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Part 1 GENERAL

1.1 Related Sections

.1 Project Documents (reference and information only):

.1 Owner's Project Requirements

.2 Basis of Design

.2 Guidelines and Industry Standards:

.1 ASHRAE Standard 202: Cx Process for Building and Systems

.2 CAN/CSA Z320-11: Building Commissioning Standard & Check Sheets

.3 IES DG-29-11: The Cx process applied to the lighting and control systems

.4 Building Cx Association: New Construction Building Commissioning Best Practices, November 2015

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 Witnessing of Tests

.1 Commissioning Agents may witness selected starting, testing, adjusting and balancing procedures.

.2 Advise the Commissioning Manager in advance that starting, testing, adjusting, or balancing procedures are ready to commence. Consult with the Commissioning Manager to determine which procedures he may elect to witness. Provide advance notice prior to commencement of each procedure or series of procedures to allow the Commissioning Manager to arrange for witnessing of tests as required.

1.3 Starting and Testing Costs

.1 Pay costs associated with starting, testing, adjusting, and cleaning, including supply of instruments, equipment, supplies, and consumable materials.

1.4 Commissioning Manuals

.1 The Commissioning Manager will prepare the Project Electrical Commissioning Manual consisting of equipment check sheets. Contractor is responsible for providing manufacturer start up reports for all pieces of equipment.

.2 All commissioning check sheets must be completed and signed off by the Contractor. Refer to the end of this section for a sample check sheet.

.3 The commissioning check sheets are designed to act as a tool for the Contractor to ensure each installation is complete before start-up, to reduce the number of deficiencies associated with system start-ups.

.4 The Contractor is responsible for verifying that all installed equipment is as per the electrical shop drawings. The Contractor is to initial and date the check sheets when the equipment technical checks are complete and also when equipment installations are complete (static checks). The Commissioning Agents will spot-check that the technical data is correct.

1.5 Reports

.1 Submit field test reports as may be required as per the individual Division 16 specification sections.

1.6 Quality Assurance

.1 Use personnel for starting, equipment and starting procedures who have experience in electrical equipment and systems commissioning, and are able to interpret results of readings and tests and report state of systems in a clear and concise manner.

.2 In the absence of specific testing requirements from the Manufacturer or the AHJ, electrical equipment commissioning shall be conducted in accordance with ANSI/NETA ATS-2021 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

.3 Where manufacturer’s test requirements and specifications differ from those in NETA ATS, the more stringent requirement shall apply.

1.7 Manufacturer’s Recommendations

.1 Prior to starting equipment or systems, obtain and review manufacturer's installation, starting and operating instructions. Read in conjunction with procedures specified herein.

.2 Use manufacturer's and supplier's trained personnel where necessary to maintain validity of manufacturer's warranty.

.3 Compare actual installation with manufacturer's recommended installation. Record discrepancies. Correct deviations detrimental to equipment performance prior to starting equipment.

1.8 Scope of Work

.1 Commissioning work of Division 26 shall include, but not be limited to:

.1 Testing and start-up of the equipment.

.2 Completion of Functional Checklists.

.3 Cooperation with the Commissioning Authority.

.4 Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.

.5 Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.

.6 Providing operation and maintenance manuals, and as-built drawings to the Commissioning Authority for verification.

.7 Providing training and demonstrations for the systems specified in this Division.

.2 The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:

.1 Emergency power distribution and controls, including operation of Automatic Transfer Switches and Generators

.2 Electrical equipment Kirk Key interlocking schemes

.3 Electrical support for mechanical HVAC equipment listed in the Mechanical Specifications

.3 System components which will not be functionally performance tested but shall be included in the commissioning scope for conformance to the design documents, verification of specified Contractor testing, construction phase observation, and training verification shall include:

.1 Primary switchgear

.2 Primary transformer

.3 Main switchgear

.4 Distribution switchgear

.5 Distribution Switchboards

.6 Panel boards

.7 Isolation power systems

.8 Power conditioners

.9 Power factor correction

.10 Paralleling gear

.11 Automatic transfer switch

.12 Lightning protection systems

.13 Grounding system

.14 SCADA / BMS system

.15 Lighting and lighting control

.4 Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the commissioning process:

.1 Functional Checklists are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. Verification is completed by the Division 23, 26, and 28 contractors and documented using Functional Checklists.

.2 Functional Performance Tests (FPT) shall determine if the electrical system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.

.5 Comprehensive training of O&M personnel shall be performed by the Electrical Contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the College. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.9 Documentation

.1 The Commissioning Authority shall oversee and maintain the development of the document process. The GC shall facilitate project documentation through the web-based commissioning software. The commissioning documentation shall include, but not be limited to, the following:

.1 Commissioning Plan

.2 Commissioning Schedule

.3 Document Request Log

.4 Commissioning RFIs

.5 Commissioning Field Reports

.6 Design Team Issues Log

.7 Contractor Commissioning Issues Log

.8 Pre-Functional Checklists

.9 Functional Performance Test

1.10 Requirements

.1 Obtain certificates of approval and for compliance with regulations from Authorities having jurisdiction. Include copies of certificates with start-up reports.

Part 2 PRODUCTS

2.1 Testing Instruments and Equipment

.1 Provide all special tools and equipment required for testing during the commissioning process, including ancillary equipment such as two-way radios and ladders required to perform starting of electrical equipment and systems.

.2 Instruments used in equipment start-up must be calibrated and accurate. Provide calibration certificates if requested by the Commissioning Agents.

.3 Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) necessary for the continued operation and maintenance of equipment shall become the property of the College upon completion of the commissioning process.

Part 3 EXECUTION

3.1 General

.1 A pre-construction meeting of all commissioning team members shall be held at a time and place designated by the College. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

.2 The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.

.3 A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the commissioning process, the Commissioning Authority shall notify the College.

.4 Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 26 contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 Commissioning Reviews

.1 Provide access to all system equipment being commissioned. Do not conceal or cover equipment or systems prior to scheduling commissioning reviews.

3.3 Participation

.1 The Contractor shall provide skilled technicians to start-up and debug all systems within Division 26. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

.2 System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

.3 The Commissioning Authority reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub-system.

3.4 Check Sheets, Field Reports and Data

.1 Record all data gathered on site on start-up report forms and commissioning check sheets.

.2 Make copies of all starting and testing data before equipment and system start-up personnel leave site. Maintain one copy of all data taken during starting on site.

.3 Maintain one copy of all final starting, testing, adjusting and balancing reports on site up to Substantial Completion of the Work for reference purposes.

.4 Make copies of all red-line record drawings available for Commissioning Agents to review.

3.5 Coordination

.1 The Commissioning Manager will prepare a Draft Commissioning Schedule prior to the start-up of building systems. The Contractor shall provide tentative dates for when each system will be ready for commissioning activities to commence.

.2 At approximately 50% Construction Phase, commissioning meetings will be scheduled by the Commissioning Manager on site for coordination of commissioning activities.

.3 Prior to commencement of each particular testing procedure, coordinate all sub-trades, manufacturers, suppliers and other specialties to ensure all phases of work are properly completed. Establish necessary manpower requirements.

3.6 Starting And Testing Phases

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

.1 Pre-Starting: visual inspection (static review)

.2 Starting: actual starting procedure.

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

.4 Substantial Completion of the Work: final cleaning, : performance verification of equipment and systems under full control

.5 Final Acceptance of the Work: deficiency clean-up and fine-tuning of systems.

.2 After each distinct phase of work has been completed, correct deficiencies and advise Commissioning Manager before commencing the next phase.

3.7 Commissioning Reports

.1 The Commissioning Manager will issue commissioning reports following all commissioning activities on site. The Contractor is responsible for completion of deficiencies as listed in the Commissioning Reports and shall return signed-off copies of issued commissioning reports noting action taken on items.

.2 All commissioning deficiencies will be tracked to resolve and final sign-off by the Commissioning Manager.

3.8 Deficiency Resolution

.1 In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the University, with input from the contractor, equipment supplier, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the University shall have final jurisdiction over any additional work done to achieve performance.

.2 Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Authority shall notify the College,

indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the College reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the Contractor's responsibility.

.3 Sheridan College's contract with the Commissioning Authority includes up to two tests of each piece of equipment or system included in the commissioning scope. Commissioning Authority time and expenses required for retests beyond two, if required, due to incomplete installation or otherwise, will be paid by the College and reimbursed by the contractor.

3.9 Additional Commissioning

.1 Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s), suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.10 Seasonal Commissioning

.1 Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning shall be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

.2 Heating equipment shall be tested during winter design extremes. Cooling equipment shall be tested during summer design extremes with a fully occupied building. Each contractor and supplier shall be responsible to participate in the initial and the alternate peak season tests of the systems as required to demonstrate performance.

3.11 Systems Manual

.1 The Systems Manual shall be submitted in paper AND/OR electronic format and shall contain the following major sections:

.1 System Descriptions – written description for each major system

.2 Operating Instructions – instructions for each major piece of equipment

.3 Ongoing & Preventative Maintenance – maintenance procedures and parts lists for each major piece of equipment

.2 Posted Operating Instructions and Diagrams

.1 Simplified one-line diagrams of the systems listed shall be developed using AutoCAD and posted neatly under Plexiglas in the most appropriate

equipment room for easy reference by operating and maintenance personnel.

3.12 Training

.1 The Electrical Contractor, and appropriate sub-contractors, shall provide comprehensive operating and maintenance instruction on building systems prior to delivery. The instruction shall include appropriate and relevant classroom instruction delivered by competent instructors based upon the contents of the operating manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and why systems were designed as they were. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer representatives for which operating instructions are provided. The manufacturer representative training shall emphasize operating instructions, and preventive maintenance as described in the operating manual.

.2 Each classroom training period shall be followed by an inspection, explanation, and demonstration of the subject system by the instructors. Where practicable and safe, all equipment shall be started up and shut down.

.3 The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the College.

.4 The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the College.

END OF SECTION