

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of ventilating and air conditioning systems. TAB includes the following:
  - 1. Planning systematic TAB procedures.
  - 2. Design Review Report.
  - 3. Systems Inspection report.
  - 4. Systems Readiness Report.
  - 5. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  - 6. Recording and reporting results.
- B. Definitions:
  - 1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications".
  - 2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  - 3. AABC: Associated Air Balance Council.
  - 4. NEBB: National Environmental Balancing Bureau.
  - 5. Hydronic Systems: Chilled water and condenser water systems.
  - 6. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.
- B. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise and Vibration Requirements.
- C. Section 23 07 11, HVAC INSULATION: Piping and Equipment Insulation.
- D. Section 23 09 23, DIRECT-DIGITAL CONTROLS FOR HVAC: Controls and Instrumentation Settings.

**1.3 QUALITY ASSURANCE**

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Contracting Officer's Representative (COR) and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as

required by the COR. The responsibilities would specifically include:

- a. Shall directly supervise all TAB work.
  - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
  - c. Would follow all TAB work through its satisfactory completion.
  - d. Shall provide final markings of settings of all HVAC adjustment devices.
  - e. Permanently mark location of duct test ports.
5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.
- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
  2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline.
  3. Systems shall be adjusted for energy efficient operation as described in PART 3.
  4. Typical TAB procedures and results shall be demonstrated to the COR for chilled and condenser water systems (pumps) as follows:
    - a. When field TAB work begins.
    - b. During each partial final inspection and the final inspection for the project if requested by VA.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PRODUCT DATA.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the COR staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:
  - 1. Design Review Report within 60 days for design-build projects after the system layout on air and water side is completed by the Contractor.
  - 2. Systems inspection report on equipment and installation for conformance with design.
  - 3. Systems Readiness Report.
  - 4. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
  - 5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
  - 2003.....HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
- C. Associated Air Balance Council (AABC):
  - 2002.....AABC National Standards for Total System Balance
- D. National Environmental Balancing Bureau (NEBB):
  - 7<sup>th</sup> Edition 2005 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

1<sup>st</sup> Edition 1994 .....Procedural Standards for the Measurement and  
Assessment of Sound and Vibration

2<sup>nd</sup> Edition 1999 .....Procedural Standards for Building Systems  
Commissioning

E. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA):

3<sup>rd</sup> Edition 2002 .....HVAC SYSTEMS-Testing, Adjusting and Balancing

## **PART 2 - PRODUCTS**

### **2.1 PLUGS**

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

### **2.2 INSULATION REPAIR MATERIAL**

See Section 23 07 11, HVAC INSULATION. Provide for repair of insulation removed or damaged for TAB work.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

### **3.2 DESIGN REVIEW REPORT**

The TAB Specialist shall review the Contract Plans and specifications and advise the COR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

### **3.3 SYSTEMS INSPECTION REPORT**

- A. Inspect equipment and installation for conformance with design.
- B. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments. Check for conformance with submittals.

### **3.4 SYSTEM READINESS REPORT**

- A. Inspect each System to ensure that it is complete including installation and operation of controls.

- B. Verify that all items such as piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the COR.

### **3.5 TAB REPORTS**

- A. The TAB contractor shall provide raw data immediately in writing to the COR if there is a problem in achieving intended results before submitting a formal report.
- B. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.

### **3.6 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume water systems for test and balance work.
- C. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- D. Water Balance and Equipment Test: Include circulating pumps:
  - 1. Adjust flow rates for equipment.
  - 2. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for chilled and condenser water systems.

### **3.7 VIBRATION TESTING**

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal compressors, pumps and motors.
- B. Record initial measurements for each unit of equipment on test forms and submit a report to the COR. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the COR.

### **3.8 MARKING OF SETTINGS**

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

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