

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: After completion of the work of installation, test and regulate all components of the new heating, air conditioning and ventilating systems to verify air volumes and heating-cooling flow rates indicated on the Drawings.
- B. Balancing Organization:
 - 1. Balancing of the Heating and Air Conditioning Systems: Performed by a firm providing this service established in the State of Oregon.
 - 2. Balancing Organization: Approval by Architect. Air Balancing Specialties, Neudorfer Engineers, Northwest Engineering Services, Pacific Coast Air Balancing, or approved.
 - 3. Provide all necessary personnel, equipment, and services.
- C. Balancer shall perform work as a Contractor to the General Contractor directly, not through the Mechanical Contractor.

1.2 QUALITY ASSURANCE

- A. Balancing of the Heating and Air Conditioning Systems: Agency shall be a current member of NEBB or AABC specializing in the adjusting and balancing of systems specified with a minimum of 10 years documented experience.
- B. Testing, adjusting, and balancing shall be performed under direct field supervision of a Certified NEBB Supervisor or a Certified AABC Supervisor.

1.3 SUBMITTALS

- A. See Section in Division 1, Administrative Requirements, for submittal procedures.
- B. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
- C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit under provisions of Section 23 05 00.
 - 2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 4. Provide reports in soft cover, letter size, 3-ring 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.
 - 5. Include detailed procedures, agenda, sample report forms, and copy of AABC National Project Performance Guaranty or other certifying agency prior to commencing system balance.
 - 6. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE 111, NEBB forms, or forms containing information indicated in Schedules.
 - 7. Include the following on the title page of each report:
 - 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 and Owner.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.
- D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.
- E. Provide a list of equipment, air supply, return and exhaust, heating water, and chilled water systems not in compliance with tolerances subsequently specified.

PART 2 - PRODUCTS

-- NOT USED --

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.
- 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 10 percent or minus 5 percent of design for supply systems and +/- 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent or minus 5 percent of design to space. Adjust outlets and inlets in space to within +/- 10 percent of design.
- C. Hydronic Systems: Adjust to within +/- 10 percent of design.

3.3 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements 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.

3.4 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust noise distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

- H. 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.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02" (12.5 Pa) positive static pressure near the building entries.

3.5 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Packaged rooftop heating/cooling units
 - 2. Air coils
 - 3. Air handling units
 - 4. Fans
 - 5. Air Filters
 - 6. Air inlets and outlets
- B. Report:
 - 1. 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 amount of building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
 - 2. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
- C. Electric Motors:
 - 1. Manufacturer
 - 2. Model/frame
 - 3. HP/BHP
 - 4. Phase, voltage, amperage; nameplate, actual, no load
 - 5. RPM
 - 6. Service factor
 - 7. Starter size, rating, heater elements
 - 8. Sheave make/size/model
- D. V-Belt Drives:
 - 1. Identification/location
 - 2. Required driven RPM
 - 3. Driven sheave, diameter, and RPM
 - 4. Belt, size, and quantity
 - 5. Motor sheave diameter and RPM
 - 6. Center to center distance, maximum, minimum, and tested
- E. Heating Section:
 - 1. Identification/number
 - 2. Location
 - 3. Service
 - 4. Manufacturer
 - 5. Air flow, design and tested

6. Entering air temperature, design and tested
 7. Leaving air temperature, design and tested
 8. Air pressure drop, design and tested
- F. Air Moving Equipment:
1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Arrangement/Class/Discharge
 6. Air flow, specified and tested
 7. Return air flow, specified and tested
 8. Outside air flow, specified and tested
 9. Total static pressure (total external), specified and tested
 10. Inlet pressure
 11. Discharge pressure
 12. Sheave make/size/bore
 13. Number of Belts/Make/Size
 14. Fan RPM
- G. Return Air/Outside Air:
1. Identification/location
 2. Supply air flow, design and tested
 3. Return air flow, design and tested
 4. Outside air flow, design and tested
 5. Return air temperature
 6. Outside air temperature
 7. Mixed air temperature, design and tested
- H. Exhaust Fans:
1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Air flow, specified and tested
 6. Total static pressure (total external), specified and tested
 7. Inlet pressure
 8. Discharge pressure
 9. Sheave Make/Size/Bore
 10. Number of Belts/Make/Size
 11. Fan RPM
- I. Duct Traverses:
1. System zone/branch
 2. Duct size
 3. Area
 4. Design velocity
 5. Design air flow
 6. Test velocity
 7. Test air flow
 8. Duct static pressure
 9. Air temperature
 10. Air correction factor
- J. Air Distribution Tests:
1. Air terminal number
 2. Room number/location
 3. Terminal type
 4. Terminal size
 5. Area factor
 6. Design velocity
 7. Design air flow

8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

3.6 DETAILED REQUIREMENTS

A. Adjusting and Balancing:

1. Adjust and balance all portions of the mechanical systems to produce indicated results within limits of minus 5 or plus 10 percent or as subsequently directed by the Architect.
2. Balancing data may be spot checked with instruments similar to that used by the balancing firm.
3. If, in the judgment of the Architect, the discrepancies warrant additional adjustment, readjust and rebalance the systems at no additional project cost.

END OF SECTION