DIVISION 15 - MECHANICAL

Section 15990 - Testing, Adjusting And Balancing

Introduction

Acceptance testing during construction and achieving an acceptable final air and water balance are critical elements of project completion. It is therefore extremely important that the balancing and the associated report be accomplished and submitted before or at the time of substantial completion. Similarly, timely reviews by the Consultant/UA will ensure that the final balance is acceptable prior to occupancy.

Part 1 – General

- Ductwork Acceptance Testing
    - Test pressure for ductwork shall be at the design pressure class for the system.
    - Ductwork downstream of terminal units and ductwork with a design pressure less than 1” wg may be approved via visual inspection by the University.
    - Testing to be per the latest edition of The SMACNA Air Leakage Testing Manual. If more stringent requirements are required discuss with UFS Project Manager and Mechanical Engineer and include requirements in the project construction documents.
    - Orifice tube to be provided of appropriate size to show allowable leakage within the calibrated range of the tube.
    - All tests to be witnessed by UFS Inspector.
    - Chart for converting pressure to volume shall be specific for the device used in testing.
    - If sample testing is allowed – the test sections will be randomly selected by the UFS inspector from completed work. The use of sample testing must be discussed with and approved by the UFS Project Manager

- Piping Systems Acceptance Testing
    - Piping to be inspected and pressure tested prior to insulation. Pressure test durations and pressures shall be per the table below.
    - Where not specified in the table, pressurized piping systems tests to be for a 4-hour duration.
    - Pressure gauge for the test must have a suitable range such that the test pressure is in the middle 1/3 of the range.
    - All tests to be witnessed by UFS Inspector.
    - No loss of pressure allowed for all testing.

Utility	**Minimum** Duration	**Minimum** Pressure
All Fire Protection	Per NFPA	Per NFPA
Gravity Systems	2 hrs.	10 ft hydraulic head or 5 psig pneumatic
Domestic Water	4 hrs.	100 psig
Mechanical Hydronic Piping	4 hrs.	150 psig
Low Pressure Steam	4 hrs.	150 psig
High Pressure Steam	4 hrs.	200 psig
Low Pressure Natural Gas (≤1/2 psig)*	30 minutes	10 sig
Medium Pressure Natural Gas (>1/2 psig)*	30 minutes	60 sig
Laboratory Gas**	4 hrs.	150 psig

* = Test per utility provider requirements, but no less than the above parameters.
** = Where laboratory gas service pressures exceed 100 psig, discuss with UFS Project Manager, UFS Mechanical Engineer, U of A Environmental Health & Safety for project specific requirements.

- Vibration Testing
    - Vibration testing to be performed on all rotating equipment 3 horsepower and above in accordance with AABC Standards.
    - Equipment shall have a maximum vibration velocity reading no greater than 0.04in/sec.
- Fume Hood Testing: Discuss with UFS
    - Each fume hood shall be identified with a plaque indicating the location and number of exhaust fan serving the hood.
    - Each exhaust fan shall be identified with a weather-proof plaque indicating the location(s) of the fume hood(s), by room number (s), that the fan serves.
- Air Systems
    - All work shall be in accordance with latest edition of AABC or NEEB Standards and applicable sections of ASHRAE and SMACNA HVAC systems testing, adjusting, and balancing procedures.
    - Prior to conducting TAB procedures, ensure that all manual dampers are in the fully open position unless indicated otherwise on the design documents.
    - Final air flow rates shall be within ± 10% of the design values or as indicated in the construction documents, whichever is most stringent. .
    - Ensure all temperature sensors and controls are calibrated prior to conducting test and balance procedures.
    - At the time of final inspection, recheck in the presence of the University and Design Professional, random selections of air quantities and fan data recorded in the certified report. Points or areas for recheck shall be selected by the University and Design Professional and be approximately 10% of the report data.
    - At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.
    - Testing to be conducted on a hierarchical principal, i.e. each piece of equipment for proper operation, followed by each sub-system followed by entire system, followed by inter-ties to other major systems.
    - Following final acceptance of the certified reports by the Design Professional, permanently mark the settings of all valves, dampers, and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.
    - VFD controlled fan systems to be tested in bypass mode to verify satisfactory operation of static pressure high limit sensor.
- Hydronic Piping Systems
    - Balance the entire water system to ensure all coils, heat exchangers, etc., are operating to design conditions. Adjust the circuits by means of the balancing valves and record balance position.
    - Prior to conducting TAB procedures, ensure that all manual valves are in the fully open position unless indicated otherwise on the design documents.
    - Final hydronic flow rates shall be within ± 10% of the design values or as indicated in the construction documents, whichever is most stringent.
    - After system balance, each pump shall be checked for design, working and shut-off head conditions. Any pump that varies by more than +10% from the design conditions shall have the impeller trimmed or changed until design conditions have been met. For variable speed pumps that vary by more than +20% at maximum speed, discuss with UFS Project Manager and Mechanical Engineer.
    - Flow through all heat exchangers, chillers, boilers, and other such equipment shall be balanced to ensure that the pressure drop through the equipment is within ± 10% of the manufacturer's design conditions while still maintaining design flow rates within tolerance.
    - When both the air and water systems are fully operational, entering air and water and leaving air and water readings shall be taken as close as possible to the peak design conditions to ensure the coil performance meets the design conditions. Coil water working conditions shall only be taken in conjunction with the air flow working conditions for the coil.
    - Coordinate with the Contractor to ensure that all necessary valves for control and balancing are installed in all locations required. Notify the University and Design Professional in writing that this coordination has

taken place. Include in this letter any recommendations made regarding valves, locations, installation, etc.
- Testing to be conducted on a hierarchical principal, i.e. each piece of equipment for proper operation, followed by each sub-system followed by entire system, followed by inter-ties to other major systems.
- Following final acceptance of the certified reports by the University and Design Professional, permanently mark the setting of all valves and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

- **Part 2 - Products**

  No Discussion.

- **Part 3 – Execution**
- All required balancing shall be completed and the final report submitted as a condition of substantial completion.

End of Section 15990