Required Scope of Commissioning Services for Div. 22, 23 & 26

Commissioning services are to be provided in four (4) phases: design phase, construction, acceptance, and post-acceptance.

Phase 1 – Design Phase:

During the design phase the commissioning authority shall carry out the following scope of work:

- Contract Document Review
  1. The Commissioning Authority will collect and review Design intent information from the designers and verify that it meets the Owner’s project requirements. Design intent documentation will be used in conjunction with the contract documents to develop the commissioning plan, pre-functional tests, and functional performance tests.

- Commissioning Plan
  1. The Commissioning Authority will develop a commissioning plan for the project. The commissioning plan is a tool through which the commissioning process is described and incorporates the Owner, Designers, Contractor and Commissioning Authority’s roles relative to the commissioning process. The commissioning plan will include the following:
     a. The purpose of commissioning
     b. Detail the commissioning process
     c. Identify commissioning team members
     d. Include a commissioning team organization chart
     e. Define commissioning team member responsibilities
     f. Describe prefunctional and functional test procedures
     g. Outline systems to be commissioned
     h. Provide the commissioning schedule

Phase 2 – Construction:

During the construction phase the commissioning authority shall carry out the following scope of work:

- Prefunctional Test Checklists
  1. The Commissioning Authority will develop prefunctional test checklists for each piece of commissioned equipment. The prefunctional test checklist will outline required steps for the Contractor to complete prior to functional testing. Prefunctional test checklists verify installation, start-up and operational assessments have been completed for the equipment
  2. Manufacturer start-up forms provided with pieces of equipment will be collected in addition to the prefunctional test checklists.

- Commissioning Field Notebook
  1. The Commissioning Authority will develop a commissioning field notebook to be used and completed by the Contractor. The notebook will identify and track all pertinent commissioning documentation required during the installation, start-up and check-out phases. The notebook will be maintained by the Contractor on site and will be made available to all subcontractors for their use. The Notebook provides a central location for the subcontractors and Commissioning Authority to identify, copy, and organize all pertinent commissioning information.
  2. The commissioning field notebook will contain:
     a. Summary describing Notebook contents and use.
     c. Tabs for each system with copies of prefunctional and functional test check sheets for pieces of equipment identified as part of that system.
     d. Commissioning project communication reports, deficiency logs schedule information or any other documentation provided by the Commissioning Authority.
e. Dates when Commissioning Authority will be onsite.

- **Commissioning Kickoff Meeting**
  1. The commissioning plan will be presented to the commissioning team during a commissioning kickoff meeting. The commissioning team will review the plan and provide comments to the Commissioning Authority. The Commissioning Authority will incorporate appropriate comments into the plan and a finalized commissioning plan will be distributed to the commissioning team.
  2. The commissioning field notebook will be presented to the Contractor during the commissioning kickoff meeting. Instruction for its use will be conveyed during the meeting.

- **Installation Inspections**
  1. During the course of construction, the Commissioning Authority will perform installation inspections for commissioned equipment and systems. Deficiencies will be noted and conveyed in project communication reports to the appropriate commissioning team members.

- **Prefunctional Test Checklist Completion**
  1. Using the prefunctional test checklists developed by the Commissioning Authority, the Contractor will verify that the systems they install are in compliance with the construction documents and are fully functional. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed, and returned to the Commissioning Authority indicating specific system completion.
  2. Contractor will issue a written notice of readiness to the Commissioning Authority upon completion of all systems work, start-up and endorsement of prefunctional tests.

- **Contractor Submittal Review**
  1. In preparation for development of functional test procedures, the Commissioning Authority will review Contractor submittals for commissioned equipment and systems.
  2. The Contractor will provide copies of the submittals for commissioned systems and equipment to the Commissioning Authority for use in development of functional test procedures. Submittals will be reviewed for conformity with the Design intent.

- **Functional Test Procedures**
  1. The Commissioning Authority will develop functional test procedures for each piece of commissioned equipment. The functional tests outline the process for testing the building’s systems. Functional tests verify the performance of equipment adhere to the Design intent.
  2. Functional test procedures include, but are not limited to, the following:
    a. Onsite verification of testing, adjusting and balancing performance.
    b. Onsite verification of the performance of automatic controls in all seasonal modes.
    c. Onsite verification of the performance of HVAC system.
    d. Onsite verification of the performance of electrical systems.
    e. Onsite verification of the performance of plumbing systems.
    f. Onsite verification of the performance of all life safety devices and systems as they interface with the HVAC systems.
    g. Onsite verification of the response of automated controls to alarms, fire alarm input, and power failures.
    h. Verification of trending capabilities of the automated controls system.

- **Functional Testing**
  1. Functional testing is intended to begin upon completion of a system. The Commissioning Authority will not begin the functional testing process until each system is complete and documented. Testing may proceed prior to the completion of systems and/or sub-systems if expediting this work is in the best interests of the Owner.
  2. Functional testing is performed by the Contractor and witnessed by the Commissioning Authority onsite to verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. As tests are successfully completed, systems will be deemed acceptable by the Commissioning Authority.
  3. The Contractor is responsible for coordinating participation of Commissioning Authority and subcontractors in functional testing.

- **Commissioning Deficiency Log**
1. When acceptable performance cannot be achieved by tested equipment and systems, the cause of the deficiency will be identified. Deficiencies will be collected and tracked in a commissioning deficiency log maintained by the Commissioning Authority.

- **Corrective Measures**
  1. If acceptable performance cannot be achieved by a piece of equipment or a system and if the deficiency is caused by installation error by the Contractor, the necessary corrective measures shall be carried out by the Contractor. Once corrective measures have been completed, the equipment or system will be retested by the Commissioning Authority until acceptable performance is achieved.
  2. The Contractor will be allowed one retest by the Commissioning Authority after initial testing of the equipment. If acceptable performance is not achieved after the initial retest, the Contractor shall be financially responsible at standard rates to reimburse the Owner representatives for the additional time taken to resolve the deficiency.

- **Project Communication Reports**
  1. In addition to the prefunctional test checklists, functional test procedures, and the commissioning deficiency log, project communication reports will be delivered for all other commissioning activities performed by the Commissioning Authority. Project communication reports will be issued to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents; daily activities on-site; installation deficiencies; and successful or unsuccessful functional testing results.

- **Commissioning Meetings**
  1. Commissioning meetings will be held periodically during the construction process to review the status of the construction and commissioning work, develop construction completion and testing schedules, and the status of submittals required by this Section. Attendance by the Construction Team is required for commissioning meetings.
  2. Commissioning meetings will be coordinated by the Contractor. Meeting minutes will be developed and maintained by the Commissioning Authority.

- **Performance Period**
  1. Upon successful completion of functional test procedures, a performance period of 15 consecutive calendar days shall commence on first day following the last performance test. This period shall be completed prior to final acceptance of the project. In event of failure to meet standard of performance during any initiated performance period, it is not required that one 15-calendar day period expire in order for another performance period to begin.
  2. If equipment or system operate and demonstrate continuing compliance with specified requirements for period of 15 consecutive calendar days from commencement date of performance period, it shall be deemed to have met the standard of performance.
  3. Equipment will not be accepted by the Owner and final payment will not be made by the Owner until acceptable performance is met.
  4. Contractor shall provide Commissioning Authority with trend logs of the system performance for the control variables and set point in each control process in 15-minute time increments.
  5. Systems shall be first tested as independent building systems followed by tests of systems tied into Owner’s systems. Types of Owner’s systems include, but are not limited to, central plant heating and cooling; off-site security / alarm monitoring; and campus automated controls systems.
  6. Upon Contractor’s completion of the requirements of the commissioning plan and the successful completion of the performance period, and receipt of the required documentation, the Commissioning Authority shall provide the Owner with a statement of acceptable performance.

- **Operations & Maintenance Manual Review**
  1. The Contractor shall assemble operations & maintenance manuals as described in other sections of these contract documents.
2. The Commissioning Authority will review the operations & maintenance manuals of commissioned systems and equipment once they have been reviewed and accepted by the designer.

- **Training**
  1. A training plan will be developed by the Contractor outlining equipment that requires training, who will perform the training, when the training will occur, and the required duration of the training. Once the training plan is developed, the Owner will provide that the appropriate personnel attend the training.
  2. Training sessions should include using the operations & maintenance manuals and as-built drawings assembled by the Contractor.
  3. Detailed requirements for training and instruction are contained in other sections of these Contract Documents. The Commissioning Authority will track that training requirements have been satisfied by the Contractor.

- **Commissioning Report**
  1. Once acceptable performance is achieved, the Commissioning Authority will complete a commissioning report. The report shall include:
     a. A commissioning activity executive summary
     b. The finalized commissioning plan
     c. The completed commissioning field notebook including prefunctional test checklists and specified commissioning related documentation
     d. Completed functional test procedures
     e. Commissioning project communication reports
     f. Up to date commissioning deficiency log
     g. Performance period trend log analyses

**Phase 3 – Acceptance:**

During the acceptance phase the commissioning authority shall carry out the following scope of work:

- Review and inspect, on a sample basis, the testing, adjusting and balancing work that has been carried out by another agency.
- Conduct functional performance testing of sub-systems, systems, and interactions between systems, leading to acceptance of the completed work. Document results of all tests witnessed.
- Organize and direct the training of O&M personnel.

**Phase 4 – Post Acceptance:**

During the post-acceptance phase the commissioning authority shall carry out the following scope of work:

- Conduct functional performance testing of sub-systems, systems, and interactions between systems that could not be carried out prior to acceptance due to unsuitable weather conditions.
- Prepare and submit a final commissioning report.
- Provide follow-up for quality performance during the warranty period.
- All back checks during this phase shall be performed by the Commissioning Authority.

**Systems to be commissioned:**

- Systems and equipment to be functionally tested include, but are not limited to:
  1. Heating water system:
1. Heating Water Pumps
   a. Heating Water Pumps
   b. Expansion Tanks
   c. Glycol Feeder
   d. Variable Frequency Drives

2. Chilled water system
   a. Chilled Water Pumps
   b. Expansion Tanks
   c. Variable Frequency Drives
   d. Glycol Feeder

3. Air-handling systems
   a. Air Handling Units
   b. Chilled Water Coils
   c. Heat Recovery Systems
   d. Hot Water Coils
   e. Dampers
   f. Valves
   g. Variable Frequency Drives
   h. Fan Coil Units
   i. Pressure Independent Air Controllers
   j. Exhaust Fans

4. Auxiliary heating and cooling equipment
   a. Hydronic Unit Heaters/Cabinet Heaters
   b. Air Conditioning/Condensing Units

5. Domestic water systems
   a. Pressure Reducing Valves
   b. Water Heaters
   c. Domestic Hot Water Circulation Pumps
   d. Expansion Tanks

6. Automated control system including equipment operational sequences; point to point checkout; control component calibration; graphics; alarming; fire alarm interface; trending.

7. Lighting system controls including switches; photocells; occupancy sensors; timers and other devices affecting lighting system operation.

8. Emergency power equipment including generators; uninterruptible power supply systems; automatic transfer switches.