

Capital Projects Group

Testing, Adjusting and Balancing Specification

Specification 20 05 50

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Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes

LIST OF CONTENT

1. GENERAL.....	2
1.1. SCOPE OF WORK	2
1.2. RELATED WORKS.....	2
1.3. REFERENCE STANDARDS	2
1.4. SUBMITTALS	2
1.5. QUALITY ASSURANCE.....	3
2. PRODUCTS.....	4
2.1. NOT USED.....	4
3. EXECUTION	4
3.1. SCOPE OF WORK	4
3.2. TESTING, ADJUSTING AND BALANCING	5

1. GENERAL

1.1. SCOPE OF WORK

- 1.1.1. Provide testing, adjusting and balancing (TAB) work to equipment and systems as detailed on drawings and as specified herein.
- 1.1.2. 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.

1.2. RELATED WORKS

- 1.2.1. Section 20 05 05 - Mechanical Work General Instructions. Refer to Section 20 05 05 for specific definitions related to this Section.
- 1.2.2. Section 20 05 10 - Basic Mechanical Materials and Methods.
- 1.2.3. Section 20 05 40 - Mechanical Work Commissioning.
- 1.2.4. Other Mechanical Division sections.

1.3. REFERENCE STANDARDS

- 1.3.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.
- 1.3.2. Associated Air Balance Council (AABC).
- 1.3.3. CAN/CSA B139, Installation Code for Oil-Burning Equipment.
- 1.3.4. Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.
- 1.3.5. National Environmental Balancing Bureau (NEBB).
- 1.3.6. National Standards for a Total System Balance published by Associated Air Balance Council.
- 1.3.7. Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau.

1.4. SUBMITTALS

- 1.4.1. Refer to submittal requirements in Section 20 05 05.
- 1.4.2. 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.

- 1.4.3. 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.
- 1.4.4. 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.
- 1.4.5. Submit a report by Agency after each site visit made by Agency during construction phase of this Project.
- 1.4.6. Submit a draft report, as specified in Part 3 of this Section.
- 1.4.7. Submit a final report, as specified in Part 3 of this Section.
- 1.4.8. Submit a testing and balancing warranty as specified in Part 3 of this Section.
- 1.4.9. Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.5. QUALITY ASSURANCE

- 1.5.1. 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 five projects similar to this Project within past three years, and is to be certified as an independent agency in required categories by one of following:
 - a) AABC - Associated Air Balance Council;
 - b) NEBB - National Environmental Balancing Bureau.
- 1.5.2. TAB technicians performing work are to be fully qualified and experienced in TAB of respective products and work.
- 1.5.3. 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:
 - a) National Standards for a Total System Balance published by Associated Air Balance Council;
 - b) Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;
 - c) Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

1.5.4. Regulatory Requirements:

- a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.
- b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. NOT USED

3. EXECUTION

3.1. SCOPE OF WORK

3.1.1. 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.

3.1.2. Mechanical systems to be tested, adjusted and balanced include but are not limited to following:

- a) 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.
- b) TAB of fuel oil system is to include supply and return oil flows as applicable, and is to be in accordance with requirements of CAN/CSA B139;
- c) 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";
- d) 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";
- e) TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows;
- f) TAB of snow melting glycol systems;
- g) TAB of in floor heating glycol systems;

- h) Existing systems, revised as part of mechanical work, are to be tested, adjusted and balanced as for new systems.

3.2. TESTING, ADJUSTING AND BALANCING

3.2.1. Conform to following requirements:

- a) as soon as possible after award of Contract, Agency is to carefully examine a white print 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;
- b) 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;
- c) 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;
- d) 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;
- e) 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.
- f) mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;
- g) obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;
- h) 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;
- i) Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

- j) wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;
- k) for belt-driven equipment, Agency is to report to Commissioning Agent who in turn is to inform Contractor and Consultant of any situation where sheaves have to be replaced to suit testing and balancing, and replacements are to be done by Contractor at no cost;
- l) 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 afore mentioned 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;
- m) 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;
- n) 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 $\pm 5\%$ of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;
- o) Agency is to perform testing, adjusting and balancing to within $\pm 5\%$ of design values, and make and record measurements which are within $\pm 2\%$ of actual values;
- p) for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;
- q) 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.

3.2.2. Prepare reports as indicated below.

- a) 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. Submit two complete sets of draft reports. Only one complete set of draft reports will be returned.

- b) Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit two complete sets of final reports. Use units of measurement (SI or Imperial) as used on Project Documents.
 - c) 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. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:
 - 1) General Information and Summary;
 - 2) Air Systems;
 - 3) Hydronic Systems;
 - 4) Temperature Control Systems;
 - 5) Special Systems.
 - d) 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.
- 3.2.3. 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.

- 3.2.4. When final report has been accepted, Contractor is to submit to Metrolinx, in name of Metrolinx, 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 Metrolinx, 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 Metrolinx.
- 3.2.5. After acceptance of final report, Agency is to perform post testing and balancing site visits in accordance with following requirements:
- a) post testing and balancing site visits are to be made for each year of equipment 2 years warranty period; for each year perform TAB:
 - 1) once during 1st month of building operation;
 - 2) once during 3rd month of building operation;
 - 3) once between 4th and 12th months in a season opposite to 1st and 3rd month visit.
 - b) during each return visit and accompanied by Metrolinx representative, Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints;
 - c) Agency is to schedule each visit with Contractor and Metrolinx, and inform Consultant;
 - d) after each follow-up site visit, Agency is to issue to Contractor and Consultant a report indicating any corrective work performed during visit, abnormal conditions and complaints encountered, and recommended corrective action.

END OF SECTION