

**SECTION 22 08 00**  
**PLUMBING SYSTEMS COMMISSIONING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Section 01 9113 – General Commissioning Requirements
- B. Section 23 0800 – Mechanical Systems Commissioning
- C. Section 26 0800 – Electrical Systems Commissioning

**1.2 DESCRIPTION**

- A. The purpose of this section is specifying the Division 22 responsibilities and participation in the commissioning process. All Construction Professionals responsible for Division 22 installation or other activities shall have commissioning responsibilities described herein.
- B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers Commissioning of Plumbing Systems, which are a part of the project.
- C. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning verifies that systems are operating in a manner consistent with the Construction Documents. The general requirements of the commissioning process and the duties of the Commissioning Authority are detailed in Section 01 9113, General Commissioning Requirements. Become familiar with the requirements and coordination obligations of Section 01 9113, General Commissioning Requirements as they apply to the applicable work Division 22, and execute commissioning responsibilities specified herein.
- D. This Section covers plumbing systems commissioning, as required to demonstrate that the applicable equipment and systems of Division 22 are ready for safe and satisfactory operation, as defined by the Construction Documents. Commissioning shall include, but shall not be limited to, identification of piping and equipment, cleaning, check-out, preparation of equipment and systems documentation and of maintenance and operation manuals, Owner training, and preparation of record drawings.
- E. Commissioning shall conclude with the completion of required deferred testing, training, and system documentation as specified herein and required to demonstrate the proper operation of the plumbing equipment and systems provided by this Division.

- F. Commission the following plumbing systems and equipment and witness the following tests:

1. Domestic hot water system, pumps and associated equipment

### 1.3 QUALITY ASSURANCE

- A. The Contractor shall provide a Plumbing Commissioning Supervisor. The Plumbing Commissioning Supervisor shall have ten (10) years' experience in plumbing contracting. The Plumbing Commissioning Supervisor shall become familiar with the Owner's project requirements and the requirements of the commissioning process as defined in this Section and in Section 01 9113, General Commissioning Requirements. Plumbing systems commissioning shall be accomplished under the supervision of the Commissioning Authority. The Plumbing Commissioning Supervisor shall assist the Commissioning Authority in coordinating and executing the required commissioning activities.
- B. The Plumbing Commissioning Supervisor shall review submittal data for conformance with the requirements of the Project, shall monitor compliance with the requirements specified herein for storage and protection of equipment during construction, shall authorize the initial starting of equipment and systems in a manner to avoid damage to equipment, and shall document that the scheduled and specified performance requirements of each system have been accomplished.

### 1.4 COMMISSIONING RESPONSIBILITIES

- A. The Plumbing Commissioning Supervisor shall be responsible for, in conjunction with the Commissioning Authority, scheduling, supervising, and coordinating and executing the start-up, testing, and commissioning activities as specified herein. Include and itemize the cost of commissioning in the contract price; and, in each purchase order or subcontract written - include requirements for submittal data, commissioning efforts and documentation, operations and maintenance data, and training as specified herein.
- B. Plumbing commissioning requirements for each phase are as follows:
  1. Construction Phase:
    - a. Attend a commissioning kick-off meeting and additional commissioning meetings, initially scheduled monthly until pre-functional testing of equipment and systems begins, and monthly thereafter during the construction phase to facilitate the commissioning process. The Plumbing Commissioning Supervisor shall coordinate meeting attendance with the Commissioning Authority.

- b. Report in writing to the Commissioning Authority, at least as often as commissioning meetings are scheduled, concerning the status of Plumbing activities as they affect the commissioning process, the status of each discrepancy identified the pre-functional and functional testing process, explanations of any disagreements with the identified deficiencies, and the proposed resolution and schedule for correction of the deficiency.
- c. Provide the Commissioning Authority with data sheets and submittals for equipment to be commissioned.
- d. Provide documentation of installed systems and equipment to the Commissioning Authority for development of functional testing procedures, prior to normal operation and maintenance manual submittals. This documentation shall include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures; full details of any Owner-contracted tests; pump curves; full factory testing reports, if any; and full warranty information, including responsibilities of the Owner to keep the warranty in force. In addition, the installation, start-up and check-out materials that are shipped inside the equipment and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. The Commissioning Authority may request further documentation necessary for the development of functional performance testing and the commissioning process. This data request may be made prior to normal submittals.
- e. Develop and submit to the Commissioning Authority, for review and comment, prior to equipment or system start-up, a complete start-up and initial check-out plan using manufacturer's start-up procedures and pre-functional checklists for equipment to be commissioned.
- f. Provide a copy of the operation and maintenance manuals and submittals of equipment to be commissioned to the Commissioning Authority for review and comment.
- g. Assist in clarifying the proposed operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- h. Provide assistance to the Commissioning Authority in preparing the specific functional test procedures as specified herein and review the proposed functional test procedures to ensure feasibility, safety, and equipment protection, and provide necessary written alarm limits to be used during the tests.

- i. Prepare a preliminary schedule for commissioning activities, including pipe pressure and leakage testing, flushing and cleaning, equipment start-up, and completion, for use by the Commissioning Authority and update the schedule during the construction period, as appropriate. Notify the Commissioning Authority immediately when commissioning activities not yet performed or not yet scheduled will delay construction.
- j. Plumbing equipment start-up shall not be initiated until completion of pressure and leakage testing and cleaning as specified in other Sections of Division 22.
- k. Provide start-up and pre-functional testing for equipment, including and execute the Plumbing-related portions of the pre-functional checklists for commissioned equipment during the start-up and initial check-out process.
- l. Perform and document start-up and system operational check-out procedures, providing a copy of documentation to the Commissioning Authority.
- m. Correct noncompliance items before beginning functional performance testing. Water testing shall be completed with discrepancies and problems remedied before functional testing of the respective water-related systems.

2. Acceptance Phase:

- a. Place equipment and systems into operation and continue their operation during each working day of the commissioning activities, as required.
- b. For each system or area, have required pre-functional checklists, calibrations, start-up and pre-functional tests of the Plumbing systems and associated controls completed and reviewed by the Commissioning Authority prior to beginning the testing process.
- c. Provide skilled technicians to execute starting and pre-functional testing of equipment and to execute the functional tests for each individual piece of equipment and system. Technicians shall be available and present during the agreed upon scheduled tests and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- d. Perform functional testing under the direction of the Commissioning Authority for specified equipment and assist the Commissioning Authority in interpreting the test data, as necessary.
- e. Correct deficiencies (differences between specified and observed performance) as identified by the Commissioning Authority and interpreted

by the Design Professional and retest the equipment, as required to demonstrate proper operation and performance.

- f. Prepare operation and maintenance manuals as specified herein, including clarifying and updating the original sequences of operation to as-built conditions.
- g. Maintain marked-up record drawings and produce final record drawings of Project drawings and contractor-generated coordination drawings. List and identify on these record drawings the locations of control system components, airflow stations, and sensor installations that are not equipment mounted.
- h. Provide specified training of the Owner's operating personnel.
- i. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Standard testing equipment required to perform start-up, initial check-out, prefunctional, and required functional testing shall be provided for the equipment or system being tested. The contractor shall be responsible for providing all the test equipment necessary.

## PART 3 - EXECUTION

### 3.1 SUBMITTALS

- A. Provide all Plumbing submittals to the Commissioning Authority for review and comment concurrent with the Design Team.
- B. Submit additional documentation as required to support the commissioning process. This additional submittal documentation shall include, at a minimum, the proposed start-up and initial check-out procedures, and pre-functional checklists.

### 3.2 EQUIPMENT START-UP AND PREFUNCTIONAL TESTING

- A. Pre-functional testing shall be required for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation, so that functional testing may proceed without delays. Follow the approved start-up, initial check-out, and prefunctional testing procedures. Sampling strategies shall not be used

for prefunctional testing. The prefunctional testing for equipment and subsystems of a given system shall be successfully completed and documented prior to functional testing of the system.

- B. The following procedures shall apply to equipment and systems to be commissioned:
1. Start-up and initial check-out plan: develop the detailed start-up and prefunctional testing plans for equipment and systems that are to be commissioned, as specified herein. The Commissioning Authority shall review the proposed procedures and prefunctional testing documentation to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.
  2. The start-up and initial check-out plan shall consist, as a minimum, of the following:
    - a. The manufacturer's standard written start-up and check-out procedures copied from the installation manuals and manufacturer's normally used field check-out sheets. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
    - b. Contractor-developed prefunctional checklists.
  3. Identify which trade is responsible for executing and documenting each of the line-item tasks and note that trade on the form. Each form may have more than one trade responsible for its execution.
- C. Four weeks prior to start-up, schedule equipment and systems start-up and check-out and notify the Commissioning Authority in writing. The execution of the prefunctional checklists, start-up and check-out shall be directed and performed by the Contractor, in accordance with manufacturer's published procedures.
- D. Sensor calibration: calibration of sensors associated with a given piece of equipment or system shall be included as part of the prefunctional testing and listed on the appropriate test checklists and reports for the system. This requirement may be met during the prefunctional testing of the temperature control or automation system, but shall also be documented with the prefunctional testing procedures.
- E. Completed start-up, check-out, and prefunctional test forms shall be completed and submitted to the Commissioning Authority for review. List outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the Commissioning Authority within 2 days of test completion. The Commissioning Authority shall review the Contractor's

start-up and prefunctional testing reports and shall submit either a noncompliance report or an approval form to the Contractor. The Contractor shall correct items that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the Commissioning Authority as soon as outstanding items have been corrected and resubmit an updated start-up report and a statement of correction on the original noncompliance report. When requirements are completed, the Commissioning Authority shall recommend approval of the start-up and prefunctional testing of each system and schedule the functional testing of the equipment or system.

- F. Complete start-up and prefunctional testing for a system before functional test of that system may proceed.

### 3.3 RETESTING OF EQUIPMENT AND/OR SYSTEMS

- A. Provide labor and materials required for retesting of any functional test found to be deficient.
- B. Prior to retesting, submit required data indicating that the deficient items have been completed and/or corrected to the Commissioning Authority for approval and rescheduling of the functional test. If during the retesting it becomes apparent that the deficient items have not been completed and/or corrected as indicated in the data provided by the Contractor, the retesting shall be stopped. Costs for the commissioning team to further supervise the retesting of a functional test shall be the responsibility of the Contractor.

### 3.4 DEFERRED TESTING

- A. Schedule and coordinate, with the approval of the Owner, required seasonal testing, tests delayed until building construction is completed, or other conditions are suitable for the demonstration of equipment or system's performance, as specified herein. Deferred testing shall be executed, documented, and deficiencies corrected as specified herein for functional testing. Adjustments or corrections to the operations and maintenance manuals and as-built documents required by the results of the testing shall be made before the seasonal testing process is considered complete.

### 3.5 TESTING DOCUMENTATION, NONCONFORMANCE, AND APPROVALS

- A. List outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the functional test procedure forms or on an attached sheet. The functional test procedure forms and any outstanding deficiencies shall be provided to the Commissioning Authority within 2 days of test completion. The Commissioning Authority shall review the Contractor's start-up and prefunctional testing documentation and shall submit either a noncompliance report or an approval form to the Contractor. Work with the Commissioning Authority to correct and retest deficiencies or uncompleted items. Correct items that are deficient or incomplete in a

timely manner and notify the Commissioning Authority as soon as outstanding items have been corrected and resubmit an updated start-up report and a statement of correction on the original noncompliance report. When requirements are completed, the Commissioning Authority shall recommend approval of the start-up and prefunctional testing of each system and schedule the functional testing of the equipment or system.

- B. As functional performance testing progresses and deficiencies are identified, work with the Commissioning Authority to resolve the issues. Deficiency resolution and correction shall follow the procedures defined in Section 01 9113, General Commissioning Requirements.

### 3.6 OPERATION AND MAINTENANCE MANUALS

- A. The Plumbing Commissioning Supervisor shall compile and prepare documentation for equipment and systems covered in Division 22 and deliver this documentation for inclusion in the operation and maintenance manuals prior to the training of the Owner's personnel. The Commissioning Authority shall receive a copy of the operation and maintenance manuals for review no less than four (4) weeks in advance of Owner training.

### 3.7 INSTRUCTION OF OPERATING PERSONNEL

- A. The Plumbing Commissioning Supervisor shall schedule, coordinate and assemble, and deliver the documentation of training required by Division 22. O&M Training development and planning shall involve the Commissioning Authority as defined Section 01 9113, General Commissioning Requirements.

### 3.8 FUNCTIONAL TESTS

- A. Functional test requirements for the demonstration of proper system and equipment operation shall be defined by the Commissioning Authority. Execution of these test and demonstration of the required performance shall be the responsibility of the Contractor, under the supervision of the Commissioning Authority.
- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or subsystems at the discretion of the Commissioning Authority. Beginning system testing before full completion of construction shall not relieve the Contractor from fully completing the system, including prefunctional checklists.
- C. Functional testing shall be completed, and test documentation approved by the Commissioning Authority before the Project will be considered substantially complete.



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