

SECTION 230800 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents:
 - 1. Drawings and general provisions of the Subcontract apply to this Section.
 - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
 - 1. General requirements that apply to implementation of commissioning of HVAC systems, assemblies and components.
- C. Related Sections:
 - 1. Division 01 Section "General Requirements."
 - 2. Division 01 Section "Special Procedures."
 - 3. Division 23 HVAC Sections.

1.2 REFERENCES

- A. General:
 - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
 - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
 - 3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.
 - 4. Refer to Division 23 Section "Common Results for HVAC" for codes and standards, and other general requirements.

1.3 DESCRIPTION

- A. The purpose of commission is to ensure the University that work has been completed as specified and that systems are functioning in the manner as described in Division 23 Section "Common Results for HVAC" and specified system operating criteria. It will assist operating staff training and familiarization with new systems. It will serve as a tool to reduce post-occupancy critical systems operational difficulty or failure. It will, also, be used to develop test protocol and record the associated test data in an effort to advance the building systems from a state of substantial completion to a full dynamic operation.
- B. Commission will commence after preliminary punch list items are completed by Subcontractors.
- C. The steps associated with commissioning are outlined below:
 - 1. Step One - Installation Verification
 - 2. Step Two - System Start-Up.
 - 3. Step Three – Functional Performance Testing.
- D. Operational staff training is essential to the commission process and will run concurrently with steps one through three.
- E. The Commissioning Team will include representatives of the University, Construction and Installing Subcontractors, Test and Balance Subcontractor, FMCS Subcontractor and Construction Subcontractor's Commissioning Agent. Equipment manufacturer's representatives will be present for start-up as specified in the equipment specification sections and for equipment training.

1.4 SYSTEMS TO BE COMMISSIONED

- A. Commissioning will be performed on the following systems:
 - 1. Facility Monitoring and Control System (FMCS)
 - 2. Central Supply and Return Air Systems.
 - 3. Air Terminals.
 - 4. Chilled Water System.
 - 5. Heating Hot Water System.
 - 6. Compressed Air System.
 - 7. Low Conductivity Water System
 - 8. High Sensitivity Smoke Detection (HSSD) System

1.5 SUBMITTALS

- A. Submit under provisions of Division 23 Section "Common Results for HVAC - Review of Materials" and Division 01 Section "General Requirements."
- B. Commissioning Plan as prepared by the prime Subcontractor or his Commissioning Agent.
- C. Prime subcontractors or his Commissioning Agent shall provide Functional Performance Tests (FPT) procedures for the above listed systems. Prime subcontractors or his Commissioning Agent shall provide system narrative descriptions as part of the FPT procedures.

PART 2 - PRODUCTS

2.1 COMMISSIONING PLAN

- A. The commissioning plan shall outline the organization, scheduling, team members, and documentation pertaining to the overall commissioning process.

2.2 NARRATIVE DESCRIPTIONS

- A. A narrative description of the design intents of the systems and their intended modes of sequences of operation.

2.3 FUNCTIONAL PERFORMANCE TESTS (FPT) PROCEDURES

- A. The FPT procedures at the minimum shall consist of the following sections:
 - 1. Narrative Description:
 - a. This section provides a narrative description of the design intents of the systems and their intended modes of sequences of operation.
 - 2. Testing Prerequisites:
 - a. This section contains verification that primary mechanical, electrical, and controls systems that support or interact with the system that the FPT is prepared against are completed, tested and operational.
 - 3. Installation Verification:
 - a. This section contains verification that the system installation is completed and is ready for commissioning.
 - 4. Commencement of Functional Performance Testing:
 - a. This section records the date and time of the start of system commissioning.
 - 5. System Condition Prior to Starting Performance Testing:
 - a. This section records the current set points and parameters of the system at the start of commissioning.
 - 6. Functional Performance Test:
 - a. This section shall provide the following:

- 1) Sequential steps required to set parameters and conditions required to test component and functions throughout intended ranges of operation.
 - 2) Full range of checks and tests carried out to determine if electric and pneumatic connections, components, subsystems, systems and interfaces between systems function in accordance with the contract documents and design intents.
 - 3) All modes and sequences of control operations, interlocks and conditional control responses and specified responses to abnormal emergency conditions.
7. End of Functional Performance Test:
 - a. This section records the date and time of the end of system commissioning.
 8. Field Notes:
 - a. This section records notes or remarks during system commissioning.
 9. List systems modifications, not required by the Contract Documents, but provided by the Subcontractor. List other questions regarding such system modifications.
 10. List problems discovered during Commissioning that were corrected.
 11. List problems discovered during Commissioning that were not corrected.
 12. List recommended party that should take action on these problems.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Subcontractors shall be responsible for performing procedures presented in specification and contract drawings as detailed in the Functional Performance Tests (FPT). Members of the designated Commissioning Team shall witness various portions of the commissioning process. Responsibilities for these activities are listed in the following paragraphs. Commissioning Team members shall sign-off on appropriate sections after verifying installation, operation, or documentation. Final sign-off shall be by the University and Commissioning Agent.
- B. Any test ports, gauges, test equipment, etc., needed to accomplish the functional performance tests shall be provided by Subcontractors.
- C. Subcontractors shall provide to the Commissioning Team documentation of calibration of controls. Documentation shall include dates, setpoints, calibration coefficients, control loop verification, and other data required to verify system check-out. Documentation shall be dated and initialed by field engineer or technician performing the work.

3.2 OPERATIONAL STAFF TRAINING

- A. System narrative descriptions will be prepared by the Commission Agent and supported by flow diagrams, one line diagrams, and appropriate specification sections for major systems to be commissioned. The Commission Agent will coordinate "system description" meetings with members of facility management and maintenance department groups to review system description documentation. The meetings will provide an overview of major system features, components, and arrangements.
- B. The Subcontractor and associated manufacturer's representatives shall provide required training to operational staff after the system description meetings have occurred. The Subcontractor training sessions shall provide a more detailed analogy of systems operation and maintenance.

3.3 INSTRUMENTATION

- A. Instrumentation will be provided by the Subcontractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.
- B. Application of instruments and accuracy of measurements shall be in accordance with NEBB or AABC Standards.

3.4 DOCUMENTATION

- A. The installing Subcontractor shall be responsible for collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the Commissioning Agent documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.
- B. Documentation is to be typewritten on 8-1/2 by 11 inches (200 by 280 mm) paper and inserted in a 2 inches (50 mm) to 3 inches (75 mm) thick three ring binder. Indicate the project name, number, volume number, and volume title on the end panel of each binder.
- C. Provide a title sheet for each volume and list the following:
 - 1. Volume Title and Section Name and Number requiring this submittal.
 - 2. Project name, project number, and address.
 - 3. Subcontractor name, address, and phone number.
 - 4. Name, title, signature, and date of person making the submittal.
 - 5. Name of University, a blank line for signature, and the date of person accepting the submittal.
 - 6. Name, address, and phone number of Commission Agent; a blank line for signature; and date of person accepting the submittal.
- D. Provide a Table of Contents for multiple submittals. List each submittal and page number. Number each page, centered on the bottom in sequential numerical order. Provide tabs for multiple submittals in a single binder.

3.5 STEP ONE - INSTALLATION VERIFICATION

- A. General Commissioning responsibilities:
 - 1. Before system start-up begins, the Commission Team shall conduct a final installation verification audit. The Subcontractor shall be responsible for completion of work including change orders and punch list items to the University's satisfaction. The audit shall include, but not be limited to, checking of:
 - a. Piping specialties including balance, control, and isolation valves.
 - b. Ductwork specialty items including turning devices, balance, fire, smoke, control dampers, and access doors.
 - c. Control sensor types and location.
 - d. Identification of piping, valves, equipment, controls, etc.
 - e. Major equipment, pumps, valves, starters, gauges, thermometers, etc.
 - f. Documentation of prestart-up tests performed, including manufacturer's factory tests.
 - 2. If work is found to be incomplete, incorrect, or non-functional, the Subcontractor shall correct the deficiency before system start-up work proceeds.

3.6 STEP TWO - SYSTEM START-UP

- A. General Commissioning Responsibilities:
 - 1. A start-up plan shall be developed and submitted by the installing Subcontractor. Start-up plan to include the following:
 - a. Flushing and cleaning of pipe.
 - b. Filters, strainers, and screens.
 - c. Valve/damper positions.
 - d. Electrical tests.
 - e. Pressure tests.
 - f. Safeties.
 - g. Chemical treatment.
 - h. Manufacturer's tests.
 - 2. The start-up plan will be reviewed and a prestart-up inspection performed by designated members of the Commissioning Team. The installing Subcontractor shall commence with system start-up after approval has been given to start-up plan and the prestart-up inspection is completed. Designated members of the Commissioning Team shall witness system start-up and list system and equipment deficiencies noted during start-up. The Subcontractor shall take corrective action on system deficiencies noted and demonstrate to the Commissioning Team members suitable system operation.

3. Designated systems requiring test and balance work shall have this activity commence after systems have successfully completed start-up. System and equipment deficiencies observed during this activity is to be noted and corrected.

3.7 STEP THREE - FUNCTIONAL PERFORMANCE TESTING

A. General Commissioning Responsibilities:

1. Functional Performance Testing begins after operational testing, adjusting, and balancing of the systems have been completed by the Subcontractors; and the System Description and Hands-on Training sessions have been completed.
2. The objective of the Functional Performance Testing is to advance the building systems from a state of substantial completion to full dynamic operation in accordance with the specified design requirements and design intent.
3. Attaining this object will be accomplished by developing individual systems testing protocols which, when implemented by the Subcontractor, will allow the Commissioning Team to observe, evaluate, identify deficiencies, recommend modifications, tune, and document the systems and systems equipment performance over a range of load and functional levels.
4. Functional Performance tests for the systems to be commissioned are defined in the Commissioning Plan. These tests are intended to be conclusive but may require minor modifications as system operation dictates.

END OF SECTION 230800