SECTION 230800 - COMMISSIONING OF HVAC

This Section includes responsibilities and tasks for HVAC system commissioning.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

HVAC commissioning description.

HVAC commissioning responsibilities.

* + - * 1. Related Sections:

Section 230593 - Testing, Adjusting, and Balancing for HVAC: For requirements and procedures concerning testing, adjusting, and balancing of mechanical systems.

Section 230900 - Instrumentation and Control for HVAC: Submittal and training requirements.

Section 230923 - Direct-Digital Control System for HVAC: Submittal, training, and programming requirements.

Section 230953 - Pneumatic and Electric Control System for HVAC: Submittal and training requirements.

Section 233300 - Air Duct Accessories: Product requirements for ductwork test holes.

Section 255000 - Integrated Automation Facility Controls: Submittal, training, and programming requirements.

Section <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_**>: Electrical systems commissioning requirements.

Section <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_**>: Plumbing systems commissioning requirements.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE Guideline 1 - The HVAC Commissioning Process.

* + - * 1. Building Commissioning Association:

BCA - Commissioning Handbook.

* + - * 1. National Environmental Balancing Bureau:

NEBB - Procedural Standards for Building Systems Commissioning.

* + - * 1. Testing Adjusting and Balancing Bureau:

TABB - Commissioning Manual.

* + - 1. COMMISSIONING DESCRIPTION
         1. HVAC commissioning process includes the following tasks:

Testing and startup of HVAC equipment and systems.

Equipment and system verification checks.

Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.

Provide qualified personnel to assist in commissioning tests, including seasonal testing.

Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.

Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.

Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.

Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.

Provide training for systems specified in this Section with coordination by Commissioning Authority.

* + - * 1. Equipment and Systems to Be Commissioned:

New HVAC systems that were installed under this Contract.

Existing HVAC systems that were modified, adjusted, upgraded, or affected by the work performed under this Contract.

* + - * 1. The following is a partial list of equipment that may be included in this HVAC Commissioning:

Edit list of equipment and systems to suit Project conditions and commissioning requirements.

Chillers.

Pumps.

Cooling tower.

Boilers.

Piping systems.

Ductwork.

Variable frequency drives.

Gas-fired heating ventilating units.

Gas-fired makeup air units.

Packaged roof top air conditioning units.

Split system air conditioning units.

Humidifiers.

Air handling units.

Air handling unit AHU-<**\_\_\_\_\_\_\_\_**> duct system.

Packaged heat pump units.

Self-contained air conditioning units.

Packaged terminal air conditioning units.

Packaged terminal heat pump units.

Water source heat pumps.

Induction Units.

Unit Ventilators.

Fan Coil Units.

Electric terminal heating equipment.

Hot water terminal heating equipment.

Unit heaters.

Heat exchangers.

Computer room units.

Data room units.

Constant volume terminal units.

Variable volume terminal units.

Fans.

Variable volume changeover bypass system.

Fume hoods.

Laboratory room differential pressures.

Hospital room differential pressures.

Specialty fans.

Chemical treatment systems.

Fire dampers.

Smoke dampers.

Indoor air quality.

Equipment sound control.

Equipment vibration control.

Egress pressurization.

Smoke evacuation system.

Dust collection system.

Radiant floor heating system.

Sidewalk snow melting system.

Kitchen hood supply systems.

Kitchen hood exhaust systems.

Automatic HVAC control system.

Testing, Adjusting and Balancing work.

* + - * 1. Perform seasonal function performance tests for the following equipment and systems:

Heating equipment during heating season.

Cooling equipment during cooling season.

<**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>.

* + - 1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         5. Manufacturer’s installation instructions shall be provided along with product data.
         6. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
      2. COMMISSIONING SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Section 019100 - Commissioning: Requirements for commissioning submittals.
        2. Submittals and Reports shall be submitted by the commissioning agent hired by, and works for, the Director.
        3. Draft Forms: Submit draft of [**system verification form**] [**and**] [**functional performance test checklist**].
        4. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. [**Use [AABC] <\_\_\_\_\_\_\_\_> forms as guidelines.**] [**Submit data in metric units.**]
        5. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.
      1. CLOSEOUT SUBMITTALS
         1. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
         2. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
         3. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.
      2. QUALITY ASSURANCE
         1. Perform Work in accordance with [**BCA**] [**ASHRAE Guideline 1**] [**NEBB**] [**TABB**] requirements.
         2. Perform Work in accordance with [**[State] [Municipality] of <\_\_\_\_\_\_\_\_> [Highways] [Public Work's] standard.**]

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one copy**] [**<\_\_\_\_\_\_\_\_> copies**] of [**each**] document on site.
      1. COMMISSIONING RESPONSIBILITIES
         1. Equipment or System Installer Commissioning Responsibilities:

Attend commissioning meetings.

Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.

Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.

Provide instructions and demonstrations for Director’s Representative's personnel.

Ensure subcontractors perform assigned commissioning responsibilities.

Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.

Develop startup and initial checkout plan using manufacturer’s startup procedures and functional performance checklists for equipment and systems to be commissioned.

During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.

Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.

Provide manufacturer’s representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.

Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.

Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.

Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.

Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.

Include below the specific section number or numbers for each piece of equipment requiring factory supervised startup services.

Provide factory supervised startup services for equipment and systems specified in [**Section**] [**Sections**] <**\_\_\_\_\_\_\_\_**> [**, <\_\_\_\_\_\_\_\_>, and <\_\_\_\_\_\_\_\_>**]. Coordinate work with manufacturer and Commissioning Authority.

Perform verification checks and startup on equipment and systems as specified.

Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.

Perform operation and maintenance training sessions scheduled by Commissioning Authority.

Conduct HVAC system orientation and inspection.

* + - * 1. Temperature Controls Installer Commissioning Responsibilities:

Attend commissioning meetings.

Review design for ability of systems to be controlled including the following:

Confirm proper hardware requirements exists to perform functional performance testing.

Confirm proper safeties and interlocks are included in design.

Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.

Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.

Confirm sensors selected are within device ranges.

Review sequences of operation and obtain clarification from Director’s Representative.

Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.

Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers? stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.

Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.

Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Director’s Representative.

Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.

Perform training sessions to instruct Director’s Representative's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Section [**255000**] [**230900**] [**230923**] [**230953**] <**\_\_\_\_\_\_\_\_**>.

Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.

Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.

Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.

Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

* + - * 1. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:

Attend commissioning meetings.

Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of [**10**] [**20**] percent of measurements contained in testing, adjusting, and balancing report [**as indicated in commissioning plan.**] [**as selected by Commissioning Authority.**]

Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

* + - 1. COMMISSIONING MEETINGS
         1. Section 019100 - Commissioning: Requirements for commissioning meetings.
         2. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.
      2. SCHEDULING
         1. Section [**013000 - Administrative Requirements**] [**013216 - Construction Progress Schedule013113 Project Planning and Scheduling**]: Requirements for scheduling.
         2. Prepare schedule indicating anticipated start dates for the following:

Piping system pressure testing.

Piping system flushing and cleaning.

Ductwork cleaning.

Ductwork pressure testing.

Equipment and system startups.

Automatic temperature control system checkout.

Testing, adjusting, and balancing.

HVAC system orientation and inspections.

Operation and maintenance manual submittals.

Training sessions.

* + - * 1. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.
        2. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.
      1. COORDINATION
         1. Section 013000 - Administrative Requirements: Requirements for coordination.

Coordinate the following with Division 01 requirements.

* + - * 1. Notify Commissioning Authority minimum of [**four**] <**\_\_\_\_\_\_\_\_**> weeks in advance of the following:

Scheduled equipment and system startups.

Scheduled automatic temperature control system checkout.

Scheduled start of testing, adjusting, and balancing work.

* + - * 1. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

1. PRODUCTS
   * + 1. Not Used.
2. EXECUTION
   * + 1. INSTALLATION

Place additional installation requirements here to satisfy commissioning process. Do not duplicate installation requirements from other sections.

* + - * 1. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required [**to meet performance requirements.**] [**by Commissioning Authority.**] [**by commissioning plan.**]
        2. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
        3. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.
        4. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements. Refer to Section [**233300**] <**\_\_\_\_\_\_\_\_**>.
        5. Prior to start of functional performance test, install replacement filters in equipment [**as specified in individual section**] [**in accordance with Section <\_\_\_\_\_\_\_\_>**].
      1. FIELD TESTS AND INSPECTIONS
         1. Seasonal Sensitive Functional Performance Tests:

Test heating equipment at winter design temperatures.

Test cooling equipment at summer design temperatures [**with fully occupied building**].

Participate in testing delayed beyond [**Final Completion**] [**Substantial Completion**] <**\_\_\_\_\_\_\_\_**> to test performance at peak seasonal conditions.

* + - * 1. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.
        2. Occupancy Sensitive Functional Performance Tests:

Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.

Participate in testing delayed beyond [**Final Completion**] <**\_\_\_\_\_\_\_\_**> to test performance with actual occupancy conditions.

END OF SECTION 230800