

PART 1 - GENERAL

1.1 SUMMARY

- A. General requirements for Commissioning (Cx) of HVAC systems and equipment including installation, start-up, testing, documentation, and training according to the Construction Documents.
- B. Standard procedures for the execution of commissioning work shall be in conformance with Division 1, Section 01810 General Commissioning Requirements. Coordinate all work with the Commissioning Agent (CxA).

1.2 SECTION INCLUDES

- A. This section includes the systematic process of commissioning for all sections of Division 15.
 - 1. Commissioning Plan.
 - 2. Commissioning Schedule.
 - 3. Commissioning Basis of Design.
 - 4. Commissioning One-Line Diagrams.
 - 5. Shop Drawings Verification.
 - 6. Code Compliance Verification.
 - 7. Installation Verification.
 - 8. Control Software Verification.
 - 9. Start-Up Verification.
 - 10. Test, Adjust, and Balance (TAB) Verification.
 - 11. Commissioning Procedure.
 - 12. Functional Performance Test.
 - 13. Operations and Maintenance (O & M) Manuals Verification.
 - 14. Owner Training Verification.

1.3 QUALITY CONTROL

- A. Comply with the University's Quality Control Specifications sections of Division 1.
- B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this section.

1.4 COORDINATION

- A. Coordination and management: Provide overall coordination and management of the commissioning program. The commissioning team shall be comprised of: contractors, subcontractors, manufacturers, factory engineers, commissioning authority, and University representatives.
- B. Assure all applicable forms are submitted and are complete for each section of Division 15. The commissioning performed under this section is in addition to commissioning performed by the manufacturer and contractors for each section of Division 15 or each piece of equipment.

1.5 QUALITY ASSURANCE FOR CONTRACTOR'S SHOP DRAWINGS

- A. The shop drawings shall be reviewed and approved by the commissioning authority prior to construction. Assure proper coordination between trades. Assure proper access for service. Review and discuss at monthly commissioning meetings.
- B. Assure the electrical requirements of the actual equipment supplied by mechanical contractor are verified, reviewed, and coordinated with electrical and other trades. Review and discuss at monthly commissioning meetings.
- C. A copy of all mechanical submittals shall be submitted to commissioning authority for review, reference, and coordination.

1.6 SUBMITTALS

- A. Submittals package(s) shall include the following.
 - 1. Commissioning required submittals in accordance with Division 01 Specification Sections.
 - 2. Copy of the Design/Builder's reviewed and accepted submittals to the CxA via the OAR.
 - 3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks (PEC) and Functional Performance Tests (FPT), at least six (6) weeks prior to the start of Pre-functional Equipment Checks.
 - 4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force clearly defined.
 - 5. Installation and checklist documentation shipped with equipment and field checklist forms to be used by factory or field technicians.
 - 6. Detailed manufacturer's recommended procedures and schedules for PECs, supplemented by Contractor's specific procedures, and FPTs, at least four (4) weeks prior to the start of PEC.

1.7 COMMISSIONING MEETINGS

- A. Schedule, organize, and coordinate monthly commissioning meetings within thirty calendar days of notice to proceed. The commissioning agent shall lead these meetings. Request attendance of the owner and end-users, and owner's maintenance/staff. Provide a comprehensive agenda to all participants seven calendar days prior to each meeting. Compile and distribute meeting minutes to all participants within seven calendar days after each meeting. The construction coordination meetings by the general contractor are not a substitution for a commissioning meeting. Commissioning meetings shall be conducted in addition to the construction coordination meetings.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide test equipment, instruments, components, and tools as required for a complete commissioning of the mechanical system.

2.2 QUALITY CONTROL

- A. Verify that equipment is calibrated properly in conformance with National Institute of Standards and Technology (NIST) and NEBB requirements.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

- A. Work to be performed prior to commissioning:
 - 1. Complete all phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.
 - 2. If modifications or corrections to the installed system(s) are required to bring the system(s) to acceptance levels due to Contractor's incorrect installation or defective materials, such modifications shall be made at no additional cost to the Owner.
 - 3. Normal start-up services required to bring each system into full operational state:
 - a. Testing, motor rotation check, control sequences of operation, full and part load performance.
 - b. Commissioning shall not start until each system is complete and start-up has been performed.
- B. Pre-Commissioning responsibilities: Inspection, calibration and testing of the equipment required to commission HVAC systems.
- C. Commissioning Process Requirements: Refer to Section 01810 General Commissioning Requirements and related sections for information on meetings, start-up plans, Pre-Functional and FPT, operations & maintenance data, training requirements, and other Cx activities.

3.2 SHOP DRAWINGS VERIFICATION

- A. Review Design/Builder's shop drawings to assure accuracy and compliance.
- B. Verify that the Design/Builder's shop drawings address specified requirements including access requirements, electrical power supply requirements, sound and vibration requirements, and coordination with other trades.

3.3 CONTROL SOFTWARE VERIFICATION

- A. Verify all the required graphic presentations are completed.
- B. Verify the room numbers are updated and correct.
- C. Verify the equipment numbering methods are conducted and meet the facility standards.
- D. Verify that a graphic presentation is shown in each zone.
- E. Verify compatibility and compliance with other equipment as specified.
- F. Verify interface with other systems where specified.
- G. Verify proper software applications for 72-hour trending.

H. Verify proper programming for the sequence of operation.

I. Verify proper software licenses are provided to the owner.

3.4 START-UP VERIFICATION

A. Verify that the start-up procedures recommended by manufacturers are coordinated.

B. Coordinate and notify Owner of start-up activities. Schedule at least three working days in advance. Commissioning Authority shall physically witness start-up procedures.

C. Verify that start-up deficiency list forms are prepared to report deficiencies discovered in conjunction with system start-up. Start-up deficiency forms shall indicate the system being started-up; the location and identification of the deficient equipment/material; date of observation; initials of the observer; observed deficiency; date of correction; initials of person making the correction; and corrective action taken.

D. Issue start-up deficiency report forms to the Contractor for corrective action. Assure and document that all start-up deficiency list items have been corrected.

3.5 TEST, ADJUST, AND BALANCE (TAB) VERIFICATION

A. Coordinate with air and hydronic balancing contractor. Advise the TAB firm when systems are complete and ready for balancing.

B. Field verify the conditions above ceiling before ceiling tiles are installed.

C. Verify the completion of the TAB work prior to commencing any Functional Performance Test (FPT) activities that may be adversely affected by improper balancing.

D. Randomly check the air and hydronic balancing. Document compliance.

3.6 OPERATIONS AND MAINTENANCE (O & M) MANUALS VERIFICATION

A. Review and verify the accuracy of O & M manuals of the work related to commissioning for compliance with the requirements of Division 1 and Division 15.

B. Assure O & M manuals are concise, to the point, and tailored specifically to this facility.

C. Assure O & M manuals include standard technical literature relevant to the operation and maintenance of the provided equipment. The literature shall be specifically oriented to the equipment provided, indicating all operation and maintenance procedures, parts lists, assembly/disassembly diagrams, and related information. Wiring diagrams must be complete and specific to the equipment provided.

3.7 TRAINING

A. Provide training as required in applicable Division 15 specification sections and section 01820.

END OF SECTION