps and audible devices are operating properly. Record all trip points either by simulation or actual fault condition. Indicate on documented procedure, which faults, were conducted by which means.

   d. Start-Up Test Procedures.
      1) Energize control power.
      2) Perform control/logic checks and adjust to meet specification.
3) Verify DC float and equalized voltage levels.
4) Verify DC voltage clamp and overvoltage shutdown levels.
5) Verify battery discharge, low battery warning and low battery shutdown levels.
6) Verify fuse monitor alarms and system shutdown.
7) Verify inverter voltages and regulation circuits.
8) Verify inverter/bypass sync circuits and set overlap time.
9) Perform manual transfer and returns.
10) Simulate utility outage and verify transfer operation to battery source.
11) Verify proper recharge of batteries.

e. Provide recording multichannel oscillograph and conduct the following tests to demonstrate operation in conformance with the operating characteristics specified herein:
1) Verify sync to bypass source when within limits including operation from the on-site standby generator system.
2) Verify sync between UPS modules with input source removed alternately from each UPS module, and from both UPS modules, with each UPS module alternately selected as "master" at the ups bus controller panel.
3) Simulate all alarms and failure modes. Verify alarm indication, alarm logging, and system response to failure mode with protection of the load.
4) Verify voltage regulation and output waveform while applying and removing step loads of 25%, 50%, 75% and 100% with operation from a normal source and with operation from standby generator source.
5) Verify voltage regulation and output waveform while applying and removing step loads of 25%, 50%, 75% and 100% with operation from the battery source.
6) Verify charger current limit operation.
7) Verify voltage regulation and output waveform while transferring full load to and from the bypass source both manually and automatically.

e. Verify proper operation of battery cycle monitor.

2. All pertinent data, including parts replaced and corrective actions taken as a result of the system start-up services, shall be recorded and submitted to the Architect/Engineer, in writing.

B. Battery Charging
1. Prior to battery discharge, battery systems shall be tested including internal-cell resistance tests for all battery cells, inter-cell connection tests and inter-tier connection tests.
2. Upon completion of the UPS system start-up services, the battery systems shall be given an equalizing charge, if required, as determined by the battery system certification. The battery manufacturer's authorized firm shall include in his base bid the manpower required for qualified personnel to continuously monitor and record all pertinent data for the battery systems during the equalize charge period per the selected battery manufacturer's requirements and/or recommendations.
3. After the battery equalizing charge period, the battery systems shall be placed on a float charge per the selected battery manufacturer’s recommendations and requirements to stabilize the battery system voltage prior to load bank testing.

C. Load Bank Testing
1. A 4 hour burn-in, 100% load bank test of the entire UPS system, including UPS modules and battery systems, shall be conducted at the site by the UPS system supplier and the UPS manufacturer’s authorized firm. The load bank shall be connected to the UPS system output at the maintenance bypass cabinet. The purpose of the load bank test is to ensure that all circuitry is functional, that no shipping damage has occurred, and to verify the integrity of the installation.
2. After 4 hour burn-in test, transfer the UPS to static/internal bypass for 15 minutes and perform infrared scanning. Then transfer to maintenance bypass for 15 minutes and repeat infrared scanning. All transfers to occur while on full load.
3. Since the accuracy of the UPS system’s panel instrumentation was proven during the factory testing, they shall be used for all readings where practical. Load banks, cables, connectors and any additional recording instruments required shall be furnished and installed by the UPS system supplier and the UPS manufacturer’s authorized firm.
4. Completion of the load bank and battery load tests and cognizant Owner Representative signature evidencing approval shall constitute final acceptance of the UPS system and the commencement of the warranty period. The load bank testing will not be limited to, but shall include as a minimum, the following:
   a. Apply power in the proper sequence.
   b. Verify input and output AC and DC voltage and current reading on all three phases of system output. Record data with power quality meters set up to record input and output voltage, current, frequency and transients of the output.
   c. After 1/2 hours, verify that the battery system will support the full load for the specified time by interrupting the power inputs to the modules.
   d. Perform block loading of the system including 0%-50%-0%; 25%-75%-25%; 0%-100%-0% while recording data with the power quality meters.
   e. For the final fifteen (15) minute period, verify automatic and manual transfer functions of the UPS system to bypass, and back to UPS, by simulating all conditions which would cause transfer (including UPS module emergency shutdown-EPO).
   f. Verify proper activation of all UPS system alarms and indicators including remote types during the test procedure.

D. Battery Rundown Test:
1. The test shall be conducted with each UPS module at full load.
   a. Remove the AC input and record the time and measure and record voltage drop across each battery connection under full load.
   b. At thirty second intervals, record the DC voltage and current.
   c. Record the time in which the battery discharge related alarm occurs
   d. Conduct an infrared scan of the battery installation during discharge test.
   e. Using the wave form recorder set at the highest resolution, record the critical load voltage and one phase input current prior to and during the entire input fail.
f. Continue to record without interruption for a minimum of five minutes to demonstrate the input walk-in current and the input current limit. These manual readings are required as well as automated data recording.

2. Upon successful completion of the battery tests and after the batteries have a chance to reach their normal charge and temperature, take a full set of cell voltage readings, specific gravity and cell temperature readings.

3. After completion of installation and acceptance of battery system by the Owner, UPS supplier shall certify that installation is complete and in accordance with all of UPS suppliers requirements and the UPS supplier warrantee is in effect.

E. Any damage, discrepancies and/or parts replaced as a result of the load bank test shall be noted and the Owner/Engineer informed of such, in writing. All battery system data recorded during the continuous monitoring period and the load test shall be submitted to the Owner/Engineer for analysis.

F. If the system does not function properly, further tests shall be performed on any item of equipment to determine whether it meets the pertinent specifications. Any measurements deemed necessary by the Architect/Engineer shall be made. Modify or adjust any item of equipment to meet the specifications for the particular item of equipment and the functional requirements of the complete system.

G. Record all system test results and corrective actions undertaken for submittal to the Owner at the time of system acceptance.

H. An integral power system test designed to demonstrate the operation of the UPS system in conjunction with the emergency generators shall also be conducted by the Contractor with the assistance of the UPS supplier. The test shall extend for at least four (4) hours and shall prove the following:
   1. Compatibility between the UPS system and the generators, i.e. harmonics shall not influence voltage regulation and the UPS input filter shall not affect the generators.
   2. Ability of the UPS system to synchronize the generator output.
   3. Ability of the UPS system to transfer the load from UPS system to maintenance bypass and back while on generator power.
   4. Ability of the UPS to limit battery recharge current while on generator power.

3.2 DEMONSTRATION

A. The UPS supplier shall provide qualified field service personnel as required to supervise the site tests. The UPS supplier's field service technicians shall provide all special instrumentations, including line disturbance analyzers, oscilloscopes and event recorders, required to perform the tests.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain the UPS System.

END OF SECTION