
SECTION 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
 - 1. American Iron and Steel (AIS)
 - 2. Build America, Buy America Act
- B. See Supplementary Conditions for details.

1.02 SUMMARY

- A. Section Includes:
 - 1. Testing, adjusting, and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
 - 3. Sound measurement of equipment operating conditions.
 - 4. Vibration measurement of equipment operating conditions.

1.03 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.04 SUBMITTALS

- A. Section 013300 “Submittal Procedures”: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.

- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Furnish reports in soft cover, letter size, three-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.05 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures": Closeout procedures.
- B. Project Record Documents: Record actual locations of balancing valves and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance.

1.07 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience.

1.08 SEQUENCING

- A. Section 017300 - Execution: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 013100 "Project Management and Coordination": Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.
4. Duct systems are clean of debris.
5. Fans are rotating correctly.
6. Access doors are closed and duct end caps are in place.
7. Air outlets are installed and connected.
8. Duct system leakage is minimized.
9. Service and balancing valves are open.

3.02 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.03 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 ADJUSTING

- A. Section 017700 "Closeout Procedures": Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- J. At modulating damper locations, take measurements and balance at extreme conditions.
- K. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near building entries.

3.06 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Heating Terminal Units.
 - 2. Fans.
- B. Report Forms:
 - 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.

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- i. Project altitude.
 - j. Report date.
 2. Summary Comments:
 - a. Design versus final performance.
 - b. Notable characteristics of system.
 - c. Description of systems operation sequence.
 - d. Summary of outdoor and exhaust flows to indicate building pressurization.
 - e. Nomenclature used throughout report.
 - f. Test conditions.
 3. Instrument List:
 - a. Instrument.
 - b. Manufacturer.
 - c. Model number.
 - d. Serial number.
 - e. Range.
 - f. Calibration date.
 4. Electric Motors:
 - a. Manufacturer.
 - b. Model/Frame.
 - c. HP/BHP and kW.
 - d. Phase, voltage, amperage; nameplate, actual, no load.
 - e. RPM.
 - f. Service factor.
 - g. Starter size, rating, heater elements.
 - h. Sheave Make/Size/Bore.
 5. V-Belt Drive:
 - a. Identification/location.
 - b. Required driven RPM.
 - c. Driven sheave, diameter and RPM.
 - d. Belt, size and quantity.
 - e. Motor sheave diameter and RPM.
 - f. Center to center distance, maximum, minimum, and actual.
 6. Unit Heater and Convection Heater Data:
 - a. Manufacturer.
 - b. Identification/number.
 - c. Location.
 - d. Model number.
 - e. Size.
 - f. Air flow, design and actual.
 - g. Entering air temperature, design and actual.
 - h. Leaving air temperature, design and actual.

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7. Air Moving Equipment:
 - a. Location.
 - b. Manufacturer.
 - c. Model number.
 - d. Serial number.
 - e. Arrangement/Class/Discharge.
 - f. Air flow, specified and actual.
 - g. Return air flow, specified and actual.
 - h. Outside air flow, specified and actual.
 - i. Total static pressure (total external), specified and actual.
 - j. Inlet pressure.
 - k. Discharge pressure.
 - l. Sheave Make/Size/Bore.
 - m. Number of Belts/Make/Size.
 - n. Fan RPM.
 8. Return Air/Outside Air Data:
 - a. Identification/location.
 - b. Design air flow.
 - c. Actual air flow.
 - d. Design return air flow.
 - e. Actual return air flow.
 - f. Design outside air flow.
 - g. Actual outside air flow.
 - h. Return air temperature.
 - i. Outside air temperature.
 - j. Required mixed air temperature.
 - k. Actual mixed air temperature.
 - l. Design outside/return air ratio.
 - m. Actual outside/return air ratio.
 9. Exhaust Fan Data:
 - a. Location.
 - b. Manufacturer.
 - c. Model number.
 - d. Serial number.
 - e. Air flow, specified and actual.
 - f. Total static pressure (total external), specified and actual.
 - g. Inlet pressure.
 - h. Discharge pressure.
 - i. Sheave Make/Size/Bore.
 - j. Number of Belts/Make/Size.
 - k. Fan RPM.
 10. Duct Leak Test:
 - a. Description of ductwork under test.
 - b. Duct design operating pressure.
 - c. Duct design test static pressure.

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- d. Duct capacity, air flow.
 - e. Maximum allowable leakage duct capacity times leak factor.
 - f. Test Apparatus:
 - 1) Blower.
 - 2) Orifice, tube size.
 - 3) Orifice size.
 - 4) Calibrated.
 - g. Test static pressure.
 - h. Test orifice differential pressure.
 - i. Leakage.
11. Sound Level Report:
- a. Location.
 - b. Octave bands - equipment off.
 - c. Octave bands - equipment on.
 - d. RC level - equipment on.
12. Vibration Test:
- a. Location of points:
 - 1) Fan bearing, drive end.
 - 2) Fan bearing, opposite end.
 - 3) Motor bearing, center (when applicable).
 - 4) Motor bearing, drive end.
 - 5) Motor bearing, opposite end.
 - 6) Casing (bottom or top).
 - 7) Casing (side).
 - 8) Duct after flexible connection (discharge).
 - 9) Duct after flexible connection (suction).
 - b. Test Readings:
 - 1) Horizontal, velocity and displacement.
 - 2) Vertical, velocity and displacement.
 - 3) Axial, velocity and displacement.
 - c. Normally acceptable readings, velocity and acceleration.
 - d. Unusual conditions at time of test.
 - e. Vibration source (when non-complying).

END OF SECTION

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