

SECTION 230500

HVAC TESTING, ADJUSTING, AND BALANCING

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Test, adjust and air balance:

Discovery Elementary School:

AC A-1, AC A-2, AC A-3, AC C-1, AC C-4, AC D-1, AC D-2 AC D-3 AC D-4, AC D-5, AC Relo 1, AC Relo 2, AC Relo 23, Relo 26 and AC Relo 27.

- B. The air balance will be to ensure that each rooftop unit has the air flow shown in the HVAC schedule.

Provide an air balance report that shows the outside air and economizer are providing the correct amount of CFM.

- C. Provide reduced scale drawings with air and water flows and equipment identified to correspond with data sheets, and indicating sensor/thermostat locations.

1.02 SUBMITTALS

- A. Draft Reports: Submit for review prior to final acceptance of Project.

- B. Assemble a PDF letter size with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating sensor/thermostat locations.

1.03 TESTING, ADJUSTING AND BALANCING

- A. This section covers testing and balancing of environmental systems including air distribution systems, and the equipment and apparatus connected thereto. The testing and balancing of all environmental systems shall be the responsibility of one Testing, Balancing and Adjusting (TBA) firm. The minimal standards to be met are those set forth in Chapter 40 in the latest edition of the ASHRAE Systems Handbook.

- B. The balancing, testing and adjustments of the complete mechanical systems shall be the direct responsibility of the Contractor and he shall engage the services of an independent firm specializing in this work. The definition of independent shall mean the firm is not associated with any contracting or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. Acceptable testing, adjusting and balancing firms are those which are AABC certified. NEBB firms must also be AABC certified.

- C. The balancing work shall be performed by the same firm having total professional responsibility for the final testing, adjusting, and balancing of the entire system.

- D. Testing and balancing work shall be directly supervised and the results confirmed by a Registered Professional Mechanical Engineer who shall represent the TBA firm in progress meetings as requested, and shall be available for interpreting all material found in the balance report.

- E. The balancing firm shall provide all tools, equipment and instruments required and shall take all readings, and make all necessary adjustments.
- F. After all adjustments are made, prepare a detailed written report and submit for review. Report shall bear the Registered Professional Mechanical Engineer's Stamp of the person supervising the work. Final acceptance of this project will not be made until a satisfactory report is received.
- G. Verify the following conditions before proceeding with work:
 - 1. Conduct site observations during construction to determine the location of required balancing devices and confirm that they are properly located and installed. Submit a written report of these observations to the Architect.
 - 2. Installation of the designated system is complete and in full operation.
 - 3. Outside temperature conditions, occupant loads, lighting loads, special equipment requiring extra sensible or ventilation requirements, and solar conditions are within a reasonable range relative to design conditions or provide for acceptable simulation of loads and conditions that will result in a properly balanced system.
- H. All thermal overload protection shall be observed and noted on the data sheets. If the starter equipment is furnished and installed by the Contractor and thermal overload protection is incorrect, such information shall be tabulated, including required size thermal overloads, and included in the report. If thermal overload protection is incorrect, it shall be the responsibility of the Contractor to see that proper overload protection is installed.
- I. Measure and set any special conditions such as minimum outside air quantities; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in the "Balancing Report" section. All balancing devices such as dampers and valves shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
- J. Provide temperature recorders for spaces as necessary to verify acceptable space temperature conditions.
- K. Upon request of the Mechanical Engineer a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by re-measuring outlets or terminals selected at random by the Mechanical Engineer to verify accuracy of settings.
- L. Requirements for balancing air systems are as follows:
 - 1. Before any adjustments are made; the major items of equipment shall have been checked to assure all bearings have proper lubrication; all belt drives shall have been adjusted for proper alignment and tension; and the systems shall have been checked for such items as dirty filters, duct leakage, filter leakage, damper leakage, equipment vibrations, correct damper operations, etc.
 - 2. Adjust fan systems, major duct sections, registers, diffusers, etc., to deliver design air quantities within plus or minus 5%. If individual air outlets serve more than one space, they may have a tolerance of 10% from the average. Design CFM is based on filters being approximately 50% loaded. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed, verify that motor is not overloaded with the filters clean.
 - 3. Check and adjust CFM settings at supply diffusers and return air grilles.
 - 4. Exchange and pay for sheaves and/or belts as required to adjust the rpm of fans to handle specified air quantity.

- M. Provide a PDF of the "Balancing Report" to the Mechanical Engineer. The Mechanical Engineer shall review this report. This report shall contain a general information sheet listing instruments used, method of balancing, altitude correction calculations, manufacturer's grille, register, and diffuser data. Report shall contain the following additional data.
1. Equipment data sheets listing make, size, serial number, rating, operating data, etc., of all mechanical equipment including fans, motors, starters, and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils and other system components, and measured motor current and voltage.
 2. Balancing data sheets listing the required and actual CFM of all supply, return, and exhaust outlets or inlets, and totals summarized by systems.
 3. A reduced set of contract drawings with outlets marked thereon for easy identification of the designation used in the data sheets.
 4. Listing of any abnormal or notable conditions not covered in the above.
- N. Even though it is the responsibility of the balancing firm to check the physical operation of each operating piece of equipment, the control contractor must assure the balancing firm that all controls are accurately calibrated and must cooperate with him during the balancing work period.
- O. The agency performing the system balance and performance test, shall personally verify that all system control functions and interlocking do in fact provide the desired results as stated. The agency shall provide a written statement within the air balance report verifying this fact.

**PART 2 – PRODUCTS
(NOT APPLICABLE)**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before starting work, verify systems are complete and operable.
- B. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.
- C. Beginning of work means acceptance of existing conditions.

3.02 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to deliver design supply and return air quantities.
- B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.
- C. Measure air quantities at supply diffusers and return air grilles.
- D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes to accomplish system air flow. Vary branch air quantities by damper regulation.

- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.
- G. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.
- I. At modulating damper locations, take measurements and balance at extreme conditions.

3.03 FIELD QUALITY CONTROL

- A. Verify recorded data represents actually measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION