



DESIGN REQUIREMENTS

TESTING, ADJUSTING, AND BALANCING FOR HVAC

GENERAL INFORMATION

- 1.1 An independent Testing and Balancing Contractor shall be retained to provide certified Testing and Balancing Reports for all projects.

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- 2.1 The balancing agency shall have successfully completed at least five projects of similar size and scope, and shall be a Certified member of "Associated Air Balance Council" or National Environmental Balancing Bureau (NEBB).
- 2.2 The balancing agency shall have no affiliation with a mechanical contracting or sheet metal company.
- 2.3 The balancing effort shall be under the direct supervision of a licensed Professional Engineer in the State of New York. The licensed engineer shall sign and seal the Balancing Report.
- 2.4 Specify separate reports on the cooling and heating water circulating systems, ATC system, and heating and ventilating systems. These reports shall certify test methods and instruments used, all readings obtained, temperature and pressure drops, RPM of equipment, amperage of all motors, air quantities at each outlet supply, return and air balancing problems encountered, and suggestions. Reports to be submitted to the design team shall include data on all tests in the form normally used by AABC and NEEB. The reports must be varied to suit the specific specifications. Reports shall include fan and pump curves for the final speeds developed from the fan manufacturer's performance test data for all major equipment and schematics for all systems tested.
- 2.5 Request initial Balancing Reports to document existing conditions for all renovation projects.

CONSTRUCTION REQUIREMENTS

- 3.1 Air Balancing and Testing
 - a. On initial startup, prior to any test, the balancing agency must check the rotation and running amperage of all fan motors to prevent damage to equipment by overload.

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- b. New, clean filters must be installed in all supply systems prior to balancing.
- c. All main supply air ducts must be traversed, using a pitot tube and manometer. The intent of this operation is to measure the total air quantity supplied by the fan and to verify the distribution of air to zones.
- d. Inspect all fan scrolls and remove objects or debris. Inspect all coils and remove debris or obstructions. Verify that all fire and smoke dampers in the system are open or closed depending on their proper sequence.
- e. All fans and duct systems shall be completely balanced by the adjustment of sheaves, dampers, registers and other volume and diverting control devices. Replace sheaves if required to meet design conditions.
- f. The balancing agency shall make any changes in pulleys, sheaves, belts and dampers or to add dampers required for properly balancing the system.
- g. All diffusers, grilles and registers shall be adjusted to minimize drafts and noise in all areas. Dampers furnished integrally with diffusers and registers shall be used only for “fine tuning” the system. Volume dampers in branch ductwork shall be the primary air balancing device.
- h. Air systems shall be leak tested as described in SMACNA. The total system leakage shall not exceed 3 percent of the total system air quantity.
- i. The balancing agency shall adjust outside air and return air modulating dampers to admit the specified quantity of air under all modes of operation. All final adjusted air quantities shall be within 10 percent of the design requirements.
- j. Upon completion of balancing, a complete testing and balancing report must be submitted to the University and the engineer. The balancing report shall, as a minimum, include the following:
 - 1. Fan model number.
 - 2. Total fan air quantities - Design and Actual.
 - 3. Fan static pressure - Design and Actual.
 - 4. Fan tip speed - Design and Actual.
 - 5. Fan outlet velocity - Design and Actual.
 - 6. Fan brake horsepower.
 - 7. Motor horsepower.

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8. Voltage and full load amperage draw - Design and Actual.
9. Single line diagrams of the duct system indicating all terminal outlets and identified by a unique number.
10. Data sheets shall list all outlets (supply, return and exhaust), each outlet's size, location, "K" factor, design CFM and actual CFM.
- k. Upon completion of all air balancing, all dampers shall be marked indicating the final adjusted position.

3.2 Water Balancing and Testing

- a. On initial startup, prior to any test, check the rotation and running amperage of all pump motors to prevent damage to equipment by overload.
- b. All water system must be completely filled and vented, and all strainers cleaned prior to balancing. Expansion tanks shall be inspected to verify proper water level and pressure. All air vents shall be checked to ensure that they are properly installed, operating properly and freely, and that all air is out of the system. The operation of makeup water valves shall be confirmed. Testing shall include all terminal devices.
- c. All pumps and piping systems shall be completely balanced by the adjustment of plug cocks, globe valves or other control devices, to obtain the required flow quantities. Balancing shall be done with all controls set for full flow through coils. All automatic throttling valves shall be in the full-open position. All circuit setters shall be set to the proper flow.
- d. For equipment and coils without flow measuring devices, flow shall be balanced by means of pressure drop using data supplied by the equipment manufacturer indicating the relationship between flow and pressure drop.
- e. Upon completion of balancing, a complete testing and balancing report must be submitted to the University and the Engineer. The balancing report shall, as a minimum, include the following:
 1. Pump manufacturer, model number and size.
 2. Total pump water flow - Design and Actual.
 3. Total head - Design and Actual.
 4. Pump speed - Design and Actual.
 5. Pump impeller size.
 6. NPSH (if available).

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7. Pump motor horsepower.
8. Voltage and full load amperage draw - Design and Actual.
9. Suction, discharge and total head at no flow and design flow.
10. For all orifice plates, record the pipe size, orifice size, flow factor, required differential pressure, final differential pressure and calculated final flow quantity.
11. For all venturi type, pitot tube, or other flow measuring devices record the pipe size, manufacturer and size of device, and the direct reading or the differential pressure, and calculated final flow.
12. Upon completion of water balancing, all plug valves and other throttling devices shall be marked indicating the final adjusted position.

3.3 Motors

- a. Motors, ½ HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating if high-efficiency motor.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- b. Motors Driven By Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

REFERENCE

- 4.1 The applicable CSI Specification Section is 23 05 93.