

SECTION 230800 – COMMISSIONING HVAC SYSTEMS

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(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Delete paragraphs not applicable to the project, and note some pertinent editor's comments in this section by the University. Also turn off all "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section and all other sections of Division 23.
- B. The OPR and BOD documentation are included by reference for information only.

1.2 SUMMARY

- A. This section includes the requirements for commissioning the HVAC systems, assemblies and equipment.

1.3 DESCRIPTION

- A. The following equipment and/or accessories shall be commissioned as part of this project: **<Edit for Project Requirements>**
 - 1. Chilled water systems and equipment
 - 2. Condenser water systems and equipment
 - 3. Hydronic hot water heating systems equipment
 - 4. Energy recovery systems and equipment
 - 5. Air distribution systems and equipment
 - 6. Building automation system
 - 7. Interface connections with the BAS.

1.4 ACTION SUBMITTALS

- A. Refer to Division 01 Specification Section "COMMISSIONING" for CxA's role.
- B. Refer to Division 01 Specification Section "SUBMITTAL PROCEDURES" for specific requirements.
- C. Refer to Division 01 Specification Section "COMMISSIONING" for additional submittal requirements related to submittals of equipment to be commissioned and Cx specific submittals.

1.5 COORDINATION

- A. Refer to Division 01 Specification Section “COMMISSIONING” for requirements pertaining to coordination during the commissioning process.

1.6 GENERAL DOCUMENTATION

- A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems.

1.7 WARRANTY/GUARANTEE

- A. See Division 23, Specification Section “Basic Mechanical Requirements – HVAC” for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Refer to Division 01 Specification Section “COMMISSIONING” for requirements pertaining to testing equipment.

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify in writing to the CxA that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the CxA that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., for pumps and AHU’s normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.

- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TAB VERIFICATION

- A. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- B. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CxA.
 - 1. The CxA will coordinate with the CM and TAB contractor to determine the date of field verification. Notice will not include data points to be verified.
 - 2. The TAB subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than +/- 10%.
 - 4. Failure of more than 10% of selected items shall result in rejection of final TAB report.
 - 5. TAB contractor shall remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC testing shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC contractor, TAB Subcontractor, and HVAC Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Procedures: Where applicable follow manufacturer's written procedures. If no procedures are prescribed by the manufacturer, proceed as follows:
 - 1. HVAC Piping Distribution Systems: Includes chilled water, condenser water, hot water heating, natural gas, energy recovery, steam and condensate piping systems.
 - a. Verify that all valves and accessories have been installed correctly, are accessible and operate as intended.
 - b. Verify that specified leak tests of piping systems are complete.
 - 2. HVAC Air Distribution Systems: Includes supply, return, general exhaust, fume hood and miscellaneous exhaust duct systems.
 - a. Verify that all ductwork, air devices, terminal units and accessories have been installed correctly, are accessible and operate as intended.
 - b. Verify that specified leak tests of duct systems are complete.
 - 3. HVAC Equipment: Includes chillers, cooling towers, pumps, backflow preventers, heating hot water equipment, air handlers, energy recovery units, and exhaust fans.

- a. Verify that all equipment has been installed in accordance with the manufactures recommendations and all equipment can be easily accessed for maintenance.
 - b. Verify that all valves, trim, fittings, controls, and accessories have been installed correctly and operates as intended.
 - c. Verify that all required interfaces with the BAS have been installed correctly and operates as intended.
 - d. Operate equipment as intended to ensure the design conditions can be obtained.
4. HVAC Building Automation System:
- a. Verify that all control hardware and software, sequences of operations, and integration of factory controls has been installed correctly and operates as intended.
 - b. Verify that all control valves, trim, fittings, and accessories have been installed correctly and operates as intended.
 - c. Verify that all equipment test, training, and startup procedures have been completed per the specifications.
 - d. Verify that all required interfaces between the BAS and HVAC equipment have been installed correctly and operates as intended.
 - e. Verify that all control graphics and programming has been installed in accordance with the manufactures recommendations and operates as intended.
 - f. Operate equipment as intended to ensure the design conditions can be obtained.

END OF SECTION 230800