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| Version | Date | Description of Revisions |
| 1 | December 3, 2018 | Initial Specification Release. iMCC standards update. (MS) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**For each project the Consultant is responsible for the correct application of the specifications and for updating and modifying all highlighted items, as well as updating and modifying those sections that are directly applicable to the project. All updates and modifications to this standard document are to be highlighted to the Region for review and acceptance on each project.**

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GENERAL

## Intent

### Except where otherwise specified, contractor shall arrange and pay for testing, adjusting, commissioning and related requirements specified herein. This shall include arranging and paying for appropriately qualified manufacturers’ representatives to provide or assist in providing electrical equipment and system demonstration and instruction as specified herein.

### If results do not conform to applicable requirements, the contractor shall repair, replace, adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

### Provide all labour, materials, instruments and equipment necessary to perform the tests specified.

### All tests to be witnessed by the Consultant and optionally, persons designated by the Region.

### Submit proposed inspection, testing, adjusting and balancing procedures, in writing, for approval two (2) weeks prior to the work being performed.

## Submittals

### The following documents shall be submitted for review:

#### Details of test procedures and listing of test instruments prior to proceeding.

#### Test results on the specified forms and a report outlining the completed testing.

#### Recommended periodic on-going testing requirements.

#### Furnish manufacturer's certificate or letter confirming that entire installation has been installed to manufacturer's instructions.

#### Copies of production test records for production tests for MCC.

#### Provide operation and maintenance data for incorporation into manual. Include values and settings of protective devices.

#### Provide a collated, complete set of test records for the MCC.

# EXECUTION

## Readiness for Testing and General Requirements

### Prior to energization of the MCC and commencement of inspection or tests, visually check and verify that the following has been completed:

#### The entire assembly is clean inside and outside. The cables are not lying loosely or hanging free.

#### The equipment is adequately bonded and grounded with the ground wires installed clear of bus work.

#### The phasing of all bus work and primary circuits is identified.

#### All equipment is correctly identified (front and back, if applicable).

#### Each starter is identified with correct drive number and drive title where applicable.

#### All cables leaving the MCC have proper cable connectors, and are properly identified.

#### All unused holes are adequately plugged.

#### Relay and metering sections of MCC are properly identified where applicable.

#### Equipment nameplate data corresponds with characteristics of power supply.

#### A single line diagram for the primary supply and feeder system is available in all electrical rooms.

#### The installation is in a safe condition, there are no unguarded live parts. Conduit seals are in place if a hazardous condition could occur during the testing phase.

#### Visually and mechanically inspect to include the following: anchoring, grounding, torque of feeder and incoming connections, electrical clearances, starter and feeder unit drawout mechanisms, and check installation using manufacturer's checklist.

## Prefunctional Checkout

### Prior to functional testing, adjust and make operational all protective devices. Prior to energization of equipment, perform a functional checkout of the control circuit consisting of energizing each control circuit and operating each control, alarm or malfunction device and each interlock in turn to verify that the specified action occurs. Submit a description of the proposed functional test procedures prior to the performance of functional checkout.

### Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.

## Coordination of Protective Devices

### Ensure circuit protective devices such as overcurrent trips, relays and fuses are set to values and settings provided.

## Load Balance

### Measure phase current to MCC with normal loads operating at time of acceptance. If load unbalance exceeds 15 percent, adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

### Measure phase voltages at loads and adjust transformer taps to within 2 percent of rated voltage of equipment.

### Submit, at completion of work, a report listing phase and neutral currents on MCC, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

## Insulation Resistance Measurements

### General

#### Prior to energizing the MCC, conduct insulation resistance tests on MCC busing, each type of motor start unit (except for VFDs) and each control circuit. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, EEMAC or ANSI standards for the equipment or material being tested, unless otherwise specified. Record the ambient temperature at which insulation resistance is measured on the test form.

### Record insulation resistance measurements on an appropriate form.

### Test Instruments

#### Unless otherwise specified, use the following insulation resistance testers (Megger):

##### 500 V instrument for circuits, feeders and equipment up to 350 V.

##### 1000 V instrument for 350-600 V circuits, feeders and equipment.

## IR Testing

### IR Scan under load. Perform thermograms at all connections, plus heat sinks, body, etc. Record ambient temperature and temperature rise above ambient. Compare information will every other subsequent inspection. Compare with the specifications for maximum temperature above ambient and maximum operating temperature. Refer to latest ANSI/NETA standards. Provide documentation of certified Level 2 thermographer use.

## Circuit Breakers

### Visually inspect all connections and assemblies and check all manual operations and physical interlocks on circuit breakers as specified.

### Check all electrical controls, including anti-pump and trip free operation.

### Check correct position indication.

### Verify trip settings from each protective device.

## Potential and Current Transformers ***[Consultant to confirm]***

### Verify winding ratio (nameplate rating).

### Verify terminal polarity.

### Check insulation resistance.

### Verify grounding connections.

## Protective Relays ***[Consultant to confirm]***

### Perform secondary current and/or potential injection on site to verify to the Engineer that protective relays trip as designed and set.

### After normal load has been added, complete a load test of protective relays with the given load; ensure that the correct amplitude and phasor quantities of current and voltage are read by relay.

## Starter/RVSS/VFD

### Refer to applicable motor starter/RVSS/VFD section for specific inspection and testing requirements.

### Perform tests in accordance with Section 16010 – Electrical General Requirements.

### Perform tests in accordance with Section 13510 – PCS SCADA Local Area Network.

### The MCC manufacturer shall load the IP Address and Subnet Mask into each unit.

### The IP Address will be provided by the Region after the contractor has submitted the completed IP request form (found in 1810A forms).

### The MCC manufacturer shall test the MCC to ensure that each unit and device communicates properly prior to shipment.

### A qualified manufacturer's representative shall attend the site setting and commissioning of the MCC and all network enabled devices and provide the Consultant with written certification that the completed assembly has been properly installed, configured and setup.

### Reliability Test to include the following:

1. Electromagnetic- compatibility (electrical noise) series of tests.
2. Electrostatic discharge immunity test.
3. Chattering contactor test.
4. Surge immunity tests.
5. High current noise effect (jogging starter) test.
6. RFI - immunity test.
7. Load testing - all devices (VFD's, RVSS, O/L relays etc.) fully loaded and subjected to their respective temperature rise tests.
8. Power supplies tested for regulation under load, ability to withstand a short circuit and reverse output capacity.

### Functional test to include (but not limited to) the following:

1. Network cable and connection integrity tests.
2. Network verification tests - For each device, an IP address and data rate is set and verified. System tests to ensure all devices operate in harmony and that no addressing conflict exists.
3. A command to verify operation to be transmitted to each device output to energize and de-energize its respective contactor or starter.

**END OF SECTION**