SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

This Section includes testing, adjusting and balancing (TAB) to produce design flows for the following:

1. Air Systems:
    a. Constant-volume air systems.
    b. Dual-duct systems.
    c. Variable-air-volume systems.
    d. Multizone systems.
    e. Induction-unit systems.

2. Hydronic Systems
    a. Constant-flow systems
    b. Variable-flow systems
    c. Primary-secondary systems
3. Kitchen hood systems
4. Fume hoods and Bio-Safety cabinet systems
5. Exhaust hood systems
6. Space pressurization
7. Shaft pressurization systems
8. Existing HVAC systems

1.2 DEFINITIONS

Accuracy: The *accuracy* of an instrument is the capability of that instrument to indicate the true value of a measured quantity.

Adjusting: *Adjusting* is the varying of system flows by partially closing balancing devices, such as dampers and valves, and varying fan speeds to achieve optimum system operating conditions within design and installation limitations.

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AHJ: The local governing **A**uthority **H**aving **J**urisdiction over the installation.

Balancing: *Balancing* is the methodical proportioning of air and hydronic flows through the system mains, branches, and terminal devices using acceptable procedures to achieve the specified airflow or hydronic flow within testing and design limitations.

Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

Conformed Contract Documents: Current and complete documents.

Deficiency: *Deficiency* is considered any circumstance that adversely affects the specified balance of a device or system.

Environmental Systems: *Environmental Systems* are systems that primarily use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

May: The word **may** is used to indicate a course of action that is permissible as determined by the NEBB Firm.

NEBB Certified TAB Firm: A *NEBB Certified TAB Firm* is a firm that has met and maintains all the requirements of the National Environmental Balancing Bureau for firm certification in Testing, Adjusting, and Balancing and is currently certified by NEBB. A NEBB Certified TAB Firm shall employ at least one NEBB Qualified TAB Supervisor in a full time management position.

NEBB Certified TAB Report: The data presented in a NEBB Certified TAB Report accurately represents system measurements obtained in accordance with the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems*. A NEBB Certified TAB Report does not necessarily guarantee that systems included are balanced to design flows. Any variances from design quantities, which exceed NEBB tolerances or contract document tolerances, are noted in the test-adjust-balance report project summary.

NEBB Qualified TAB Supervisor: A *NEBB Qualified TAB Supervisor* is a full time employee of the firm in a management position who has successfully passed the supervisor level written and practical qualification examinations and maintains the Supervisor re-qualification requirements of NEBB.

NEBB Qualified TAB Technician: A *NEBB Qualified TAB Technician* is a full time employee of the firm who has met the technician level experience requirements of NEBB and has successfully passed the technician level written and practical qualification examinations. A NEBB Qualified TAB Technician shall be supervised by a NEBB Qualified TAB Supervisor. (Supervision is not intended to infer constant oversight. A NEBB Qualified TAB Technician is capable of performing assigned tasks with periodic supervision.)

Precision: *Precision* is the ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

Procedure: A *Procedure* is defined as a specific set of tasks to be accomplished to achieve the defined result.

Range: *Range* is the upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.
Resolution: *Resolution* is the smallest change in a measured variable that an instrument can detect.

Shaft Pressurization System: A type of smoke-control system that is intended to positively pressurize stair and / or elevator shafts with outdoor air by using fans to keep smoke from contaminating the shafts during an alarm condition.

Shall: The word **shall** is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and procedures and from which no deviation is permitted. Note: In the event unique circumstances prevent a required action from being fulfilled, a notation shall be included in the TAB report explaining the exception. For example, such notation could be one of the following: *Not Available, Not Applicable, or Not Accessible.* The simple notation "N/A" is not allowed.

Should: The word **should** is used to indicate that a certain course of action is preferred but not necessarily required.

Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

TAB Technician: A *TAB Technician* is an employee of a NEBB Certified TAB firm who assists a NEBB Qualified TAB Supervisor and / or a NEBB Qualified TAB Technician by performing TAB work in the field. (Supervision is not intended to infer constant oversight. A TAB Technician may be capable of performing assigned tasks without direct, full time supervision.)

Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system

Testing: *Testing* is the use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristics, velocities, and air and hydronic quantities for an evaluation of flow conditions.

Testing, Adjusting, and Balancing (TAB): TAB is a systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as *"Testing*, *Adjusting, and Balancing"* and are described in this document.

1.3 TAB FIRM QUALIFICATIONS

The TAB Firm shall be NEBB Certified in Testing, Adjusting and Balancing of Air and Hydronic Systems.

1.4 TAB FIRM SUBMITTALS

1.4.1 Qualification Data: When requested, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in Sub-section 1.3 *TAB Firm Qualifications.*

1.4.2 TAB Agenda: When requested, submit 2 copies of the TAB Agenda. Include a complete set of report forms intended for use on this Project.

1.4.3 Certified TAB Reports: Submit a final TAB report in accordance with the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems*.

1.5 QUALITY ASSURANCE

1.5.1 The NEBB Certified TAB Firm shall submit 2 copies of the firm's NEBB TAB Certification.

1.5.2 When requested, the NEBB Certified TAB Firm shall furnish the NEBB Certificate of Conformance Certification.

1.5.3 TAB Report Forms: Prepare report forms in accordance with the requirements from the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.*

1.5.4 Instrumentation Calibration: Calibration of instruments shall be in accordance with the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.*

1.6 CONSTRUCTION TEAM RESPONSIBILITY TO TAB AGENCY

1.6.1 Provide the NEBB Certified TAB Firm with a conformed set of contract documents (drawings, specifications, and approved submittals), including all current approved change orders / contract modifications.

1.6.2 Develop a project schedule with the input of the NEBB Certified TAB Firm that coordinates the work of other disciplines and provides adequate time in the construction process to allow successful completion of the TAB work.

1.6.3 Notify the NEBB Certified TAB Firm of schedule changes.

1.6.4 Ensure that the building enclosure is complete, including but not limited to, all structural components, windows and doors installed, door hardware complete, ceilings complete, stair, elevator and mechanical shafts complete, roof systems complete, all plenums sealed, etc.

1.6.5 Ensure that all necessary mechanical work is complete. This includes, but is not limited to, duct leakage testing and hydrostatic testing. The piping systems should be flushed, filled, vented, and chemically treated. The duct systems and equipment have been cleaned. For additional requirements see the NEBB Pre-TAB checklist in Appendix B.

1.6.6 Complete the installation of permanent electrical power systems serving the HVAC equipment and systems. Such systems shall be properly installed in accordance with all applicable codes to ensure the safety of all construction personnel.

1.6.7 Complete the installation of all HVAC equipment and systems to ensure safe operation.

1.6.8 Perform the start up of all HVAC equipment and systems in accordance with the manufacturer’s recommendations.

1.6.9 Complete installation, programming (including design parameters and graphics), calibration, and startup of all building control systems.

1.6.10 Verify that the building control system provider has commissioned and documented their work before the TAB work begins.

1.6.11 Require that the building control system firm provide access to hardware and software, or onsite technical support required to assist the TAB effort. The hardware and software or the onsite technical support shall be provided at no cost to the NEBB Certified TAB Firm.

1.6.12 Furnish and install all drive changes as required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXAMINATION

Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. *Contract Documents* are defined in the General and Supplementary Conditions of Contract.

3.1.1 Verify that balancing devices, such as test ports, gauge cocks, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

3.1.2 Examine approved submittal data of HVAC systems and equipment.

3.1.3 Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, flow-control devices, balancing valves and fittings, and manual volume dampers, are installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

3.1.4 Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

3.1.5 Report deficiencies discovered before and during performance of TAB procedures. Record default set points if different from indicated values.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

3.2.1 Perform testing and balancing procedures on each system according to the procedures contained in the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems* and this section.

3.2.2 Mark equipment and balancing device settings (including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices) with paint or other suitable permanent identification material to show final settings.

3.3 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

Perform TAB of existing systems to the extent indicated by the contract documents and the current edition of the NEBB *Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems*.

3.4 ACCEPTANCE CRITERIA

The systems will be considered balanced in accordance with NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems* when the following conditions are satisfied:

3.4.1 All measured airflow and hydronic flow quantities are within ± 10 percent of the design quantities unless there are reasons beyond the control of the NEBB Certified TAB Firm. Deficiencies shall be noted in the TAB report.

3.4.2 There is at least one direct path with fully open dampers from the fan to an air inlet or outlet. Additionally, if a system contains branch dampers, there will be at least one wide-open path downstream of every adjusted branch damper.

3.4.3 There is at least one direct path with fully open balancing valves from the pump discharge balancing valve (if present) to a terminal device. Additionally, if a system contains branch balancing valves, there will be at least one wide open path downstream of every adjusted branch balancing valve.

3.5 REPORTING

Provide appropriate deficiency information to the construction team as TAB work progresses. Deficiency information shall be sufficient to facilitate contractor's dispatch of appropriate personnel to resolve items noted prior to final TAB work.

3.6 FINAL REPORT

The final report shall be in accordance with the requirements of the current edition of the NEBB *Procedural Standard for the Testing, Adjusting, and Balancing of Environmental System*.