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| Version | Date | Description of Revisions |
| 1 | September 08, 2006 | Approved final document. |
| 2 | February 19, 2010 | Modified ‘Related Sections’ |
| 3 | March 21, 2011 | Minor edits |
| 4 | June 3, 2013 | Final Draft – Consolidated Comments Spec Update Project |
| 5 | July 28, 2014 | Changes to reflect renaming of commissioning specification and final review (AV) |
| 6 | February 9, 2015 | Updated, Finalized Specification – Reference eDOCS #5630520 v5 (AV) |
| 7 | December 3, 2018 | 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 inspecting, testing, adjusting, balancing 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.

## Related Sections

### [Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.

### Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.

### This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the Section for the specific project it may be deleted.]

### [List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Sections:

#### Section 01425 – Computerized Maintenance Management System Data Requirements

#### Section 01430 – Operation and Maintenance Data

#### Section 01600 – Material and Equipment

#### Section 01740 – Cleaning

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 01820 – Demonstration and Training

#### Division 01 – General Requirements (insert applicable specifications)

#### Division 11 – Equipment (insert applicable specifications)

#### Division 40 – Process Interconnections (insert applicable specifications)

#### Division 15 – Mechanical (insert applicable specifications)

#### Division 16 – Equipment (insert applicable specifications)

#### Design Guidelines Section 17 – Operation Manual Guideline

#### Product requirements for [item]... for installation under this Section.

## Submittals

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

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

#### Test and inspection 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 as it pertains to each system has been installed to manufacturer's instructions.

#### Copies of production test records for production tests for manufactured electrical equipment.

#### 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 each item of electrical equipment and interconnecting wiring. Include all relevant forms attached at the end of this section.

# EXECUTION

## Readiness for Testing and General Requirements

### Prior to energization of any equipment 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 electrical equipment have proper cable connectors, and are properly identified.

#### All unused holes are adequately plugged.

#### All unused wall and floor openings are sealed.

#### Relay and metering sections of equipment enclosures 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.

## 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 panelboards, switchboards, and motor control centres 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 panelboards, switchboards, transformers and motor control centres, 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 equipment, conduct insulation resistance measurements on conductors and energized parts of electrical equipment. 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.

### Conductor and Cable Tests

#### Measure the phase-to-ground insulation resistance for all circuits 120 volts and above except lighting circuits. Disconnect solid state equipment unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

#### Check phase rotation and identify each phase conductor of each feeder.

#### Check each feeder for continuity, short circuits and grounds.

#### After installing cable but before splicing and terminating, perform insulation resistance test on each phase conductor.

#### Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

#### Replace entire length of cable if cable fails to meet any of test criteria.

### 5 kV Cables (before terminations are complete) ***[Consultant to confirm]***

#### Insulation tests between phases and from phases to ground:

##### Hipot

##### Megger.

#### The following minimum values must be attained:

##### Hipot voltage: 18 kV DC

##### Hipot duration - Equipment connected: 1 minute

##### Hipot duration - Equipment not connected: 10 minutes

##### Megger reading 10 M ohms

## Circuit Breakers***[Consultant to confirm]***

### 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.

## Loadbreak Switches and Disconnects ***[Consultant to confirm]***

### Check all manual operations and physical interlocks.

### Check correct position indication.

## 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.

## Motor Starters up to 600V***[Consultant to confirm]***

### Refer to Section 16223 – Motor Starters to 600V for specific inspection and testing requirements.

## Variable Frequency Drives up to 600V***[Consultant to confirm]***

### Refer to Section 16224 – VFDs to 600V for specific inspection and testing requirements.

## Reduced Voltage Soft Starters up to 600V***[Consultant to confirm]***

### Refer to Section 16226 – RVSS’ to 600V for specific inspection and testing requirements.

## Motor Control Centres***[Consultant to confirm]***

### Refer to Section 16225 – Motor Control Centres for specific inspection and testing requirements.

## Medium Voltage Variable Frequency Drives***[Consultant to confirm]***

### Refer to Section 16262 – MV VFDs for specific inspection and testing requirements.

## Medium Voltage Reduced Voltage Starters***[Consultant to confirm]***

### Refer to Section 16261 – MV RVSS’ for specific inspection and testing requirements.

**END OF SECTION**