1. GENERAL

1.01 SECTION INCLUDES

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 DEFINITIONS

.1 "Agency" – means agency to perform testing, adjusting, and balancing work.

.2 "TAB" – means testing, adjusting, and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.

.3 "hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.

.4 "air systems" – includes outside air, supply air, return air, exhaust air, and relief air systems.

.5 "flow rate tolerance" – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.

.6 "report forms" – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting, and balancing.

.7 "terminal" – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

.8 "main" – means duct or pipe containing system's major or entire fluid flow.

.9 "submain" – means duct or pipe containing part of the systems' capacity and serving 2 or more branch mains.

.10 "branch main" – means duct or pipe servicing 2 or more terminals.

.11 "branch" – means duct or pipe serving a single terminal.

1.03 SUBMITTALS

.1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.

.2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

.3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

1.04 CLOSEOUT SUBMITTALS

.1 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.

.2 Submit a draft report, as specified in Part 3 of this Section.

.3 Submit a final report, as specified in Part 3 of this Section.

.4 Submit a testing and balancing warranty as specified in Part 3 of this Section.

.5 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.05 QUALITY ASSURANCE

.1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting, and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:

.1 AABC – Associated Air Balance Council;

.2 NEBB – National Environmental Balancing Bureau.

.2 NBCTA certification in lieu of the above noted organizations is not permitted.

.3 Testing, adjusting, and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with one of following publications:

.1 National Standards for a Total System Balance published by Associated Air Balance Council;

.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;

.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

2. PRODUCTS – NOT USED

3. EXECUTION

3.01 SCOPE OF WORK

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.

.2 Mechanical systems to be tested, adjusted, and balanced include:

.1 TAB of domestic water systems (all piping extended from Municipal main) is to include:

.1 domestic hot water recirculation piping;

.2 tempered water piping flows.

.2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.3 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.4 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities, and flows.

3.02 TESTING, ADJUSTING, AND BALANCING

.1 Conform to following:

.1 as soon as possible after award of Contract, Agency is to carefully examine a set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;

.2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;

.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting, and balancing;

.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;

.5 testing, adjusting, and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting, and balancing;

.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;

.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;

.11 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;

.12 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;

.13 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of ±5% of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;

.14 Agency is to perform testing, adjusting, and balancing to within ±5% of design values, and make and record measurements which are within ±2% of actual values;

.15 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;

.16 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

.2 Prepare reports as indicated below.

.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports and submit for review.

.2 Upon verification and approval of draft reports, prepare final reports organized and formatted as specified below. Use units of measurement (SI or Imperial) as used on Project Documents.

.3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Report forms complete with schematic systems diagrams and other data are to be consolidated in electronic format as a PDF. PDF file to be indexed and organized into sections, as it applies to the project, as follows:

.1 General Information and Summary;

.2 Air Systems;

.3 Hydronic Systems;

.4 Temperature Control Systems;

.5 Special Systems.

.4 Agency is to provide following minimum information, forms, and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;

.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;

.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;

.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition,

Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting, and balancing, they are to be immediately corrected without additional cost to Owner.

End of Section