

**CONSTRUCTION SPECIAL SPECIFICATION**

**SECTION 15995\_S**

**MECHANICAL SYSTEMS COMMISSIONING**

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**SPECIAL SPECIFICATION****SECTION 15995S****MECHANICAL SYSTEMS COMMISSIONING****PART 1 - GENERAL****1.01 RELATED WORK SPECIFIED ELSEWHERE**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01810S – Facility Commissioning Requirements
- C. Section 13995S – Special Construction Systems Commissioning
- D. Section 16995S – Electrical Systems Commissioning

**1.02 BUILDING SYSTEMS & COMPONENTS TO BE COMMISSIONED**

- A. The following systems, equipment and their components are included in the scope of the commissioning activities and are considered to be commissioned systems and equipment.
  - 1. Section 15051 – Piping Systems
    - a. Confirm installation per contract requirements.
    - b. Pressure test piping at 1.5 times the design maximum working pressure prior to being placed in service.
  - 2. Section 15122S – Expansion Tanks
  - 3. Section 15123S – Buffer Tanks
  - 4. Section 15140S – Plumbing Specialties
    - a. Backflow Preventers
    - b. Trap Primers
  - 5. Section 15310 – Automatic Sprinklers and Water Based Fire Protection Systems
    - a. Confirm installation per contract requirements.
    - b. Confirm fire alarm notification to master panel.
    - c. Test individual alarm devices.
    - d. Confirm flow switch alarm generation in sprinkler system.

- e. Confirm alarm check valve alarm generation.
  - f. Confirm proper installation of fire barrier at all pipe penetrations.
6. Section 15510S – Heating Boiler
- a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm design flowrate.
    - Measure pump current draw using handheld current transformer.
    - Measure pressure rise developed by pump using installed gauge.
  - d. Confirm design entering and leaving water temperature and pressure using manual gauges at primary headers or internal sensors on boiler.
  - e. Confirm stack temperature using manual temperature gauge installed on stack.
  - f. Confirm proper staging of boilers as demand fluctuates.
  - g. Confirm shutdown upon various alarm conditions.
7. Section 15540S – Pumps
- a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm pressure rise and current draw at design operating conditions.
    - Measure pump current draw using handheld current transformer.
    - Measure pressure rise developed by pump using installed gauge.
  - d. Confirm shutdown upon various alarm conditions.
  - e. If variable speed, confirm modulation based on differential pressure or temperature per contract sequence of operations.
8. Section 15685S – Water-Cooled Centrifugal Chillers
- a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm condenser water flowrate and differential temperature using integral condenser water supply and return temperature sensors and integral condenser water flow meter.
  - d. Confirm chilled water flowrate and differential temperature using integral chilled water supply and return temperature sensors and integral chilled water flow meter.
    - Measure input power to determine overall chiller efficiency by using integral or handheld current transformer.
  - e. Confirm staging of chillers as demand fluctuates.
  - f. Confirm shutdown upon various alarm conditions.

9. Section 15730S – Unitary Air Conditioning Equipment
10. Section 15755S – Heat Exchangers
11. Section 15790S – Air Coils
  - a. Confirm installation per contract requirements.
  - b. Confirm control valve modulation per contract sequence of operations.
  - c. Confirm entering and leaving water temperatures using installed temperature gauges.
  - d. Confirm entering and leaving air temperatures using handheld temperature sensor or previously installed sensors.
  - e. Confirm pre-heat pump start/stop based on contract sequence of operations.
12. Section 15810 – Ductwork
13. Section 15858S – Fan Coil Units
14. Section 15860S – Centrifugal Fans
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm flowrate using hand-held airflow sensor.
15. Section 15870S – Power Ventilators
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm flowrate using hand-held airflow sensor.
16. Make Up Air Handling Units – Gas
17. Humidifiers – Electric Indirect Type
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm modulation based on actual space humidity.
  - d. Confirm shutdown upon various alarm conditions.
18. Steam Boilers & Make-up Water Components
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm steam delivery pressure and temperature using manual gauges installed on steam header.
  - d. Confirm stack temperature using manual temperature gauge installed on stack.
  - e. Confirm proper staging of boilers as demand fluctuates.
  - f. Confirm shutdown upon various alarm conditions.

19. Refrigerant Alarm System
20. Seismic Bracing
21. Unit Heaters
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm leaving air temperature differential using hand-held temperature sensor.
  - d. Confirm shutdown upon various alarm conditions.
22. Evaporative Coolers
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm airflow quantity using hand-held airflow sensor.
  - d. Confirm proper cooler pump and drain pump operation.
  - e. Confirm proper float switch operation.
23. Reverse Osmosis Water Treatment Systems
  - a. Confirm installation per contract requirements.
  - b. Confirm start/stop per contract sequence of operations.
  - c. Confirm delivered water quality to humidifiers using hand-held water sampling device and third-party laboratory analysis.

### 1.03 RESPONSIBILITIES

- A. The Contractor shall be responsible for scheduling, supervising and performing start-up, testing and commissioning activities specified in this section and necessary to demonstrate to SNL successful operation of the commissioned systems.
- B. The Contractor shall review submittal data for conformance with requirements, shall authorize the initial starting of equipment and systems in a manner to avoid damage during construction, shall oversee start-up and testing, and shall document that the operational requirements of each system have been accomplished.

## PART 2 - PRODUCTS

### 2.01 TEST EQUIPMENT

- A. The Contractor shall provide the necessary equipment to fully test the commissioned systems as defined in the functional performance test procedures provided by the CxA.

- B. Instrumentation shall meet the following standards:
1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
  2. Be calibrated on the manufacturers' recommended intervals with calibration tags permanently affixed to the instrument being used.
  3. Be maintained in good repair and operating condition throughout the duration of use on this project.
  4. Be re-calibrated/repared if dropped or damaged in any way since last calibrated.

## 2.02 MEAN OF ACCESS

- A. The Contractor shall provide means for the CxA and Owner Representatives to access, observe and visually confirm proper operation of all equipment and systems. These means shall be in compliance with all OSHA and job-site safety regulations.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. The Contractor shall attend commissioning meetings as required by the Prime Contractor.
- B. The Contractor shall report in writing to the CCL concerning the status of activities as they affect the commissioning process and the status of deficiencies found during site visits or the performance of functional testing.
- C. The Contractor shall provide the CxA with data sheets and submittals for equipment to be commissioned.
- D. The Contractor shall prepare a preliminary schedule for commissioning activities.
- E. The Contractor shall notify the CxA when commissioning activities not yet performed or scheduled will delay construction.

### 3.02 START-UP PLAN

- A. The Contractor shall perform start-up testing for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation, so that functional performance testing may proceed without delays.

- B. The Contractor shall prepare a start-up plan for each piece of equipment. This plan shall be submitted to the CxA for review and comment. The start-up plan shall consist, at a minimum of the manufacturer's standard start-up and check out procedures copied from the installation manuals.
- C. Four (4) weeks prior to expected start-up for a piece of equipment, the Contractor shall notify SNL in writing. The execution the start-up plan shall be directed and performed by the Contractor. The CxA and/or SNL may be present for the start-up of the equipment.
- D. The Contractor shall submit the completed checklists and startup reports to the CxA for review. The Contractor shall note all non-compliance items on these checklists. The Contractor shall notify the CxA when outstanding items have been corrected.
- E. The Contractor shall complete the start-up plan and resolve or correct all issues resolved before functional testing may begin.

### 3.03 FUNCTIONAL PERFORMANCE TESTS

- A. The Contractor shall provide all documentation as requested to the CxA for development of functional performance testing procedures. This documentation shall include, at a minimum, manufacturer installation, start-up, operation and maintenance procedures. The CxA may request further documentation as necessary for the development of functional performance tests.
- B. The Contractor shall review the functional performance test procedures developed by the CxA.
  - 1. The Contractor shall respond in writing to the CxA regarding the acceptability of the proposed test procedures.
  - 2. The Contractor shall note any necessary modifications to the procedures due to the actual equipment/systems or safety concerns and shall submit these to the CxA for consideration.
- C. The Contractor shall place equipment and systems into operation and continue the operation as required during each working day of the testing activities.
- D. The Contractor shall accomplish the functional performance testing of equipment based on procedures developed by the CxA and as reviewed by the Contractor.
  - 1. The Contractor shall provide skilled technicians to operate the systems during functional performance testing.
  - 2. The Contractor shall correct any deficiencies identified during testing and retest equipment as required.

- E. Functional performance testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of the system upon mutual agreement between the Contractor, SNL and the CxA.
- F. Functional testing shall verify all sequences of operation defined in the Contract Documents for the commissioned equipment and systems.
  - 1. Testing shall occur by overriding setpoints or sensor readings at the FCS or by other means mutually agreed to by the Contractor, the CxA and SNL to initiate sequences of operation and verifying the response of the system.
  - 2. Sequences of operation shall be verified under normal power, emergency power, and fire alarm scenarios.
- G. Upon successful completion of all functional performance tests, the Contractor(s) shall perform Integrated Systems Testing. The testing shall document and verify the proper response of all Division 15 systems to all potential utility and emergency power operating and failure scenarios.

#### 3.04 DEFERRED FUNCTIONAL PERFORMANCE TESTING

- A. The Contractor shall perform any deferred testing as required to properly demonstrate successful operation to the SNL CM.
  - 1. Some test conditions may not be able to be simulated and thus require these actual conditions to be present to implement the test.
  - 2. A mutually convenient time to SNL, CxA and Contractor will be scheduled when these test conditions will be present to conduct this deferred testing.
- B. The Contractor shall perform these tests as indicated in the functional performance test procedures.
- C. The Contractor shall correct any deficiencies or failures identified in the process of performing these tests.

END OF SECTION