METROLINX

Capital Projects Group

Mechanical Work Commissioning Specification

Specification 20 05 40

Revision 0
Date: August 2018

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Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes

LIST OF CONTENT

1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Commission work in accordance with requirements of this Section and as required by Consultant, Commissioning Agent and outlined in Commissioning Plan.

1.1.2. Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.1.3. This Section specifies commissioning requirements that are common to Mechanical Divisions Work Sections and it is a supplement to each Section and is to be read accordingly.

1.1.4. Retain services of a qualified Commissioning Agent to provide following commissioning objectives:

a) prepare Commissioning Plan aligned with Metrolinx Commissioning Plan and project closeout documents;

b) to support quality management by means of monitoring and checking installation;

c) to verify equipment/system performance by means of commissioning of completed installation;

d) to move completed equipment/systems from "static completion" state to "dynamic" operating state to transfer a complete and properly operating installation from Contractor to Metrolinx.

1.1.5. Prerequisites to successful completion of commissioning:

a) submittal of signed start-up and test reports;

b) completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;

c) permanent electrical and control connections of equipment;

d) successful completion and documentation of pre-functional performance testing;

e) submittal of letters to Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

1.2. RELATED WORKS

1.2.1. Sections of Mechanical Divisions work.

1.2.2. Metrolinx documentation outlining station services commissioning and handover protocol.

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. ASHRAE Guideline 0, The Commissioning Process.

1.3.3. ASHRAE Guideline 1.1, The HVAC Commissioning Process.

1.3.4. ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems.

1.3.5. ASHRAE Guideline 1.5, Commissioning Smoke Control Systems.

1.3.6. CAN/CSA B139, Installation Code for Oil-Burning Equipment.

1.3.7. CAN/CSA B149.1, Natural Gas and Propane Installation Code.

1.3.8. CAN/CSA B149.2, Propane Storage and Handling Code.

1.3.9. CSA Z320, Building Commissioning Standard and Check Sheets.

1.4. SUBMITTALS

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

1.4.2. Submit copies of Commissioning Agent qualification credentials.

1.4.3. Commissioning Package

a) Submit the following:

1) Commissioning Plan;

2) Commissioning Procedures;

3) Certificate of Readiness;

4) complete test sheets specified in Section 20 05 40; attach to the Certificate of Readiness;

5) Source Quality Control inspection and test results attached to the Certificate of Readiness.

1.4.4. Commissioning Closeout Package

a) Submit the following:

1) Deficiency Report;

2) Commissioning Closeout Report;

3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals:

i) Identification: manufacturer’s name, type, year, serial number, number of units, capacity, and identification to related systems;

ii) functional description detailing operation and control of components;

iii) performance criteria and maintenance data;

iv) safety precautions;

v) operating instructions and precautions;

vi) component parts availability, including names and addresses of spare part suppliers;

vii) maintenance and troubleshooting guidelines/protocol;

viii) product storage, preparation, handling, and installation requirements;

ix) Commissioning Report.

1.4.5. Submit to Commissioning Agent, at same time as submittal to Consultant, copies of each shop drawing or product data sheet associated with equipment or systems to be commissioned.

1.4.6. Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.

1.4.7. Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

1.4.8. Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

1.4.9. After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter (Certificate of Readiness) confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.4.10. Submit complete documented and signed test reports with recorded results test sheets.

1.4.11. Submit close out documentation including deficiency lists with confirmation of deficiencies being corrected.

1.5. QUALITY ASSURANCE

1.5.1. Commissioning work is to be in accordance with requirements of referenced standards and Commissioning Agent.

1.5.2. Commissioning Agent is to meet following qualifications:

a) be a third-party company to Contractor;

b) be a member of Professional Engineers Association in Province of the work;

c) be a member of Building Commissioning Association, and a Certified Commissioning Professional (CCP) as designated by Building Commissioning Association;

d) have a minimum of five years of successful documented commissioning experience on projects of similar size and complexity as this Project;

e) supply a qualified P. Eng. and a Building Commissioning Association Certified Commissioning Professional (CCP) or an ASHRAE Commissioning Project Management Professional (CPMP) on site to supervise commissioning process.

1.6. COMMISSIONING TERMINOLOGY

1.6.1. Commissioning: process of demonstrating to Metrolinx and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.

1.6.2. Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.

1.6.3. Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm equipment has been properly installed and is operational as intended.

1.6.4. Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

1.6.5. Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

1.6.6. Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.

1.6.7. Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.

1.6.8. Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.7. TESTING EQUIPMENT

1.7.1. Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2. PRODUCTS

2.1. NOT USED

3. EXECUTION

3.1. COMMISSIONING

3.1.1. Perform commission work in accordance with requirements of this Section and as required by Commissioning Agent and in compliance with standards listed in Part 1including but not limited to CAN/CSA B139, B149.1,149.2 and Z320, and ASHRAE Guidelines 0, 1.1, 1.2 and 1.5.

3.1.2. Project may be constructed in phases as described in issued documents. Phase commissioning to suit progress and phases of Work.

3.2. DEFICIENCIES LISTED DURING COMMISSIONING

3.2.1. Commissioning Agent and Consultant to list deficiencies. Contractor to correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Metrolinx and Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent immediately.

3.2.2. Document that each deficiency has been corrected and verified.

3.3. SYSTEMS TO BE COMMISSIONED

3.3.1. Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent. Include for applicable requirements from below and supplement to meet any specific project requirements.

3.3.2. Commissioning of drainage systems includes:

a) commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;

b) commissioning of equipment such as interceptors and backflow preventers.

3.3.3. Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Metrolinx's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.

3.3.4. Commissioning of water systems (all piping extended from Municipal main) includes:

a) commissioning of pumps and controls;

b) commissioning of water heaters;

c) commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;

d) commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;

e) commissioning of plumbing fixtures;

f) commissioning of well water systems;

g) commissioning of septic systems.

3.3.5. Commissioning of compressed air system includes "head end" compressor equipment, pressure reducing equipment, and outlets.

3.3.6. Commissioning of natural gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.1, and any supplemental requirements of governing authorities.

3.3.7. Commissioning of propane gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.2, and any supplemental requirements of governing authorities.

3.3.8. Perform commissioning of fuel oil system in accordance with requirements of CAN/CSA B139.

3.3.9. Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. 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".

3.3.10. Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. 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".

3.3.11. Commissioning of HVAC chemical treatment systems includes feed and monitoring equipment, and testing of system fluids to confirm proper concentration of chemical. Note that use of such chemical treatment systems is subject to Metrolinx approval (Environmental).

3.3.12. Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.

3.3.13. Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above, and integrated lighting and occupancy controls.

3.3.14. Control work commissioning includes confirmation of proper operation of equipment and systems connected offsite to remote systems and communications with remote systems.

3.3.15. Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.

3.3.16. Commissioning of special usage room controls includes confirmation of proper operation of individual components, and proper operation of overall control system, all in accordance with governing Codes and Standards.

3.3.17. Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

3.3.18. Commissioning of snow melting systems.

3.3.19. Commissioning of in-floor heating systems.

3.3.20. Perform commissioning of existing systems, revised as part of the Work, to standards as for new systems.

3.3.21. Where equipment is integrated to other equipment (BAS, boilers, etc.) to provide a system with sequence of operations, commission equipment as a complete system to ensure proper sequence of operations.

3.4. COMMISSIONING PROCESS

3.4.1. Perform commissioning process in stages and include, but not be limited to, following:

a) Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual;

b) Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions;

c) Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work;

d) Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work;

e) Stage 5: Successful seasonal commissioning of all building equipment and systems;

f) Stage 6: Successful 2nd year of warranty period commissioning of all building equipment and systems, similar to process for 1st year.

3.5. RESPONSIBILITIES OF COMMISSIONING AGENT

3.5.1. During construction phase, Commissioning Agent is to:

a) review Contractor's shop drawings for commissioning related issues, and report any such issues to Consultant;

b) as soon as possible after project start-up, prepare and issue a Commissioning Plan based on Contractor's construction schedule;

c) prior to tests, supply pre-functional performance test commissioning data sheets for equipment and systems to be commissioned to Contractor;

d) monitor and inspect installation on a regular basis throughout construction stages, issue reports identifying any issues which may have an impact on commissioning process, and work with project team to expeditiously resolve any problems that may arise due to site conditions;

e) arrange with Contractor for on-site commissioning meetings on an as-required basis, to be attended by Contractor and applicable subcontractors, Metrolinx, and Consultant, chair meetings, and prepare and distribute meeting minutes to attendees;

f) witness and validate tests, identify deficiencies, and issue progress reports;

g) coordinate commissioning scheduling with Contractor;

h) review final TAB report on site with Contractor, and check 100% of TAB results for fan equipment, 100% of TAB results for duct systems outward from fan equipment, and issue a report to Consultant;

i) for smaller multiple items of equipment such as air terminal boxes, fan coil units, backflow preventers, and similar equipment, review completed commissioning data sheets submitted by Contractor and review data sheet information on-site with Contractor for 100% of quantity of each item of equipment;

j) review pre-functional performance test commissioning data sheets submitted by Contractor, then witness and supervise functional performance testing and supervise and direct commissioning process, validate commissioning procedures, witness completion of commissioning data sheets by Contractor, and sign completed data sheets;

k) perform a preliminary review of Contractor's O & M Manuals, before they are issued to Consultant, and issue any comments to Consultant;

l) coordinate, with Contractor and Metrolinx, training and instructions by Contractor and his equipment and system manufacturers/suppliers to Metrolinx's operating and maintenance personnel, and comment on quality of training and instructions to Consultant;

m) prepare and issue Systems Operation Manual to Metrolinx prior to equipment and system training by Contractor.

3.5.2. During post construction phase, Commissioning Agent is to:

a) prepare and issue final report on commissioning, identifying any deficiencies that remain outstanding;

b) recommend any training and/or instructions to be given to Metrolinx's operating and maintenance personnel in addition to training and instructions already given;

c) after Substantial Performance of the Work, perform witness system checks and validate documentation by Contractor for each year of 2-year warranty period; for each year perform as follows:

1) once during 1st month of building operation;

2) once during 3rd month of building operation;

3) once between 4th and 12th month of building operation but during a season opposite to 1st or 3rd month visits.

d) ensure any deficient work resulting from system checks described above are corrected;

e) 1 year after Substantial Performance of the Work, attend a question and answer session(s) with Contractor to answer any questions and concerns related to commissioning work from Metrolinx's operating personnel.

3.6. RESPONSIBILITIES OF CONTRACTOR

3.6.1. During construction phase, Contractor is to:

a) prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;

b) prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule monthly as required;

c) when requested by Commissioning Agent, arrange site commissioning meetings with Metrolinx, Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;

d) promptly correct reported deficient work, and report when corrective work is complete;

e) where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;

f) under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;

g) complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 100% of data sheet information for each type of equipment, and perform any corrective action required because of site checks;

h) perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required because of site checks by Commissioning Agent;

i) in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant and Commissioning Agent a minimum of 5 working days' notice;

j) perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.

3.6.2. During post construction phase, Contractor is to:

a) optimize system operation in accordance with building occupant's needs and comments using System Operation Manual prepared by Commissioning Agent as reference;

b) complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

c) accompanied by Commissioning Agent, perform complete system checks and "fine tuning" with signed documentation for each year of 2 years of warranty period; for each year perform as follows:

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 visits.

d) correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

e) 1 year after Substantial Completion conduct a question and answer session(s) at building with Metrolinx operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that must be addressed.

END OF SECTION