

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1: GENERAL**

**1.01 Summary**

- A. Perform all work required to prepare the building HVAC systems for testing, adjusting and balancing indicated by the Contract Documents as follows:
  - 1. Responsibilities of Project Contractor.
  - 2. Preparation for balancing of air systems.
  - 3. Preparation for balancing of hydronic and steam systems.
- B. The scope of the TAB work as defined in Section 230593.01 is indicated in order that the Contractor will be advised of the coordination, adjustment, and system modification which will be required under the project work in order to complete the Owner's requirements for final TAB. The TAB firm will not have a contractual relationship with any Contractor referred to herein, but will be responsible to the Construction Inspector and the Owner for the satisfactory execution of the TAB work. The Contractor in his original bid shall allow for the costs required to cover all work which may be required in the TAB phases as defined herein and as may be necessary for the completion of the TAB work as defined by the TAB firm.

**1.02 Related Sections**

- A. Section 230593.01 – System Testing, Adjusting & Balancing.

**1.03 Scope of Work**

- A. Testing, adjusting and balancing (TAB) of the Air Conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm selected and employed directly by the Owner, separate and apart from the Construction Contract. However, the preparation for and corrections necessary for the Testing, Adjusting and Balancing of these systems, as described herein, are the responsibility of the Contractor.
- B. As a part of this project Construction Contract, the Contractor shall make any changes or replacements to the sheaves, belts, dampers, valves, etc. required for correct balance as advised by the TAB firm, at no additional cost to the Owner.

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

- C. The Contactor shall provide and coordinate the services of qualified, responsible Subcontractors, suppliers, and personnel as required to correct, repair, and/or replace any and all deficient items or conditions found during the course of this project, including the testing, adjusting, and balancing period.
- D. In order that all systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor shall operate said systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. This length of time shall be subject to the approval of the Construction Inspector.
- E. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner provided services, during the construction period, and prior to Substantial Completion as defined in the Uniform General Conditions of this Construction Document.
- F. The Drawings and Specifications indicate valves, dampers and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor or the Construction Inspector shall be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.

**1.04 Responsibilities of the Project Contractor**

- A. The Contractor shall:
  - 1. Have the building and air conditioning systems in complete operational readiness for TAB work to begin.
  - 2. The Contractor shall allow sufficient time for the TAB firm to perform his contracted work within the construction schedule. The Contractor shall complete his work by systems or floors, whichever is the most efficient for scheduling. After awarding of the Contract and the Contractor has developed a construction schedule, a TAB coordination meeting shall be held at the Owner's office with the TAB agency, the General Contractor and his primary subcontractors (i.e. mechanical, electrical, building automation, etc.) to develop a testing schedule for

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

the project. The Contractor shall submit copies of the proposed schedule to (2) weeks prior to this meeting to the Owner and TAB Agency.

- a. The following are time requirements: The hot water and chilled waters must be 100% complete to balance. The air systems are pressure independent and can be balanced by systems, etc., but once the total system is complete, the total flows and system tracking will require finalization. Lab certification will be performed when the building is 100% operational and balanced.
3. Promptly correct deficiencies of materials and workmanship identified as delaying completion of TAB work.
4. Be responsible for any added costs to the Owner resulting from his failure to have the building and air conditioning systems ready for TAB when scheduled, or from his failure to correct deficiencies promptly.
- B. Complete operational readiness of the building requires that construction status of the building shall permit the closing of doors, windows, ceilings installed, etc., to obtain simulated or projected operating conditions.
- C. Complete operational readiness of the air conditioning systems also require that the following be accomplished:
  1. Air Distribution Systems:
    - a. Verify installation for conformity to design. All supply, return, and exhaust ducts terminated and pressure tested for leakage as required by the Specification.
    - b. All volume, smoke and fire/smoke dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return and relief air shall provide tight closure and full opening, smooth and free operation.
    - c. All supply, return, exhaust and transfer grilles, registers, diffusers and terminal devices installed.
    - d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and/or sealed to eliminate excessive bypass or leakage of air.

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

- e. All fans (supply, return and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating; record motor amperage and voltage on each phase at start-up and running, and verify they do not exceed nameplate ratings.
  - f. All single variable terminal units (“mixing boxes”) shall be installed and functional (i.e. controls functioning).
2. Water Circulating Systems:
- a. Check and verify pump alignment and rotation.
  - b. Open all valves to their full open position, close bypass stop valves. Set mixing valves to full-flow through systems components. After the system is flushed and checked for proper operation, remove and clean all strainers. The Contractor shall repeat the operation until circulating water is clean.
  - c. Record each pump motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating.
  - d. Verify that the electrical heater elements are of the proper size and rating.
  - e. In preparation of TAB all water circulating systems shall be full and free of air, expansion tanks shall be set for proper water level, and all air vents shall be installed at high points of systems and operating freely. Systems shall be cleaned and flushed. Chemicals shall be added to closed systems to treat piping and inhibit corrosion.
  - f. Check and set operating parameters of the heat exchangers and control devices to the design requirements.
3. Automatic Controls
- a. The Contractor shall schedule a meeting with the Engineer, Control Contractor, TAB firm and Owner’s Representative for a pre-submittal review to establish that his interpretations of the sequences of operation are correct.

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

- b. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, dampers sequences, air and water resets, fire and freeze stats, high and low temperature thermostats, safeties, etc.
  - c. Verify that all controlling instruments are calibrated and set for design operating conditions with the exception of room thermostats or sensors, which shall be calibrated at the completion of TA service with cooperation between the TAB firm and Control Contractor.
  - d. The Automatic Temperature Control Contractor and/or Energy Management System Contractor shall thoroughly check all controls, sensors, operators, sequences, etc., before notifying the TAB agency that the Automatic Temperature Controls and Energy Management Systems are operational. The Automatic Temperature Control Contractor and/or Energy Management System Contractor shall provide technical support (technicians and necessary computers) to the TAB agency for a complete check of these systems.
4. Tabulated Data: The motor amperages, voltages shall be recorded showing “actual” and “nameplate” voltage and amperage and submitted and actual RPM. This applies to each piece of electrically driven air conditioning equipment in the system including supply and exhaust fans, fans of fractional horsepower, pumps, etc.
- D. Notification of System Readiness:
1. After completion of the work in Paragraph 1.5.a through c above, the Contractor shall notify the Owner in writing, certifying that the work has been accomplished and that the building and the air conditioning systems are in operational readiness for testing, adjusting, and balancing. He shall include a copy of the tabulated data of Paragraph 1.5.c.4 above.
  2. The Owner will, in turn, notify the TAB firm of the readiness for balancing and forward copies of the Contractor’s certification and the tabulated voltages and currents.
  3. Should the TAB firm be notified as described above, and the TAB work commenced and the systems are found NOT to be in readiness if the systems, the Contractor shall request an inspection be made by duly

**SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC**

appointed representative of the Owner, Architect, TAB firm, and the Contractor. This inspection will establish to the satisfaction of the represented parties whether or not the system meets the basic requirements for TAB services. Should the inspection reveal the TAB services notification to have been premature, all cost of the inspection and wasted work accomplished by the TAB firm shall be reimbursed to the appropriated parties by the Project Contractor.

**1.05 Responsibilities of the TAB Firm**

- A. Refer to Section 23 05 93.01 entitled “System Testing, Adjusting and Balancing.”

END OF SECTION 23 05 93