

SECTION 15990  
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish all labor, equipment and services necessary for and incidental to Air and Water Systems Testing and Balancing.
- B. Include an extended warranty of one year after final acceptance by Owner, during which time the Owner may request a recheck, or resetting of any outlet, coil or device listed in the test report. Provide technicians to assist in making any test or adjustment required.
- C. The Contractor shall procure the services of an independent testing and balancing agency, with previous consent of the Owner or the Owner's Representative. The Testing and Balancing Agency shall specialize in testing and balancing of heating, ventilating, air-moving equipment, air-conditioning system and Hydronic systems. The testing agency shall provide proof of having successfully completed at least five projects of similar size and scope, and shall be a certified member of the Associated Air Balance Council and/or National Environmental Balancing Bureau and/or Testing Adjusting and Balancing Bureau (TABB), unless otherwise approved. The Mechanical Contractor shall award the test and balance contract to the selected agency as soon as possible after approval of the agency by the Owner or the Owner's Representative.
- D. Testing and Balancing shall not begin until the systems have been completed and are in full working order. Submit four (4) copies of data for the testing and balancing work for review by the Owner or Owner's Representative.

1.2 REFERENCES

- A. AABC – National Standards for Total System Balance.
- B. ADC – Test Code for Grilles, Registers, and Diffusers.
- C. ASHRAE 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- D. NEBB – Procedural Standards for Testing, Adjusting, and Balancing.
- E. SMACNA – HVAC Systems Testing, Adjusting, and Balancing.
- F. TABB-International Standards for Environmental Systems Balance

1.3 SUBMITALS

- A. Submit name of testing, adjusting and balancing agency for approval within 30 days after award of Contract.
- B. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- C. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- D. Provide reports in soft cover, letter size, binder manuals, complete with index 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.

#### 1.4 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Standards – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems or Testing Adjusting and Balancing Bureau (TABB)-National Standards for Environmental Systems Balance.
- B. Maintain one copy of applicable standards on site.

#### 1.5 QUALIFICATIONS

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

### PART 2 PRODUCTS

- A. Replacement of adjustable pulleys, additional balancing dampers, additional fan belts, pressure taps and fitting, hydronic balancing valves and any other devices or equipment required to effect proper testing, adjusting and balancing shall be provided shall be provided by the Contractor at no additional cost to the Owner.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a 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. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services, which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

### 3.2 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets; Adjust total to within plus 10 percent and minus 10 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.

### 3.3 ADJUSTING – GENERAL

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark setting of valves, dampers, and other adjustment devices allowing setting to be restored. Set and lock memory stops.

- C. After adjustment, take measurement to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

### 3.2 AIR SYSTEMS PROCEDURE

- A. Test and adjust fan RPM to design requirements.
- B. Test and record motor full load nameplate rating and actual ampere draw.
- C. Test and record system static pressures, fan suction and discharge.
- D. Adjust all main supply and return air duct to proper design CFM.
- E. Test and adjust each diffuser, grille and register. Reading and tests of diffusers, grilles and registers shall include design velocity (FPM) and as adjusted velocity, design CFM and adjusted CFM.
- F. Test and record outside, mixed air and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
- G. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
- H. Test and adjust air handling and distribution systems to provide required or design supply, return, outside and exhaust air quantities.
- I. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- J. Measure air quantities at air inlets and outlets.
- K. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- L. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- M. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- N. Provide system schematic with required and actual air quantities recorded at each outlet or inlet

- O. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- P. Adjust outside air automatic dampers, outside air, return air and exhaust dampers for design conditions.
- Q. Measure temperature conditions across air, return air, and exhaust dampers to check leakage.
- R. Where modulating dampers are provided, take measurement and balance at extreme conditions.
- S. Measure and record pressure differentials between designated spaces such as Operating Rooms, Sterilizer Rooms, Medical Gas Tank Rooms, Red Bag Storage Rooms, etc.

### 3.3 WATER SYSTEM PROCEDURE

- A. Prepare itemized equipment schedules, listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating or cooling elements all zone balancing valves circuit pump and ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions and measured conditions. Prepare individual pump report sheets for each zone or circuit.
- B. Adjust water systems to provide required or design quantities.
- C. Use calibrated Venturi tubes, orifices, or other metered fitting and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, bale flow balance on temperature difference across various heat transfer elements in the system.
- D. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- E. Effect system balance with automatic control valves fully open to heat transfer elements.
- F. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- G. Test pumps and adjust flow. Record the following on pumps report sheets: (a) suction and discharge pressure, (b) running amps and brake horsepower of pump motor under full flow and no flow conditions, (c) pressure drop across pump in feet of water and total GMP pump is handling under full flow conditions.
- H. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

### 3.4 REQUIRED REPORTS TO BE SUBMITTED

#### A. Report Forms

##### 1. Title Page

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency.
- c. Telephone number of Testing, Adjusting, and Balancing Agency
- d. Project name
- e. Project location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- 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 of 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
- 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. Pump Data:

- a. Identification/number
- b. Manufacturer
- c. Size/model
- d. Impeller
- e. Service
- f. Design flow rate, pressure drop, BHP
- g. Actual flow rate, pressure drop, BHP
- h. Discharge pressure
- i. Suction pressure
- j. Total operating head pressure
- k. Shut off, discharge and suction pressures
- l. Shut off, total head pressure

7. Heating Coil Data:

- a. Number/number
- b. Location
- c. Service

- d. Manufacturer
- e. Air flow, design and actual
- f. Water flow, design and actual
- g. Water pressure drop, design and actual
- h. Entering water temperature, design and actual
- i. Leaving water temperature, design and actual
- j. Entering air temperature, design and actual
- k. Leaving air temperature, design and actual
- l. Air pressure drop, design and actual

8. 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

9. 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

10. 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

11. Duct Traverse:

- a. System zone/branch
- b. Duct size
- c. Area
- d. Design velocity
- e. Design air flow
- f. Test velocity
- g. Test air flow
- h. Duct static pressure
- i. Air temperature
- j. Air correction factor

12. Air Distribution Test Sheet:

- a. Air terminal number
- b. Room number/location
- c. Terminal type
- d. Terminal size
- e. Area factor
- f. Design velocity
- g. Design air flow
- h. Test (final) velocity
- i. Test (final) air flow
- j. Percent of design air flow

**END OF SECTION**

