



April 23, 2014

Addendum # 4

TO: ALL PROSPECTIVE BIDDERS

RE: IFB # 028-1-2014/BH

Please modify Project Manual for above referenced IFB as outlined:

ADD Specification Section 014520 as follows:

SECTION 014520 - TESTING, ADJUSTING, AND BALANCING (TAB)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. TAB Agent: The entity responsible for performing and reporting the TAB procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.
- O. CTI: Cooling Tower Institute.
- P. NEBB: National Environmental Balancing Bureau.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
- R. TAB: Testing, Adjusting, and Balancing

1.3 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days of the Contractor's Notice to Proceed, submit evidence that the TAB Agent and this Project's TAB team members meet the qualifications indicated in the "Quality Assurance" Article below.
- B. Warranty: Submit warranties indicated below.
- C. Special Guarantee: Submit Special guarantee indicated below
- D. Contract Documents Examination Report: Within 60 days of the Contractor's Notice to Proceed, submit the Contract Documents review report as indicated in Part 3 below.
- E. Strategies and Procedures Plan: Within 90 days of the Contractor's Notice to Proceed, submit the TAB strategies and step-by-step procedures as indicated in Part 3 below. Include a complete set of report forms intended for use on this Project.
- F. Testing Adjusting and Balancing Conference Notification: Within 120 days of the Contractor's Notice to Proceed, submit the testing adjusting and balancing conference notification. The notification shall include the date, time and location of the conference as well as a list of attendees.
- G. TAB Conference Minutes: Within 180 days of the Contractor's Notice to Proceed, submit the TAB conference minutes. Minutes shall include a list of attendees and a record of the discussions and decisions made during the conference.

- H. System Readiness Reports: 60 days prior to substantial completion the contractor performing work under section “Building Automation System” (BAS) shall complete pre-commissioning checklists. The contractor performing work under this section shall, as part of the system readiness report, witness pre-commissioning activities and shall initial each element on the pre-commissioning checklist. The system readiness report shall be completed and submitted as specified. Do not include the checklists as they will be submitted under section “BAS”.
- I. Certified TAB Reports: Within 60 days of substantial completion submit the testing and balancing reports prepared, as indicated in this Section, on approved forms certified by the TAB Agent.
 - 1. Balancing report.

1.4 QUALITY ASSURANCE

- A. Agent Qualifications: Agent and agent’s representatives shall be certified by either AABC or NEBB. The testing and balancing agent shall be one of the following:
 - 1. C&W Tesco, Inc.
430 Southlake Boulevard, Suite B-12
Richmond, VA 23236
804.379.9345
 - 2. Complete Commissioning, Inc.
6304 Aaron Lane
Clinton, MD 20735
301.877.2260
 - 3. Mechanical Systems Testing and Balancing, Inc. (MSTB)
7314 Impala Drive
Richmond, Virginia 23228
804.264.0454
 - 4. Testing Specialties, Inc.
PO Box 2788
Chesapeake, VA 23327
757.436.2345
- B. Testing and Balancing Agents not listed shall be permitted to bid. The following information shall be submitted as part of the Quality Assurance Submittal:
 - 1. Provide evidence of satisfactory completion of at least two projects of similar size and scope. Submit the following for each project:
 - a. Completed testing and balancing reports for each project.
 - b. If not included in the testing and balancing report, provide equipment startup checklists for each project.
 - c. Owner contact for each project.
 - d. Design engineer contact for each project.
 - e. Architect contact for each project.
 - 2. The architect shall determine whether the agent is qualified and the decision shall be final. Re-submittals on behalf of the same company shall not be considered.

- C. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Set meeting and submit TAB Conference Notification.
 - 1. Minimum Agenda:
 - a. Submittal distribution requirements.
 - b. Contract documents examination report.
 - c. TAB plan.
 - d. Work schedule and project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- D. TAB Reports: Use standard forms from AABC's "National Standards for TAB" or NEBB's "Procedural Standards for TAB of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for TAB of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

- A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Minimize conflicts with the Owner's operations.

1.6 COORDINATION

- A. Coordinate the efforts of work performed under other sections for operation of systems and equipment to support and assist TAB activities.
- B. Notice: Provide 7 days' advance notice to the contractor and Moseley Architects for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air, water, potable water, and non potable water distribution systems have been satisfactorily completed.

1.7 WARRANTY

- A. General Warranty: The national project performance guarantee indicated in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. Special Guarantee: Provide a guarantee on NEBB or AABC forms stating that NEBB or AABC will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are hereby required by the Contract Documents.
 - 2. Verify that quantities and locations of devices proposed by the contractor and indicated on the Contract Documents are accessible and appropriate for effective balancing and efficient system and equipment operation.
 - 3. Verify flow rates specified and compare to central equipment capacities.
 - 4. Identify discontinuities and omissions in the Contract Documents.
 - 5. Provide a detailed Testing and Balancing plan within six weeks of the Notice to Proceed.
 - 6. Record configuration, set up, parameters, etc, that change during the testing period.
 - 7. Respond to Warranty issues. Record configuration, set up, parameters, etc, that change during the warranty period.
- B. Examine BAS submittal data prior to submission and provide comments to contractor, and Moseley Architects.
- C. Examine submittal data of HVAC systems and equipment prior to submission and provide comments to contractor, and Moseley Architects.
- D. Examine project record documents and provide comments to contractor, and Moseley Architects.
- E. Examine Architect's design data, including HVAC system descriptions, statements of design, assumptions for environmental conditions, control drawings, and statements concerning systems and equipment.
- F. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use

tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

- G. Examine system and equipment installations to verify that they are complete and that TAB, and cleaning indicated has been performed.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment is ready for operation, including functioning controls.
- K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers for clean screens and proper perforations.
- M. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 - 5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to design values.

- R. Report deficiencies discovered before and during performance of TAB procedures.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 1. Permanent electrical power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for TAB of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating if high-efficiency motor.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass to prove proper operation. Record observations, including controller manufacturer, model number, serial number, and nameplate data.

3.5 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with air, water, and potable water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.6 TOLERANCES

A. Set system airflow, water, and potable water-flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: 0 to plus 10 percent.

2. Air Outlets: minus 10 percent to plus 10 percent.

3. Return Inlets: minus 10 percent to plus 10 percent.

4. Exhaust Inlets: 0 to plus 10 percent.

5. Heating-Water Flow Rate: minus 5 percent to plus 5 percent.

6. Cooling-Water Flow Rate: minus 5 percent to plus 5 percent.

7. Potable water: minus 5 percent to plus 5 percent.

8. Unless indicated otherwise: minus 10 percent to plus 10 percent.

3.7 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: When 50% of the construction contract period has elapsed, the contractor performing work under this section shall visit the site twice per month thereafter. After each site visit for each system being tested and balanced, prepare a report to describe completed work, work in progress, and work at variance with the contract documents. Include a list of deficiencies and problems found in each system. Prepare a separate report for each system and each building floor for systems serving multiple floors. Submit the report to the contractor and architect. The contractor shall be responsible for ensuring that deficiencies are corrected. Deficiencies shall remain on the list permanently, shall be issued with each report, and shall be checked off only when they are corrected.

3.8 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB Agent.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Contractor's name and address.

7. Report date.
8. Signature of TAB Agent who certifies the report.
9. Table of contents.
10. Operating sequences that vary from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type, and size.
13. Notes to explain why certain final data in the body of reports varies from design values.
14. Test conditions for fans and pump performance forms, including:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings, including:
 - 1) Percentage of maximum pitch or diameter.
 - 2) Maximum RPM.
 - 3) Minimum RPM on VAV systems.
 - e. Settings for supply-air static-pressure controllers on VAV systems.
 - f. System operating parameters/conditions that affect performance.

E. System Diagrams: Include schematic layouts of air, water, and potable water water distribution systems. Provide single-line diagrams including the following:

1. Quantities of outside, supply, return, exhaust, and water flow rates.
2. Duct outlet, and inlet sizes.
3. Pipe sizes and locations.
4. Indicated Terminal unit(s): Information & location(s).
5. Indicated Balancing station(s): Information & location(s).
6. Indicated Meter(s): Information & location(s).

F. Test Reports:

1. All equipment test reports.
2. Duct Traverse Reports.
3. Terminal-Device Reports.
4. Coil Reports.
5. Instrument Calibration Reports.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing work performed under this section, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods:

1. Winter: Re-test heating equipment, including central equipment and terminal devices, when the outside air temperature is below 30 degrees F.
2. Summer: Re-test cooling equipment, including central equipment and terminal devices, when the outside air temperature is above 90 degrees F.

END OF SECTION 014520

All other provisions of the IFB shall remain unchanged. These clarifications shall become part of the IFB package, and Bidder shall acknowledge receipt of the Addendum by signing in the space provided below and returning it with its bid.

Name: _____

(Prospective Bidder)

Signature: _____

Sincerely,

Bill Huskey, VCO

Buyer