SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives.

1.03 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Report Forms: Test data sheets for recording test data in logical order.

D. Test: A procedure to determine quantitative performance of a system or equipment.

E. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

F. AABC: Associated Air Balance Council.

G. AMCA: Air Movement and Control Association.

H. NEBB: National Environmental Balancing Bureau.

I. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

A. Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

1.05 QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing", from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing."

1.06 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.07 COORDINATION

A. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine equipment performance data. Relate performance data to project conditions and requirements. Compare this data with the design data and installed conditions.

D. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

E. Examine air-handling equipment to ensure clean filters have been installed and equipment with functioning controls is ready for operation.

F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

G. Examine equipment for installation and for properly operating safety interlocks and controls.

H. Examine automatic temperature system components to verify the following:
   1. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   2. Changeover from heating to cooling mode occurs according to design values.

3.02 PREPARATION

A. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment access doors are securely closed.
   5. Balance dampers are open.
   6. Isolating valves are open.
   7. Windows and doors can be closed so design conditions for system operations can be met.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing" and this Section.

3.04 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Check dampers for proper position to achieve desired airflow path.

C. Check for airflow blockages.

D. Check condensate drains for proper connections and functioning.

E. Check for proper sealing of air-handling unit components.

3.05 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.

B. Adjust fans to deliver total design airflows.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure static pressure directly at the fan outlet.

3.06 CONDENSING UNITS

A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

3.07 HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
   1. Entering- and leaving-water temperatures.
   2. Dry-bulb temperatures of entering and leaving air.

3.08 TEMPERATURE TESTING

A. Measure outside-air, wet- and dry-bulb temperatures.

3.09 TOLERANCES

A. Set HVAC system airflow rates within the following tolerances:
   1. Air Outlets and Inlets: 0 to minus 10 percent.

3.10 REPORT

A. Include a certification sheet in front of binder signed and sealed by the testing and balancing agent.

B. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting, and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of testing, adjusting, and balancing Agent.
   10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence.
   11. Nomenclature sheets for each item of equipment.
   12. Notes to explain why certain final data in the body of reports vary from design values.
   13. Test conditions for fans and pump performance forms, including the following:
      a. Settings for dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Fan speed settings, including settings of speed controllers.
      e. Other system operating conditions that affect performance.

C. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
   2. Motor Data: Include the following:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
   3. Test Data: Include design and actual values for the following:
      a. Total system static pressure in inches wg.
      b. Discharge static pressure in inches wg.
      c. Return airflow in cfm.

D. Air-Distribution-Device Reports: For air distribution units, include the following:
   1. Unit Data: Include the following:
      a. System and air-handling unit identification.
      b. Area served.
      c. Air-device type and model number.
      d. Air-device size.
   2. Test Data: Include design and actual values for the following:
      a. Airflow rate in cfm.
      b. Preliminary airflow rate as needed in cfm.
      c. Final airflow rate in cfm.

E. Compressor and Condenser Reports: For refrigerant side of air-cooled condensing units, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Unit make and model number.
      d. Manufacturer's compressor serial numbers.
   2. Test Data: Include design and actual values for the following:
      a. Suction pressure in psig.
      b. Suction temperature in deg F.
      c. Condenser refrigerant pressure in psig.
      d. Condenser refrigerant temperature in deg F.
      e. Voltage at each connection.
      f. Amperage.

3.11 ADDITIONAL TESTS

A. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15990