

## PART 1 – GENERAL

### 1.1 SCOPE OF THE WORK

- A. The purpose of this section is to specify Division 21, 22, and 23 responsibilities and participation in the commissioning process.
- B. Commissioning is the responsibility of the Contractor (including subcontractors and vendors). The Contractor is responsible for providing all scheduling, coordination and support required for start-up, testing, and commissioning (see Division 01). Commissioning Section is intended to provide an indication of the tests which must be performed by the Contractor prior to and including verification by the Owner's Representative. The commissioning process requires Division 21, 22, and 23 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.
- C. Work of Division 21, 22, and 23 includes the following:
  - 1. Attend commissioning scoping meetings. At a minimum, the Mechanical, TAB, and Controls Contractors shall participate. Equipment vendor representatives shall also attend upon request of the Commissioning Agent and Test Engineer. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.
  - 2. Attend other meetings as required to facilitate the commissioning process. This shall include bi-monthly meetings during the startup period and weekly meetings starting at the beginning of the Owner-witnessed point to point and Functional Testing period. Other meetings may be required as problems arise, apart from the regularly-scheduled commissioning meetings.
  - 3. Controls Contractor shall be required to attend additional meetings intended to clarify the controls sequences of operation and reconcile any differences with the design intent. This meeting shall take place after the first Controls sequence of operations is submitted and reviewed.
  - 4. Provide Commissioning Authority and Test Engineer additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the startup plan and the functional performance testing procedures.
  - 5. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (duct static pressure test reports, pipe static pressure test reports, chemical treatment reports, etc.), and TAB reports to the Commissioning Authority and Test Engineer for review.
  - 6. Mechanical Contractor shall install pressure/temperature test ports (i.e. - Pete's plugs) in all piping systems and at all locations where DDC controls pressure and temperature sensors are located.
  - 7. The Mechanical Prime Contractor shall be responsible for development of a comprehensive startup plan, incorporating the controls contractor point-to-point startup plan. The startup plan shall be developed with the help of the Test Engineer in order to integrate startup activities with the Test Engineer's commissioning plan. Mechanical Sub-Contractors shall assist the Mechanical Prime Contractor in development of the startup plan.
  - 8. The Mechanical Contractor shall provide detailed startup forms and clearly document all completed startup activities. The controls startup forms shall include detailed checkout forms with descriptions for each controlled device. All forms shall be submitted for review by the Test Engineer and Commissioning Authority prior to use.

9. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform startup and execute functional performance tests. Controls contractor shall provide skilled technicians, familiar with the project, for both startup (Owner-witnessed point-to-point testing) and functional performance testing. Commissioning functional performance testing participation from the controls contractor shall be required in addition to the point-to-point testing.
10. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.
11. Submit startup documentation to General Contractor, Test Engineer, and Commissioning Authority to verify functional testing prerequisite requirements are fulfilled before functional testing for the associated equipment or system is scheduled to start. Refer to Section "General Commissioning Requirements," for commissioning procedure. Startup documentation (point-to-point testing) shall also be required from the controls contractor as a prerequisite to functional performance testing.
12. TAB Contractor shall report any deficiencies found in a timely manner to the Mechanical Contractor. The Mechanical Contractor shall correct these deficiencies in a timely manner to facilitate functional performance testing within the commissioning schedule.
13. TAB Contractor shall coordinate all setpoint value requirements for input into the controls system, including minimum outside air damper positions, return/supply fan VFD speed mapping, pumping loop differential pressure setpoints, duct system static pressure setpoints, air terminal unit flow sensor calibration factors, etc.
14. Maintain and update as-built drawings during construction including controls as-built drawings.
15. Provide final O&M manuals that incorporate all system changes including controls sequence of operations.
16. Providing training, for equipment and systems specified under this section, with coordination by the Contractor and Owner's Representative

## 1.2 RELATED WORK

### A. Related Sections:

1. Division 23.

### B. Cooperate with the Testing, Adjusting and Balancing (TAB) firm in the following manner:

1. Allow sufficient time before final commissioning dates so that testing, adjusting and balancing can be accomplished.
2. Put all heating, ventilating, and air conditioning equipment and systems into full operation and continue the operation during each working day of testing, adjusting, balancing and commissioning.
3. Provide labor and material to make corrections when required, without undue delay.
4. Include the cost of exchange sheaves and belts as may be required by the TAB firm.

## 1.3 CODES AND STANDARDS

- ### A. Codes and Standards shall be the current version adopted by the Authority Having Jurisdiction.

## PART 2 – PRODUCTS

## 2.1 TEST EQUIPMENT

- A. Provide test equipment as necessary for start-up and commissioning of the mechanical equipment and systems. The TAB firm will provide the test equipment required to perform TAB services.
- B. Proprietary test equipment required by the mechanical equipment manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.

## PART 3 – EXECUTION

### 3.1 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so each system can be started, tested, adjusted, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are fully functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
- B. A commissioning plan will be developed by the Test Engineer and approved by the Owner's Representative.
  - 1. Division 23 shall be obligated to assist the Test Engineer in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation, identification of parties responsible for startup activities, and schedule dates for equipment startup activities.
  - 2. If system modifications/clarifications are called for in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.
  - 3. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.

### 3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 23.
  - 1. These same technicians shall be made available to assist the Contractor and Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty.
  - 2. Work schedules, time required for testing, etc., will be requested and coordinated by the Contractor.
  - 3. Division 23 will ensure that qualified technician(s) are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustment, and problem resolutions.
- B. System problems and discrepancies may require additional technician time which shall be made available for the subsequent commissioning periods until required system performance is obtained.
- C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Such qualifications include expert knowledge relative to the specific equipment involved, adequate

documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Contractor to get the job done.

### 3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the work needed to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process.
  - 1. Experimentation to render system performance will be permitted.
    - a. If the Architect deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Architect will notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.
    - b. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.
    - c. Costs incurred to solve the problem in an expeditious manner will be the Contractor's responsibility.

### 3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall.
  - 1. Initial commissioning will be done as soon as contract work is completed regardless of season.
  - 2. Commissioning under conditions representing other than the current season may be undertaken at a later time by the Test Engineer and Commissioning Authority.
  - 3. Discrepancies discovered with the Contractor's equipment or workmanship will be handled as warranty items.

### 3.5 RETESTING AND RECOMMISSIONING

- A. Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced, or repaired by the Contractor, and the same test repeated at the Contractor's expense until no fault appears.

### 3.6 TRAINING

- A. Participate in the training of the Owner's engineering and maintenance staff, as required in Divisions 01 and 23, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

- B. Training shall be conducted jointly by the Contractor, the Design Engineers, and the equipment vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

### 3.7 MISCELLANEOUS SUPPORT

- A. Division 23 shall remove and replace covers of mechanical equipment, open access panels, etc., to permit Contractor, Architect and Owner's Representative to observe equipment and controllers provided. Furnish ladders and flashlights as necessary.

**END OF SECTION**