PART 1 GENERAL

1.1 RELATED WORK

(Spec Note: Coordinate with Architectural requirements)

.1 Construction Schedules Division 1
.2 Contractor Start-Up Reports Division 1
.3 Facility Start-Up Procedures Division 1
.4 Starting of Equipment Division 1
.5 Testing, Adjusting, and Balancing Division 1
.6 Equipment and System Demonstration Division 1
.7 Testing of Equipment Section 16030
.8 Operation and Maintenance Manuals Section 16031
.9 Electrical Equipment and Systems Section 16032
   Demonstration and Instruction
.10 Electrical Starting and Testing Section 16071
    by Contractor
.11 Electrical Starting and Testing Section 16072
    by Hospital’s Testing Agent
.12 Electrical Performance Testing Section 16073
    by Hospital

1.2 INTENT

.1 This Section specifies general requirements common to all starting and testing of
electrical equipment and systems. Read this Section in conjunction with related
sections, which specify specific portions of electrical starting and testing work.

.2 Except where otherwise specified, arrange and pay for the testing and related
requirements specified in this and related sections.

.3 If test results do not conform with applicable requirements, repair, replace, or
adjust or balance equipment and systems. Repeat testing as necessary until
acceptable results are achieved.

1.3 SUBMITTALS
.1 Submit to the Consultant a list of equipment and instruments which will be used in starting, testing, balancing and adjusting electrical equipment. The owner may require changes to the proposed equipment and instruments.

.2 Submit to the Consultant sample forms, which will be used to record and monitor test results. Modify these forms as directed by the consultants.

(Spec Note: Choose one of the following Article 1.4 or 1.5 depending on whether owner uses a commissioning agent or a independent testing agent only.)

1.4 COORDINATION WITH OWNER’S COMMISSIONING AGENCY

.1 The project will be subjected to a commissioning process by the Owner. The Owner will separately purchase from one or more agents, specific testing and commissioning activities typically but not limited to the following:

(Spec Note: Edit as required in consultation with the Commissioning Agent.)

.1 Testing and commissioning of all medium and low voltage distribution equipment.

.2 Testing of electrical systems to ensure compliance with Z32.2 standards.

.3 Witnessing of the Fire Alarm Verification by a Professional Engineer.

.2 In addition, the Owner’s Commissioning Agent shall be allowed to witness any in-contract testing, adjusting, start-up, and demonstration procedures.

.3 Co-operate with independent testing agencies and allow for all labour, equipment, and tools necessary to assist in completion of the commissioning process as defined herein.

.1 Prior to execution of any testing, start-up or demonstration, verify with the Owner’s Commissioning Agent any tests required to be witnessed. Provide sufficient notice to Owner’s Commissioning Agent and Consultant prior to commencement of procedures.

.2 For independent testing by Owner’s Commissioning Agent related to 4160 and 208 volt distribution and emergency power equipment tests, patient receptacle testing, fire alarm verification, all communication equipment testing, etc., allow in tender price for availability of one journeyman electrician during testing process as needed to gain access to equipment an for removal and replacement of covers, wires, and cables.

.3 Assist Owner’s Commissioning Agent with access and removal/replacement of covers, etc. for patient care receptacle and
voltage regulation testing and any other testing defined by the Hospital as
part of the commissioning process.

.4 Co-operate with the commissioning agency as follows:

.1 Inform commissioning agency minimum 7 working days in advance of all
testing.

.2 Provide copies of manufacturer’s operating and maintenance brochures
and product bulletins for all major equipment. This information t be made
available immediately after approval of shop drawings, but no later than
three weeks prior to testing.

.3 Allow Owner’s Commissioning Agent free access to site during
construction phase.

OR

1.5 COORDINATION WITH OWNER’S TESTING AGENT

(Spec Note: Use this article where owner does not use a commissioning agent,
but where an independent testing agent is retained to perform some or all of the
testing.)

.1 The Owner will separately purchase from one or more agents, specific testing
and commissioning activities typically but not limited to the following:

(Spec Note: Edit as required in consultation with the owner)

.1 Testing and commissioning of all medium and low voltage distribution
equipment.

.2 Testing of electrical systems to ensure compliance with Z32.2 standards.

.3 Witnessing of the Fire Alarm Verification by a Professional Engineer.

.2 Co-operate with Owner’s independent testing agencies and allow for all labour,
equipment, and tools necessary to assist in completion of the commissioning
process as defined herein.

.1 For independent testing by Owner’s Commissioning Agent related to
4160 and 208 volt distribution and emergency power equipment tests,
patient receptacle testing, fire alarm verification, all communication
equipment testing, etc., allow in tender price for availability of one
journeyman electrician during testing process as needed to gain access
to equipment an for removal and replacement of covers, wires, and
cables.
.2 Assist Owner's Testing Agent with access and removal/replacement of covers, etc. for patient care receptacle and voltage regulation testing and any other testing defined by the Owner as part of the commissioning process.

.3 Co-operate with the Owner as follows:

.1 Inform Owner a minimum of 7 working days in advance of all testing.

.2 Provide copies of manufacturer's operating and maintenance brochures and product bulletins for all major equipment. This information to be made available immediately after approval of shop drawings, but no later than three weeks prior to testing.

.3 Allow Owner's Testing Agent free access to site during construction phase.

1.6 REPORT

(Spec Note: Use this article only where a Commissioning Agent is used by the Owner.)

.1 Submit Contractor Start-Up Report forms in accordance with Division 1 documenting starting and testing procedures performed, and observed tests results obtained.

1.7 FACILITY START-UP REPORTS

(Spec Note: Use only when Commissioning Agent is used by the Owner.)

.1 Facility Start-up Reports form an integral part of the Commissioning Check Sheets. All start up reports must be completed and signed off by the applicable Trade contractors and his Sub-Sub Contractor.

.2 The Trade Contractor is responsible for ensuring completion of all Commissioning Check Sheets, and keeping same neatly assembled and available for review by the Commissioning Agent throughout the course of construction.

.3 Where start-up of equipment by a manufacturer is specified in these specifications, a separate report must be completed by the manufacturer detailing procedures and test results. These reports are to be inserted in the Commissioning Check Sheet Binder in the appropriate sections.

1.8 STARTING AND TESTING – GENERAL
.1 Prior to testing ensure all electrical equipment is cleaned and free of dust.

.2 After testing, protect equipment subject to dust from construction activities.

.3 Notify the Consultant when starting and testing of all systems has been completed.

.4 Do not conceal or cover equipment until inspected, tested and approved by the Consultant.

.5 Assume all liabilities associated with starting, testing and balancing procedures.

.6 Assume all costs associated with starting, testing, adjusting and balancing, including supply of testing equipment and witnessing of factory testing by Contractor and the Consultant.

1.9 WITNESSING OF STARTING AND TESTING

.1 The [(Choose One) Owner] [(Owner’s Commissioning Agent] may witness elected starting, testing, and cleaning procedures.

.2 Provide sufficient notice (minimum five days) prior to commencing tests requiring witnessing by the Consultant and/or the [(Choose One) Owner] [Owner’s Commissioning Agent].

.3 The Consultant or the [(Choose One) Owner] [Owner’s Commissioning Agent] may witness all or any portion of testing and starting procedures performed by Contractor or Contractor’s Testing Agent.

.4 Contractor shall make himself available for all tests specified in Section 16072.

.5 Advise the [(Choose One) Owner] [Owner’s Commissioning Agent] in advance that starting, testing, adjusting or cleaning processes are ready to commence. Consult with [(Choose One) Owner] [Owner’s Commissioning Agent] to determine which procedures they may elect to witness. Provide advance notice in writing prior to commencement of each procedure or series of procedures to allow the [(Choose One) Owner] [Owner’s Commissioning Agent] to allow for witnessing of tests.

1.10 MANUFACTURER’S STARTING RECOMMENDATIONS

.1 Prior to starting equipment or systems, obtain and review manufacturer’s installation, operation and starting instructions. Read in conjunction with procedures specified in Sections [(Choose Applicable Sections) 16071] [16072] [16073].
.2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in this Section and Sections 16071 and 16072 will not void any warranties.

.3 Compare installation to manufacturer's published data and record discrepancies. Modify procedures detrimental to equipment performance prior to starting equipment.

1.11 MANUFACTURER'S SERVICE ON SITE

.1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of following electrical equipment and systems:

(Spec Note: Edit to exclude or include other systems as required.)

.1 Main Distribution
.2 Public Address System
.3 Door Security and Monitor System
.4 Fire Alarm System
.5 Pipe Heat Tracing System
.6 Emergency Generator
.7 Transfer Switches

.2 Manufacturer's personnel shall be experienced in design and operation of equipment and systems being started and have ability to interpret results of readings, and tests and report results in a logical fashion.

.3 Pre-start-up checks and function tests for electrical equipment to be provided by authorised manufacturer's service representative. Division 16 to include all costs for involvement of manufacturer's representatives for this work.

1.12 REFERENCE DOCUMENTS

.1 Perform tests in accordance with:

.1 These Contract Documents.
.2 Requirements of authorities having jurisdiction.
.3 Manufacturer's published instructions.
.4 Applicable CSA, IEEE, IPCEA, EEMAC, NEMA and ASTM standards.

.2 If requirements of any of the foregoing conflict, notify the Consultant before proceeding with tests and obtain clarification.

1.13 CONTRACTOR AND MANUFACTURER REPORTS
.1 Log and tabulate test results on appropriate [(Choose One) Commissioning Check Sheets provided by the Owner’s Commissioning Agent] [Check Sheets provided by the Owner].

.2 Submit completed [(Choose One) Commissioning Check Sheets] [Check Sheets] immediately after tests are performed.

.3 Where a particular [(Choose One) Commissioning Check Sheets] [Check Sheets] does not provide space to record specific test results required as part of the specifications Trade Contractor shall submit his own test forms for review and input by the Consultant.

.1 Record all data gathered on site on Commissioning Check Sheets or approved test report forms.

.2 Note any damage, missing parts or incomplete work on the [(Choose One) Commissioning Check Sheets] [Check Sheets].

.3 Record date of corrected deficiencies on form.

.4 Maintain one photocopy on site of all data taken during starting and testing period.

.5 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.

.4 Arrange for manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Consultant prior to shipping.

.5 Arrange for manufacturer to submit brief step-by-step description of entire starting procedure a minimum of one week prior to starting equipment.

1.14 CORRECTION OF DEFICIENCIES

.1 Correct all contract deficiencies found during electrical starting and testing of equipment and systems and the Consultant's performance verification.

1.15 PERFORMANCE TESTING

(Spec Note: This clause is usually used for projects subjected to a commissioning process.)

.1 Following Substantial completion Performance testing of electrical equipment and systems by the Trade Contractor will commence.
.2 The [(Choose One) Owner] [Owner’s Commissioning Agent] may witness any or all tests or start-ups which are the responsibility of the Contractor as specified in Section 16971 - Electrical Starting and Testing by Contractor.

.3 The Trade Contractor and/or his designated manufacturer’s representative will be fully responsible for completing all testing of systems as specified. The Owner’s Commissioning Agent may request certain functions and/or components of the systems to be demonstrated in detail.

1.16 CO-ORDINATION

.1 Co-ordinate starting of electrical equipment and systems with testing and demonstration and instruction of

.1 Electrical equipment and systems specified in Division 16.
.2 Mechanical equipment and systems specified in Division 15.
.3 Other equipment and system specified in other Divisions.

.2 Where any equipment or systems requires testing prior to starting, ensure that such work has been completed prior to starting of electrical equipment and systems.

1.17 IMPLEMENTATION

.1 Except where otherwise specified, perform all testing and related requirements specified herein during Facility Start-Up, prior to Substantial Completion of the Work.

1.18 STARTING AND TESTING PHASES

.1 Starting and testing program generally consists of following five distinct phases:

.1 Pre-Starting: visual inspection

.2 Starting: actual starting procedure.

.3 Post-Starting: operational testing, adjusting or balancing and equipment run-in phase.

.4 Substantial Completion of the Work: final cleaning, re-testing, balancing and adjusting and maintenance.

.5 Final Acceptance of the Work: re-testing and fine-tuning of system to prove all deficiencies have been corrected.
.2 After each distinct phase of work has been completed, correct deficiencies before commencing the next phase.

1.19 SCHEDULING

(Spec Note: Use this article only for a project where commissioning agent is involved.)

.1 Provide a detailed Facility Start-Up schedule as specified in Division 1. Schedules must include cross-references to other Trade Contractor’s work as needed to ensure all components for the work are ready for testing simultaneously.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 SAMPLE CHECK SHEETS

(Spec Note: Use this article only where a complete commissioning process is used on the project. Sample check sheets should be provided by the commissioning agent to provide the contractor with an indication as to the intent.)

.1 A random sampling of Commissioning check sheets as they will be issued to the Trade Contractor has been included as part of these specifications. The sample Check Sheets do not constitute a complete Check Sheet Set, but has been included to assist the Trade Contractor in assessing his involvement with the commissioning process. Individual Commissioning Check Sheets will be issued for each system, system component and device on the project at the discretion of the Commissioning Agent.

END OF SECTION