

**SECTION 15990**  
**TESTING, ADJUSTING AND BALANCING**  
**AIR AND WATER SYSTEMS**

**PART 1 - GENERAL**

**1-01 DESCRIPTION**

- A. Lockheed Martin procurement documents and Division 1 apply to work of this section.
- B. Section includes testing of
  - 1. Air moving, ventilating and air conditioning ductwork systems.
  - 2. Hydronic systems required for air conditioning and ventilating systems.
- C. Related sections
  - 1. Section 13800 - Building Automation System
  - 2. Section 15500 - Heating, Ventilating and Air Conditioning
  - 3. Section 15880 - Air Distribution

**1-02 REFERENCES**

- A. American National Standards Institute (ANSI)
- B. American Society of Heating, Refrigerating, and Air Conditioning (ASHRAE)
- C. Associated Air Balance Council (AABC)  
National Standards for Total System Balance (NSFTSB)
- D. Illuminating Engineering Society of North America (IES)  
Recommended Practices
- E. National Environmental Balancing Bureau (NEBB)  
Procedural Standards for Testing - Adjusting Balancing of Environmental Systems
- F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC  
Systems Testing, Adjusting and Balancing

### **1-03 SUBMITTALS**

- A. Submit 3 copies of the following in accordance with Section 01300 and Terms and Conditions.
  - 1. Manufacturer's data, diagrams and drawings
  - 2. Testing agency and personnel qualifications
  - 3. Instrument calibration
  - 4. Testing schedules
  - 5. Balancing reports
    - a. Prior to construction: Report of existing conditions
    - b. Prior to and during preliminary balancing: Report of conditions that will prevent successful balancing
    - c. Within 48 hours of preliminary balancing: Preliminary balance reports
    - d. Within 2 weeks of 72 hour test: 4 complete final air and water balance reports, including test results and blueprints for acceptance in written form and on disk compatible with one of the following software programs: D-Base 3+ or Micro Soft Excel 3.0.
  - 6. Summary report of clean room certification

### **1-04 QUALIFICATIONS**

- A. Testing organization shall be a member of NEBB or AABC and provide proof that it meets the Technical Standards for membership.
- B. The testing organization shall be independent of the installing contractor or sub-contractors.
- C. Testing agency shall supply all the necessary test instruments and personnel required to accomplish all balancing and testing.
- D. All balancing contractors must be familiar with STAEFA controls.
- E. For clean rooms, no work shall be performed by the Contractor filter supplier or air balance contractor who does not have at least 10 years of proven clean room experience. All tests and acceptance procedures shall be performed by a qualified independent firm which is regularly engaged in this type of work, subject to approval by LMMS.

### **1-05 WARRANTY**

- A. Test and balance agency shall provide an extended warranty of 90 days.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3-01 GENERAL**

- A. After completion and field testing of HVAC systems, perform testing, adjusting and balancing of the entire air and water system to provide the air and water flow quantities indicated on the drawings, including sound levels if required.
- B. Perform work in accordance with the procedures specified and standards of AABC-NSFTSB, and NEBB.
- C. Test, adjust and balance all air and hydronic systems including fan, pumps, diffusers, exhaust systems, make-up, chilled and heating water systems to provide the new system requirements and maintain the recorded existing conditions of the non-modified areas connected to the system. Rebalance existing zones connected to the modified areas to their original recorded conditions even if not otherwise indicated in the scope of work. Exceptions will be indicated on the Supplemental Specifications and drawings.

### **3-02 PREPARATION**

- A. Before demolition or other work is started in air and water systems to be modified, record all existing conditions of CFM, GPM, fan and pump characteristics. Include all existing zones served by the system to be modified. Submit report of existing conditions
- B. Review plans and specifications prior to balancing and testing of the system. Submit written report to LMMS indicating any deficiencies in the system that would prevent the proper adjusting, balancing, and testing of the systems.
- C. Correct operational performance deficiencies resulting from field testing prior to balancing the system.
- D. If building is occupied, restore system to normal operating conditions at the end of each working day.

### **3-03 INSTRUMENTS**

- A. Furnish all instruments and equipment to be used for the testing and balancing of the air and water systems. All instruments to be used shall be accurate and calibrated according to the standards. LMMS has the right to request instrument recalibration and use of other instruments and methodology.

### **3-04 BALANCING OF AIR SYSTEMS**

- A. Test and balance air systems to meet design air quantities in accordance with AABC and NEBB standards and take duct pressure readings.
  - 1. Test, adjust and record each fan rpm to design requirements.
  - 2. Test and record motor full load amperes and rpm.
  - 3. Make pilot tube traverse of main supply ducts and obtain design cfm at fans.
  - 4. Test and record system static pressures, suction and discharge.
  - 5. Test and adjust system for design recirculated air, cfm.
  - 6. Test and adjust system for design cfm outside air.
  - 7. Test and record entering air temperatures (DB heating and cooling).
  - 8. Test and record entering air temperatures (WB cooling).
  - 9. Test and record leaving air temperatures (DB heating and cooling).
  - 10. Test and record leaving air temperatures (WB cooling).
  - 11. Adjust all main supply and return air ducts to proper design CFM.
  - 12. Adjust all zones to required design cfm, supply and return.
  - 13. Test and adjust each diffuser, register and grille to within five percent of design requirements.
  - 14. Include reading and test of required fpm, velocity and test resultant velocity, required cfm, and test resultant cfm after adjustments of register grilles.
- B. In cooperation with the temperature control manufacturer's representative, adjust automatically operated dampers to operate as indicated.
- C. Adjust diffuser, register, and grilles to eliminate drafts and noise in all areas. Record noise levels for each diffuser on balance report.
- D. Where new air volumes are required on new and existing air handling units, vary total air system quantities by adjustment of fan speeds. Provide larger or smaller pulleys and belts to drive fans at speeds necessary to give the indicated volumes. In all cases, do not exceed nameplate limits.
- E. Provide sheaves, guards, pulleys, belts and dampers required for correct balance as recommended by air balance company.
- F. Identify each grille, diffuser, and register as to location and area complete with final air balancing result on LMMS design blueprint and final air balancing report. These two documents shall correspond with each other for reference purposes. Completed blueprint shall accompany final air balance report.
- G. Identify and list size, type, and manufacture of diffusers, registers, and grilles, and all tested equipment. Use manufacturer's rating on all equipment to make required calculations.

### 3-05 BALANCING FOR WATER SYSTEMS

- A. Do not proceed with water balancing until air balancing is complete.
- B. Perform test and balance water systems in accordance with AABC and NEBB.
- C. Adjust water systems to meet indicated water quantities. Perform phased operations and balance of water systems.

#### Phase One - Water Systems Preparation

1. Open valves to full open position, including coil stop valves, bypass valves, and return line balancing valves. Set mixing valves to full coil flow.
2. Remove and clean strainers.
3. Verify with LMMS that water system is clean
4. Check pump rotation.
5. Check expansion tanks to ensure that they are not water bound and that the remainder of system is completely full of water.
6. Check air vents and determine that they are installed and operating correctly.
7. Set temperature controls so coils are calling for full cooling. This should close automatic bypass valves at coil and chillers. Follow same procedure when balancing hot water coils, set on full call for full heating.
8. Check operation of automatic valves.
9. Check and set operating temperatures of boilers and chillers to design requirements.

#### Phase Two - Water Systems Balancing

1. Set chilled water and hot water pumps to designed gallons per minute delivery.
2. Adjust water flow of hot water through boilers. Adjust water flow of chilled water through chillers.
3. Check leaving water temperatures and return water temperatures through chillers and boilers. Reset to correct design temperatures.
4. Check water temperature at inlet side of cooling and heating coils. Note rise or drop of temperatures from source.
5. Proceed to balance each chilled water coil and hot water coil.
6. Upon completion of flow readings and adjustments at coils, mark all settings and record all data on attached metal tags.

#### Phase Three - Completion

1. Upon completion of Phase One and Two, proceed with Phase Three.
2. After adjustments to coils are made, recheck settings at pumps and heat exchangers and readjust if required.
3. Record and check the following items at each cooling and heating element:
  - a. Inlet water temperatures
  - b. Leaving water temperatures
  - c. Pressure drop across bypass valve
  - d. Pump operating suction and discharge pressures and total dynamic head
  - e. List all mechanical specifications of pumps
  - f. Rated and actual running amperage of pump motor
  - g. Water metering device readings. Attach metal tags to devices and record readings if applicable.

#### **3-06 SOUND TEST**

- A. Test system to demonstrate compliance with sound requirements.

#### **3-07 PRELIMINARY REPORT**

- A. Notify the LMMS Project Manager immediately in writing during or after the preliminary report testing and balancing when:
  1. Major discrepancy between any design requirements and actual conditions will prevent successful balancing.
  2. Unable to balance any system due to unusual circumstances such as security or physical access restrictions, system or equipment being down, etc.

#### **3-08 OPERATIONAL TEST**

- A. Conduct a 72 hour operational test for the complete air conditioning and heating system after final balancing of duct system and calibration of all control systems and components. Demonstrate that all system components are operating correctly.
- B. Adjust and rebalance the system as required to meet the design conditions.

#### **3-09 BALANCING REPORT**

- A. Upon completion of testing and balancing procedures and within 2 weeks after completion of the 72 hour test, submit balancing reports.
- B. Follow the report outline and recommended report format as contained in Section V Chapter 26 of the AABC, NSFTSB National Standard Manual or NEBB Standard Format.

**3-10 RECHECK**

- A. After completion of test work, LMMS may request a recheck of results listed in the test report. Provide technicians to assist in making any tests required during this period of time.
- B. Selection for recheck will not exceed 25 percent of the total number tabulated in the report, except for special systems which may require a complete recheck.

**3-11 CERTIFICATION OF CLEAN ROOMS**

- A. Clean air distribution system per Section 15880, Air Distribution and clean walls, floors, ceiling and ductwork downstream of HEPA filters, etc., per Section 01710, Cleaning.
- B. All tests shall indicate conformance to specified cleanliness standards. Reclean areas not conforming as necessary to attain desired cleanliness level.
- C. Use only naturally occurring contaminant as a challenge media. The use of DOP or other artificially generated material is specifically prohibited.
- D. Testing and certification will follow a three stage process.
  - 1. As-Built: Room completed and ready for testing, with all air handling and associated equipment cleaned and ready for use. Balancing of filters and HVAC completed.
  - 2. At Rest: Room with all production equipment installed, but not operating. No personnel, except test persons in the area.
  - 3. Operational: Room with all production equipment operating, and the normal complement of personnel simulating work conditions.
- E. Particle counts shall meet the following limits during testing:

<u>Particle Size (Micron)</u>	<u>Specification</u>	<u>As-Built</u>	<u>Maxcount/Ft3 At Rest</u>	<u>Operational</u>
0.3	Class 1	1	1	3
0.3	Class 10	10	20	30
0.5	Class 100	25	50	100
0.5	Class 1,000	250	500	1,000
0.5	Class 10,000	2,500	5,000	10,000
0.5	Class 100,000	25,000	50,000	100,000

F. Certification tests

1. Perform the following certification tests using IES Recommended Practices, CC006.

<u>Test</u>	<u>Facility Status</u>	<u>Requirements</u>	<u>IES-RP CC006 Sect.</u>
Velocity	As-Built	90 FPM +/- 20	4
Filter Leak	As-Built	Replacement of defective units	5.2
Particle Count	As-Built	See Paragraph 15.4.F above	8
Enclosure Leak Test	As-Built	Satisfactory repair	10
Pressurization	As-Built	0.05 inch WC	11
Lighting Level	As-Built	70 FC (or as specified)	13
Noise Level Test	As-Built	NC 65 or less	14
Temperature	Operating	73 degree +/- 5 degree F	15
Humidity	Operating	20-60% RH (or as specified)	15
Vibration, as required	Operating	As specified	16

2. Perform the following certification test using an LMMS approved technique:

<u>Test</u>	<u>Facility Status</u>	<u>Requirements</u>
THC, as required	As-Built	15 ppm (max.) methane equivalent (or as specified)

- G. After completion of tests, submit 8 copies of a summary report outlining test requirements and results for review and acceptance.

END OF SECTION