

SECTION 16030

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 GENERAL

- A. Provisions of Section 16010, General Requirements for Electrical Work apply to the work of this Section.
- B. This Specification Section covers the field inspection, mechanical completeness, and electrical acceptance tests required for electrical apparatus, wire, cable and other miscellaneous equipment and material installed and wired by Contractor.
- C. The Contractor shall prepare written procedures for the performance of all testing. The procedures shall include an itemization of all equipment, devices, cable and material requiring field testing, setting, adjustment or calibration and shall describe the required set points. The procedures shall be submitted to the Engineer for review prior to the commencement of any testing.
- D. The Contractor shall maintain records for all tests and inspections, with complete data on all readings taken. Test results shall be recorded on standard test forms. All reports shall be dated and shall include the name of the person performing the test.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The equipment to be tested under this Section is generally provided under other Specification Sections.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems to insure that the entire installation is sound and that all circuits, including power, control, relaying, instrumentation and metering will function properly and as intended.
- B. The Contractor shall furnish and maintain all tools, instruments, materials, test equipment, test connections and personnel, including supervision and labor required for testing, setting and adjusting of all electrical equipment.
- C. All tests shall be performed with proper regard for the protection of equipment and the Contractor shall be responsible for adequate protection of all personnel during such tests.
- D. No equipment shall be installed, operated or tested in such a manner as to void the manufacturer's warranty or guarantee. Should any test values or procedures as indicated in this Specification

exceed the values or overrule the procedures recommended by the manufacturer for the equipment involved, the manufacturer's recommendation, shall take precedence.

- E. Prior to energizing or placing in service any electrical equipment, testing and checking shall be completed.
- F. The witnessing or waiving of witnessing of any test shall not relieve the Contractor of its guarantees for material, equipment and workmanship.
- G. The Contractor shall promptly advise the Engineer in writing concerning the failure of any equipment or material to pass the tests performed, or to properly function as intended, or to meet calibration accuracy required. After the defects have been corrected, the test(s) shall be repeated.

3.2 SWITCHBOARDS

- A. Each switchboard shall be inspected for shipping and handling damage, mechanical completeness, and made ready for operation including the following:
 - 1. Remove all shipping blocks and debris from all cubicles and clean cubicles as necessary. If appreciable dirt has accumulated, cubicles shall be vacuumed. Compressed air will not be permitted for cleaning.
 - 2. Make visual inspection of the physical conditions of each bus and cable. Verify that proper cable tags and wire numbers have been installed.
 - 3. Check all accessible bolted electrical connections for proper torque values.
 - 4. Check ground bus for connection to plant ground grid at both ends. Check ground bus splices at all shipping breaks.
 - 5. Manually exercise all circuit breakers, contactors and magnetic devices to assure freedom of operation. Verify operation of shutters.
 - 6. Check alignment of all drawout devices, racking mechanisms and operating handles. Adjust as necessary per manufacturer's instructions.
 - 7. Check all fuses for proper size and type. Make sure all fuses are completely inserted in clips.
 - 8. Check all overload relay heater coils for proper size in accordance with motor nameplate amperes. Adjust or replace as necessary.
 - 9. Adjust all motor circuit protector circuit breakers to proper set point.
 - 10. Check and set all timers and time delay relays.
 - 11. Check polarity and field test ratios of all instrument transformers.
- B. A one minute megger shall be performed on all bus work. Tests shall be performed for each phase to phase and all phases to ground. Circuit breakers shall be racked out. ALL ELECTRONIC RELAYING, INSTRUMENTS AND DEVICES WHICH MAY BE DAMAGED BY

INSULATION RESISTANCE TESTING SHALL BE DISCONNECTED OR SUITABLY PROTECTED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.

<u>Equipment Rating</u>	<u>Megger Voltage</u>	<u>Minimum Resistance</u>
600 Volt	1000 V	100 Megohm
5 KV	5000 V	1000 Megohm
15 KV	15000 V	5000 Megohm

- C. Contact resistance and dielectric testing shall be performed on all power circuit breakers as recommended by the manufacturer.
- D. Verify proper phase sequence.

3.3 DRY TYPE TRANSFORMERS (GENERAL PURPOSE POWER AND LIGHTING)

- A. Check primary and secondary connections for correctness.
- B. Check secondary neutral for proper bonding to ground.
- C. Perform one minute megger tests of the primary windings to ground with the secondary grounded and secondary windings to ground with the primary grounded.
- D. After transformers are energized check secondary voltage and adjust taps as necessary.

3.4 ROTATING EQUIPMENT

- A. All motors shall be subjected to a one minute megger test, resistance measured to ground with all phase leads tied together. Minimum insulation resistance values are as follows:

Equipment Rating (volts)	600 or less
Megger Rating (volts)	1000
Min Resistance (megohms)	10

If minimum resistance values are not obtained, the equipment shall be dried out as required, and the above test repeated.

- B. The following visual inspection shall be made on all motors:
 - 1. Check bearings for free rotation.
 - 2. Check all ventilation openings for blockages.
 - 3. Check bearing lubrication and correct as necessary.
 - 4. Check that frame is grounded.
 - 5. Check motor leads for proper connection and color coding.
- C. The Contractor shall check all motors for proper rotation by bumping motors. Coupled motors shall not be bumped. The Contractor shall correct motor connections as necessary.

3.5 WIRE AND CABLE

- A. Control and Instrument Wiring - Control and instrument field wiring shall be visually inspected and tested for continuity to insure that all field wiring is installed in accordance with Contract Drawings and/or equipment manufacturers drawings. Verify all field conductors are properly identified with wire numbers.
- B. Low Voltage Power Wiring - All 480V and 208V power wiring shall be subjected to one minute 1000V megger test. Minimum insulation resistance shall be 50 megohms. Megger tests shall be performed between each phase (A-B, B-C, and C-A) and three phases tie together to ground.

3.6 CALIBRATION

- A. The Contractor shall check, calibrate and operate all protective relays, timers, meters, instruments and devices furnished under this Division, in accordance with manufacturers recommendations. Equipment furnished under other Divisions will be calibrated by others.
- B. Ratios of current and potential instrument transformers shall be verified by test.

3.7 FUNCTIONAL TESTING

- A. Unless otherwise noted, the Contractor shall energize and operate all alarm and control circuits under simulated or actual system conditions to verify the correctness of wiring. All control circuits shall be checked in their entirety.
- B. Control wiring, circuits and devices furnished and installed by Division 15 will be tested by Division 15.

3.8 GROUNDING

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.9 RECEPTACLES

- A. The Contractor shall check to ensure that all receptacles in patient care areas are tested in accordance with NFPA 99. Testing to include:
5. Confirm physical integrity of each receptacle by visual inspection.
 6. Verify the continuity of the grounding circuit in each receptacle circuit. Test ground impedance and document actual impedance.
 7. Verify and document actual line to neutral and neutral to ground voltage measured at each receptacle.
 8. Confirm correct polarity of hot and neutral connections in each electrical receptacle.
 9. Verify that the retention force of the grounding blade of each electrical receptacle is greater than 115 g.
 10. Test ground impedance between the receptacle grounding prong and panelboard ground bus for 10% of all new outlets installed. Testing to be split evenly between two rooms.
 11. Provide results of all tests listed above in a spreadsheet and furnish to Engineer and to EMMC Electrical Supervisor.

3.10 PANELBOARDS

- A. Panelboards shall be tested in accordance with specification section 16470.

END OF SECTION 16030