

## SECTION 26 08 10 - ELECTRICAL SYSTEM START-UP

### PART I - GENERAL

#### 1.1 REFERENCES

- A. *NFPA 70 - National Electrical Code*
- B. *IEEE Standard 400-2012 - IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above*

#### 1.2 SPECIAL CONDITIONS

- A. Independent Firm: All firms employed for testing shall be completely independent of the Project's Electrical Contractor.

#### 1.3 MATERIALS

- A. Furnish All Materials: Furnish all personnel, meters, instruments, cable connections, equipment or apparatus for making all tests.

#### 1.4 LOW VOLTAGE TESTING

- A. Test for Faults: After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. When fault condition is present, the trouble shall be rectified, then retested.
- B. Within 2 Percent: Voltage test shall be made at each lighting and distribution panel. When potential is not within 2 percent of rated voltage, the condition shall be corrected by tap changes or power company correction of line voltage.
- C. Grounded or Shorted: All wiring devices and electrical apparatus furnished under this Contract, when grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing all defective parts and materials.
- D. Megger Test: All service and feeder cables, after being pulled in place and before being connected, shall have a Megger test conducted to determine that wire and cable insulation resistance is not less than that recommended by the National Electrical Code. Copies of all tests shall be given to the AE. All cables failing insulation test shall be removed, replaced, and retested.
- E. Motor Test: All motors shall be tested under load with a True RMS type meter. Readings shall be taken for each phase, and the rpm of motors recorded at the time. All motors shall be tested for correct direction of rotation. Run tests on all motors and verify that proper overload devices have been installed. Motors controlled by a Variable Frequency Drive shall be tested while running at full RPM. The following shall be submitted for approval by the AE. Test and record the following on all motors:
  - 1. Fuse size
  - 2. Heater size
  - 3. Full load amp
  - 4. Running amp
  - 5. Rated voltage
  - 6. Terminal operating voltage
- F. Copies: 2 copies of all test data shall be delivered to the Owner and AE.

#### 1.5 HIGH VOLTAGE TESTING

- A. IEEE Standard 400-2012: On all new installations, cables shall be tested per IEEE Standard 400-2012. Maximum test voltages shall be in accordance with IEEE Standard 400-2012.
- B. Hi-Pot Test: When new cable is spliced to existing cables or tests are done on existing cables; a Facilities & Services electrical engineer shall be present and approve voltage levels for the High-Direct-Voltage (Hi-pot) test. IEEE Standard 400-2012 shall be used as a guideline except for the test voltage levels.
- C. Above 600 Volts: Cables above 600 volt and all associated terminations and splices installed shall be field tested in the presence of the AE and Owner personnel before being energized. All tests shall be in accordance with and under the direct supervision of an authorized, qualified representative of a certified testing company.
- D. Test Voltages: The maximum test potential shall be 25 KVDC for new cables only. The Owner shall specify the voltage for tests that involve existing high voltage cables. Test potentials shall be applied for 10 minutes. Allow 1 minute for voltage stabilization. Take 10 step readings at 2.5 KV increments. The following information shall be recorded:
  - 1. Leakage in microamps is to be recorded for each phase in increments starting at 1,000 volts going up to the maximum test voltage as specified in IEEE Standard 400-2012 or as specified by the Owner.
  - 2. Allow 1 minute for voltage stabilization between readings.
  - 3. After the maximum voltage is reached the leakage in microamps is to be recorded every minute for at least a minimum of 10 minutes.
- E. Graphs: In addition to the above recorded information, proper Graphs shall be plotted to show the following relationships:
  - 1. Leakage current in micro-amps versus time in minutes.
  - 2. Leakage current in micro-amps versus applied potential (KVDC).
- F. Identify Phase Conductors: Care shall be taken to properly identify the phase conductors tested in all test recordings and graph plottings.
- G. Faults: If during the field acceptance testing a high resistance fault or low resistance fault in a component such as the cable, splice, or termination is apparent, the fault shall be cleared, necessary repairs made, and the cable retested in accordance with this specification.
- H. Moisture and Water: If the acceptance testing indicates a cable with possible moisture penetration, or water is observed in a cable, the cable shall be removed and replaced with new cable. The new cable shall be free of moisture and water.
- I. Replace Rejected Cable: If after proper testing of the cable the independent testing representative and/or the AE do not approve the cable, the cable that is not approved shall be removed and a new cable installed. All cables shall be tested and approved by the AE before final acceptance. Supply all additional cable that is required.
- J. Submittals: 3 copies of all acceptance test recordings and graphs shall be submitted to the AE before final acceptance of the distribution system will be authorized.

#### 1.6 GROUND TESTING

- A. 25 Ohms Max: The resistance between ground grid and absolute earth shall not exceed 25 ohms and shall be measured in the presence of the AE before equipment is placed in operation. Testing shall be done per IEEE 81 – 2012 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

#### 1.7 FIRE ALARM AND DETECTION SYSTEM

- A. See *Section 28 30 00 – Fire and Smoke Detection System* for Fire Alarm acceptance testing.

### PART 2 - PRODUCTS

#### 2.1

PART 3 - EXECUTION

3.1

END OF SECTION **26** 08 10

This section of the *U of I Facilities Standards* establishes minimum requirements only.  
It should not be used as a complete specification.