SECTION 26 33 53i
STATIC UNINTERRUPTIBLE POWER SUPPLY - INSTALL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of three-phase, on-line, double-conversion, static-type, multi-module UPS system.

B. Meet the following performance requirements:

1. Wind, snow, ice, flood and earthquake Performance: UPS shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Refer to Section 26 00 10.
2. System shall be designed to not cause the system to have a leading power factor under low load conditions.

C. System Description:

1. This Section includes three-phase UPS Modules and System Controls in a multi-module, parallel redundant configuration, on-line, double-conversion, static-type, UPS installations complete with transient voltage surge suppression, input harmonics reduction via input filter, rectifier-charger, battery, battery disconnect device, inverter, static bypass transfer switch and external maintenance bypass/isolation switch.

1.2 RELATED WORK

A. Section 26 00 10 – Basic Electrical Requirements, is an integral part of this section. Requirements and work indicated in 26 00 10 are not repeated in this Section.

B. Section 26 08 00 – Electrical General Commissioning Requirements. Provide Installer's support as required to coordinate with the Commissioning Agent. Support all commissioning efforts and paperwork, Acceptance and Integrated Systems Testing.

1.3 COORDINATION

A. Coordinate work under provisions indicated in Section 26 00 10.

1.4 QUALIFICATIONS / QUALITY ASSURANCE

A. Conform to requirements indicated in Section 26 00 10.

1.5 REGULATORY REQUIREMENTS AND STANDARDS

A. Conform to requirements indicated in Section 26 00 10.

1.6 SUBMITTALS

A. Submit as required here in and under Section 26 00 10.

1.7 EXTRA MATERIALS

A. Furnish under provisions indicated in Section 26 00 10.

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions indicated in Section 26 00 10.

B. Provide list of all UPS settings and the values they are set to (e.g. max input current, reduced battery charging current, etc.)

1.9 OPERATION AND MAINTENANCE DATA

A. Submit under provisions indicated in Section 26 00 10.

1.10 WARRANTY

A. Provide under provisions indicated in Section 26 00 10.

PART 2 - PRODUCTS

A. Refer to shop drawings for details of pre-purchased power distribution units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for conditions affecting performance of the UPS.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install UPS on concrete base. Comply with requirements for concrete base specified in Division 03.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

C. Connections: Interconnect system components. Make connections to control supply and load circuits according to manufacturer's and project wiring diagrams unless otherwise indicated.

D. All power and grounding connections shall use two hole long barrel compression lugs with inspection windows provided by Installer.

E. Torque all bolted connections per Manufacturer's and NRTL listing requirements. Mark correct Torque location on bolt and bus with permanent marker.

3.3 GROUNDING

A. Separately Derived Systems: Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

3.4 IDENTIFICATION

A. Identify components and wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify each battery cell individually.

3.5 ADJUSTMENTS

A. Set up UPS system per requirements of the system descriptions and normal settings documents.

B. Set all CB adjustable trips in UPS to maximum values.

C. Set maximum input values to the following:

1. On normal power
   a. System: 100%
   b. Battery Charging: 15%
2. On generator power:
   a. System: 100%
   b. Battery Charging: 15%

D. Activate temperature compensated battery charging in control system.

3.6 BATTERY EQUALIZATION

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

B. Change batteries for at least 72 hours in an ambient of 25C (77F) before battery performance testing.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: A qualified testing agency shall perform tests and inspections.

B. Manufacturer's Field Service: Assist the commissioning agent and a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: A factory-authorized service representative shall inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Comply with manufacturer's written instructions.
2. Inspect interiors of enclosures, including the following:
   a. Integrity of mechanical and electrical connections.
   b. Component type and labeling verification.
   c. Ratings of installed components.
3. Inspect batteries and chargers according to requirements in NETA Acceptance Testing Specifications.
4. Test manual and automatic operational features and system protective and alarm functions.
5. Test communication of status and alarms to remote monitoring equipment.

6. Load the system using a variable-load bank to simulate kilovolt amperes, kilowatts, and unity power factor to unit's rating. Use instruments calibrated within the previous six months according to NIST standards.
    a. Simulate malfunctions to verify protective device operation.
    b. Test duration of supply on emergency, low-battery voltage shutdown, and transfers and restoration due to normal source failure.
    c. Test harmonic content of input and output current at 15, 25, 50, and 100 percent of rated loads.
    d. Test output voltage under specified transient-load conditions.
    e. Test efficiency at 15, 25, 50, 75, and 100 percent of rated loads.
    f. Test remote status and alarm panel functions.
    g. Test battery-monitoring system functions.
7. Verify temperature compensated battery charging battery charging is wired and operational.

E. Seismic-restraint tests and inspections shall include the following:

1. Inspect type, size, quantity, arrangement, and proper installation of mounting or anchorage devices.
2. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

F. The UPS system will be considered defective if it does not pass tests and inspections.

G. 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.

H. Prepare test and inspection reports.

3.8 PERFORMANCE TESTING

A. A qualified power quality specialist shall perform tests and activities indicated for each UPS system.

B. Monitoring and Testing Schedule: Perform monitoring and testing as coordinated with the commissioning.

1. Schedule monitoring and testing activity, with at least 14 days' advance notice.

C. Monitoring and Testing Instruments: Three-phase, recording, power monitors. Instruments shall provide continuous simultaneous monitoring of electrical parameters at UPS input terminals and at input terminals of loads served by the UPS. Instruments shall monitor, measure, and graph voltage current and frequency simultaneously and provide full-graphic recordings of the values of those parameters before and during power-line disturbances that cause the values to deviate from normal beyond the adjustable threshold values. Instruments shall be capable of recording either on paper or on magnetic media and have a minimum accuracy of plus or minus 2 percent for electrical parameters. Parameters to be monitored include the following:

1. Current: Each phase and neutral and grounding conductors.
2. Voltage: Phase to phase, phase to neutral, phase to ground, and neutral to ground.
3. Frequency transients.
4. Voltage swells and sags.
5. Voltage Impulses: Phase to phase, phase to neutral, phase to ground, and neutral to ground.
6. High-frequency noise.
7. Radio-frequency interference.
8. THD of the above currents and voltages.
9. Harmonic content of currents and voltages above.

D. Monitoring and Testing Procedures:

1. Make recordings at various circuit locations and with various parameter-threshold and sampling-interval settings. Make these measurements with the objective of identifying optimum UPS, power system, load, and instrumentation setup conditions for subsequent test and monitoring operations.
2. Perform continuous monitoring during testing.
   a. Set thresholds and sampling intervals for recording data at values selected to optimize data on performance of the UPS for values indicated, and to highlight the need to adjust, repair, or modify the UPS, distribution system, or load component that may influence its performance or that may require better power quality.
   b. Perform load and UPS power source switching and operate the UPS on generator power during portions of test period according to directions of Owner's power quality specialist.
   c. Operate the UPS and its loads in each mode of operation permitted by UPS controls and by the power distribution system design.
   d. Using temporarily connected resistive load banks create and simulate unusual operating conditions, including outages, voltage swells and sags, and voltage, current, and frequency transients.
   e. Make adjustments and repairs to UPS, distribution, and load equipment to correct deficiencies disclosed by monitoring and testing and repeat appropriate monitoring and testing to verify success of corrective action.

E. Coordination with Specified UPS Monitoring Functions: Obtain printouts of built-in monitoring functions specified for the UPS and its components in this Section that are simultaneously recorded with portable instruments in this article.

1. Provide the temporary use of an appropriate PC and printer equipped with required connections and software for recording and printing if such units are not available on-site.
2. Coordinate printouts with recordings for monitoring performed according to this article, and resolve and report any anomalies in and discrepancies between the two sets of records.

F. Monitoring and Testing Assistance by Installer:

1. Open UPS and electrical distribution and load equipment and wiring enclosures to make monitoring and testing points accessible for temporary monitoring probe and sensor placement and removal as requested.
2. Observe monitoring and testing operations; ensure that UPS and distribution and load equipment warranties are not compromised.
3. Perform switching and control of various UPS units, electrical distribution systems, and load components as directed by power quality specialist. Specialist shall design this portion of monitoring and testing operations to expose the UPS to various operating environments, conditions, and events while response is observed, electrical parameters are monitored, and system and equipment deficiencies are identified.
4. Make repairs and adjustments to the UPS and to electrical distribution system and load components, and retest and repeat monitoring as needed to verify validity of results and correction of deficiencies.
5. Assist the UPS manufacturer's factory-authorized service representative periodically during performance testing operations for repairs, adjustments, and consultations.

G. Documentation: Record test point and sensor locations, instrument settings, and circuit and load conditions for each monitoring summary and power disturbance recording. Coordinate simultaneous recordings made on UPS input and load circuits.

1. Verify operation of maintenance bypass SKRU interlock System.
2. Verify operation of temperature compensated battery charging.
3. Verify settings for maximum system input and battery changing current while on normal and when on generator power.

4. Verify wiring and operation of Switchboard interlock to prevent transfers from generator to utility while UPS is in bypass.

H. Analysis of Recorded Data and Report: Review and analyze test observations and recorded data and submit a detailed written report. Include the following in each report:

1. Description of corrective actions performed during monitoring and survey work and their results.
2. Recommendations for further action to provide optimum performance by the UPS and appropriate power quality for non-UPS loads. Include a statement of priority ranking and a cost estimate for each recommendation that involves system or equipment revisions.
3. Copies of monitoring summary graphics and graphics illustrating harmonic content of significant voltages and currents.
4. Copies of graphics of power disturbance recordings that illustrate findings, conclusions, and recommendations.
5. Recommendations for operating, adjusting, or revising UPS controls.
6. Recommendation for alterations to the UPS installation.
7. Recommendations for adjusting or revising generator-set or automatic transfer switch installations or their controls.
8. Recommendations for power distribution system revisions.
9. Recommendations for adjusting or revising electrical loads, their connections, or controls.

I. Interim and Final Reports: Provide an interim report at the end of each test period and a final comprehensive report at the end of final test and analysis period.

3.9 DEMONSTRATION

A. Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the UPS.

3.10 INTEGRATED TESTING

A. Installer to provide support Integrated Systems Testing (commissioning level 5) in addition to and after successful completion of Acceptance Testing (commission level 4). Provide for (1) 12 hour day of Integrated Systems Testing for each UPS system (e.g. each UPS static switch/isolation bypass switch).

END OF SECTION