1. GENERAL

1.1 RELATED DOCUMENTS

.1 All Division 15 Specification Sections, Drawings, and General Provisions of the Contract apply to Work of this Section, as do other documents referred to in this Section.

1.2 SCOPE OF WORK

.1 The Contractor will contract with and independent testing, adjusting, and balancing (TAB) agency to test, adjust, and balance the heating, ventilation, and air conditioning (HVAC) systems.

.2 The work included in this section consists of furnishing labour, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.

.3 The items requiring testing, adjusting, and balancing include the following:

.1 Air Systems:

.1 Supply Fan MUAs

.2 Exhaust Fans

.3 Zone branch and main ducts

.4 Diffusers, Registers and Grilles

.2 Hydronic Systems:

.1 Pumps

.2 System Mains and Branches

.3 Coils

1.3 DEFINITIONS, REFERENCES, STANDARDS

.1 AABC: the Associated Air Balance Council is a non-profit association of independent, certified agencies specializing in testing, adjusting, and balancing HVAC systems. The AABC National Standards, provides standards and operational criteria for HVAC systems.

.2 All Work shall be in accordance with the latest edition of the Associated Air Balance Council National Standards. If these contract documents set forth more stringent requirements than the AABC National Standards, these contract documents shall prevail.

1.4 QUALIFICATIONS

.1 Agency Qualifications: the TAB Agency shall be a current member of the AABC.

1.5 SUBMITTALS

.1 Qualifications: the TAB agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's test and balance engineer certificate.

.2 Procedures and Agenda: the TAB agency shall submit the TAB procedures and agenda proposed to be used.

.3 Sample Forms: the TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards.

1.6 TESTING ADJUSTING AND BALANCING PREPARATION AND COORDINATION

.1 Shop Drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB agency no later than 30 days prior to the start of TAB work.

.2 System installation and equipment start-up shall be complete prior to the TAB agency's being notified to begin.

.3 The building control system shall be complete and operational. The Contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.

.4 All test points, balancing devices, identification tags, etc., shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.

.5 Qualified installation or start-up personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

1.7 REPORTS

.1 Final TAB Report: the TAB agency shall submit the final TAB report for review by the Contract Administrator. All outlets, devices, HVAC equipment, etc., shall be identified, along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards.

.2 Submit six (6) copies of the Final TAB Report.

1.8 DEFICIENCIES

.1 Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate responsible person.

.2 The work necessary to correct items on the deficiency listing shall be performed and verified by the Contractor before the TAB agency returns to retest. Unresolved deficiencies shall be noted in the final report.

2. INSTRUMENTATION

.1 All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards.

3. EXECUTION

3.1 GENERAL

.1 The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards.

.2 Adjustment tolerances shall be plus or minus ten percent unless otherwise stated.

.3 Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.

.4 All information necessary to complete a proper TAB project and report shall be per AABC standards unless otherwise noted. The descriptions for work required, as listed in this section, are a guide to the minimum information needed.

3.2 AIR SYSTEMS

.1 The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. The TAB agency shall perform the following:

.1 TAB procedures in accordance with the AABC National Standards:

.1 For supply fans:

.1 Fan speeds: test and adjust fan rpm to achieve maximum or design air flow rate.

.2 Current and voltage: test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

.3 Pitot-tube traverse: perform a pitot-tube traverse of main supply and return ducts, as applicable to obtain total air flow rate.

.4 Outside air: test and adjust the outside air on applicable equipment using a pitot-tube traverse.

.5 If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 11°C (20°F) or use the difference between pitot-tube traverses of the supply and return air ducts.

.6 Static pressure: test and record system static profile of each supply fan.

.2 For exhaust fans:

.1 Fan speeds: test and adjust fan rpm to achieve maximum or design air flow rate.

.2 Current and voltage: test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.

.3 Pitot-tube traverse: perform a pitot-tube traverse of main exhaust ducts to obtain total air flow rate.

.4 Static pressure: test and record system static profile of each exhaust fan.

.3 For zone, branch and main ducts:

.1 Adjust ducts to within design air flow rate requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

.4 For diffusers, registers and grilles:

.1 Tolerances: test, adjust, and balance each diffuser, grille, and register to within ten percent of design requirements. Minimize drafts.

.2 Identification: identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

.5 For coils:

.1 Air temperature: once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

3.3 HYDRONIC SYSTEMS

.1 The TAB agency shall, as applicable, confirm that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards:

.1 For pumps:

.1 Test and adjust domestic hot water and glycol pumps to achieve maximum or design flow rate. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.

.2 Current and voltage: test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

.3 For system mains and branches:

.1 Adjust flow in pipes to achieve maximum or design flow rate.

.4 For coils:

.1 Tolerances: test, adjust, and balance all heat recovery coils within ten percent of design requirements.

.2 Verification: verify the type, location, final pressure drop and flow rate of each coil. This information shall be recorded on coil data sheets.

3.4 OPTIONAL TAB SERVICES

.1 Preconstruction Plan Check and Review:

.1 The TAB agency shall review the project documents and contractor submittals for their effect on the TAB process and overall performance of the HVAC system. It shall submit recommendations for enhancements or changes to the system within 30 days of document review.

.2 Job Site Inspections:

.1 During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times. (Typically, these are

performed when 60 percent of the total system is installed and again when 90 percent of the total system is installed, prior to insulation of the duct and piping). The TAB agency shall submit a written report of each inspection.

.3 Verification of HVAC Controls:

.1 The TAB agency shall be assisted by the building control systems contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:

.1 Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.

.2 Verify that all controlling instruments are calibrated and set for design operating conditions.

.4 Temperature Testing:

.1 To verify system control and operation, a series of three temperature tests shall be taken at approximately two hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than 1°C (2°F) from the thermostat or control setpoint during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

.5 TAB Report Verification:

.1 At the time of final review, the TAB agency may be required to recheck, in the presence of the Contract Administrator, specific or random selections of data recorded in the certified report. Points and areas for recheck shall be selected by the Contract Administrator. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed ten percent of the total number tabulated in the report.

.6 Building/Zone Pressurization:

.1 The TAB agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow, and gradually reduce the exhaust air rate to obtain the required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and gradually increase the exhaust air rate to obtain the required flow or pressure difference.

END OF SECTION