SECTION 23 0593

DUCT TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Test, balance, and adjust air duct systems as described in Contract Documents.

B. Related Sections:
   1. Other Sections of Division 23:
      a. Completing installation and start-up of mechanical systems, and changing sheaves, belts, and dampers as required for correct balance.
      b. Assisting Balancing Agency in testing and balancing of mechanical system.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Perform testing and balancing in complete accordance with Associated Air Balance Council Standards for Field Measurement & Instructions, Form P1266, Volume I. Record test data on AABC standard forms or facsimile.
   2. Noise level shall not exceed PNC 35 in Chapel or Cultural Center when all mechanical equipment is operating.

1.3 SUBMITTALS

A. Quality Assurance / Control:
   1. Four copies of complete test data for evaluation and approval.
   2. Test And Balance Report:
      a. Complete with logs, data, and records as required herein. Print logs, data, and records on white bond paper bound together in report form.
      b. Certified accurate and complete by Balancing Agency's certified test and balance engineer.
      c. Contain following general data in format selected by Balancing Agency.
         1) Project Number.
         2) Project Title.
         3) Project Location.
         4) Project Architect and Mechanical Engineer.
         5) Test and Balance Agency and Certified Engineer.
         6) Contractor and mechanical sub-contractor.
         7) Dates tests were performed.
         8) Certification Document.
         9) Report Forms similar to AABC Standard format.
      d. Report shall include following:
         1) Preface suggesting abnormalities and problems encountered.
         2) Instrumentation List including type, model, manufacturer, serial number, and calibration dates.
         3) System Identification reporting location of zones, supply, return, and exhaust openings.
         4) Record following for each piece of air handling equipment:
            a) Manufacturer, model number, and serial number.
            b) Design and manufacturer rated data.
            c) Actual CFM.
            d) Suction and discharge static pressure of each fan.
            e) Outside-air and return-air total CFM.
f) Actual operating current, voltage, and brake horsepower of each fan motor.
g) Final RPM of each motor.
h) Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
i) Belt size and quantity.
j) Static-pressure controls final operating set points.


1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Work of this Section shall be performed by independent Air Testing And Balance Agency specializing in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
   2. Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing. Work by this Agency shall be done under direct supervision of qualified heating and ventilating engineer employed by Agency.
   3. Agency shall be approved in writing by Architect.
   4. Neither Architect's engineering consultant or anyone performing work on this Project under other Sections of Division 23 shall be permitted to do this work.

1.5 SCHEDULING

A. Award test and balance subcontract to Agency upon receipt of Notice To Proceed to allow Agency to schedule this work in cooperation with other Sections involved and to comply with completion date.

B. During construction, Agency shall inspect installation of pipe systems, sheet metal work, temperature controls, and other component parts of mechanical systems. Perform inspections as follows.
   1. One inspection when 60 percent of ductwork is installed.
   2. One inspection when 90 percent of equipment is installed.

C. Do not begin air testing and balancing until:
   1. After completion of air cooling, heating, and exhaust systems including installation of specialties, devices, and new filters.
   2. Proper function of control system components including electrical interlocks, damper sequences, air and water reset, and fire and freeze stats has been verified.
   3. Automatic temperature controls have been calibrated and set for design operating conditions.
   4. Verification of proper thermostat calibration and setting of control components such as static pressure controllers and other devices that may need set points changed during process of balancing system.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 ACCEPTABLE TEST AND BALANCE COMPANIES

A. <Insert Acceptable Test and Balancing Companies>

3.2 PREPARATION

A. Heating, ventilating, and cooling systems and equipment shall be in full operation and continue in operation during each working day of testing and balancing.
3.3 FIELD QUALITY CONTROL

A. Site Tests:
   1. If requested, conduct tests in presence of Architect.
   2. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
   3. Air Testing And Balancing Procedure:
      a. Perform tests at high and low speeds of multi-speed systems and single speed systems.
         Perform following testing and balancing functions in accordance with Associated Air Balance Council National Standards:
         1) Fan Speeds: Furnaces And Fan Coil Units (with direct drive motors): Set fan speed to lowest possible setting that will achieve design CFM requirements. Adjust down from Contractor setting, if necessary.
         2) Current And Voltage: Measure and record motor current and voltage.
         3) Pitot-Tube Traverse: Perform pitot-tube traverse of main supply and return ducts to obtain total CFM.
         4) Outside Air: Test and adjust system minimum outside air by pitot-tube traverse.
         5) Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
         6) Air Temperature: Take wet and dry bulb air temperatures on entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on entering and leaving side of each heating unit.
         7) Main Ducts: Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
         8) Branch Ducts: Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
         9) Tolerances: Test and balance each diffuser, grille, and register to within 10 percent of design requirements.
         10) Identification: Identify the location and area of each grille, diffuser, and register. Record on air outlet data sheets.
         11) Description: Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
         12) Drafts: Adjust diffusers, grilles, and registers to minimize drafts.
      b. Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.
   4. Smoke testing, or some other approved means, may be required to determine leak locations if air balance report indicates that any system's CFM total is less than 10 percent of design CFM. Prior to test, verify that system's duct joints have been sealed as specified and that air moving device in question is supplying required design system air flow. Architect will approve test method required. If smoke test is selected, use following procedure. Provide necessary precautions to protect those performing or observing test from being exposed to smoke.
      a. Use zinc chloride smoke candles, titanium tetrachloride ampules or sticks, or other devices acceptable to Architect to generate smoke.
      b. Close openings in duct except for one opening at farthest end of duct run.
      c. Circulate smoke at pressurized condition of 1/2 inch 13 mm minimum water gauge static pressure.
      d. Report findings to Architect in writing.

B. Final Inspection And Adjustments:
   1. System shall be balanced and reports submitted to Architect before final inspection.
   2. Balancing Agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of air balancing test report.
      a. Architect will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building. If recheck testing demonstrates measured flow deviation of 10 percent or more from recorded information on report, report will be rejected and new inspection and report will be made and resubmitted.
      b. Perform re-balancing in presence of Architect and subject to its approval.
      c. If re-balancing is required, submit revised air test and balance reports to Architect before Substantial Completion.
      d. Spot balance and rebalance shall be performed at no additional cost to Owner.
3. Where furnace supplied to job site provides over 5 percent more air than schedule requirements, rooms supplied by that furnace shall have their supply air quantities increased by ratio of actual total air quantity supplied to minimum air quantity required by furnace schedule.

END OF SECTION