

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Water Works Association (AWWA)
- .2 Public Works and Government Services Canada (PSPC)
 - .1 PSPC - Commissioning Guidelines CP.4 - current edition.
- .3 Underwriters' Laboratories of Canada (ULC)
- .4 CSA-Z320-11 – Building Commissioning Standard
- .5 ASHRAE 202-2013 – Commissioning Process for Building and Systems

1.2 GENERAL

- .1 Term "Cx" in this section means "Commissioning".
- .2 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .3 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .4 Commissioning terms used in this Section:

- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.3 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 3 months during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.4 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PSPC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 Departmental Representative: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
 - .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Developing BMM.
 - .6 Ensuring implementation of final Cx Plan.

- .7 Performing verification of performance of installed systems and equipment.
- .8 Implementation of Training Plan.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Departmental Representative and PSPC Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.5 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
 - .5 Client: responsible for intrusion and access security systems.
 - .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.

- .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
 - .4 Redistribution of electrical services.
- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.6 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment:
 - .1 HVAC and exhaust systems:
 - .1 HVAC systems indicated on drawings. This includes rooftop units 1-30, and new distribution systems as shown.
 - .2 General exhaust systems for washrooms.
 - .3 Exhaust systems and related systems for the smudging room.
 - .2 EMCS:
 - .1 Ensure new equipment is operating as intended on existing control software.
- .2 Commission electrical systems and equipment:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment.
 - .2 Low voltage distribution systems.

1.7 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.

- .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.8 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests performed by Departmental Representative/User.
 - .10 Training Plans.
 - .11 Cx Reports.
 - .12 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.

1.9 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor some of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To

- be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
- .6 Departmental Representative will monitor some of these inspections and tests.
- .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - MECHANICAL:
 - .1 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
 - .2 EMCS:
 - .1 EMCS trending to be available as supporting documentation for performance verification.
 - .2 Perform point-by-point testing in parallel with start-up.
 - .3 Carry out point-by-point verification.
 - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of Final Acceptance Test period.
 - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.
 - .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".
- .3 Pre-Cx activities - ELECTRICAL:
 - .1 Low voltage distribution systems under 750 V:
 - .1 Requires contractor to coordinate shutdown requirements with departmental representative where applicable.
 - .2 Requires contractor to perform pre-energization and post-energization tests.
 - .3 Where equipment is to be retro-fitted into existing systems, manufacturer shall perform all pre-energization and post-energization tests so as to ensure system warranty is maintained.
 - .4 Refer to Section 26 08 00.

1.10 START-UP

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

- .1 Rooftop Units
- .2 Exhaust Fans
- .3 Controls
- .4 Distribution Panel EDP-2
- .3 Departmental Representative to monitor some of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative reserves right to verify up to 25% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.11 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.12 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.

- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
 - .1 HVAC and associated systems forming part of integrated HVAC systems: news systems as shown on drawings. Existing systems not in scope.
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PSPC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.13 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33- Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.14 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33- Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.15 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33- Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.17 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.
 - .4 Cx procedures: 3 months after award of contract.
 - .5 Cx Report format: 3 months after contract award.

- .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
- .7 Discussion of electrical distribution shutdown dates and durations: at start-up.
- .8 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
- .9 Notification of intention to start TAB: 21 days before start of TAB.
- .10 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
- .11 Notification of intention to start Cx: 14 days before start of Cx.
- .12 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
- .13 Identification of deferred Cx.
- .14 Implementation of training plans.
- .15 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.18 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.19 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.20 TESTS TO BE PERFORMED BY DEPARTMENTAL REPRESENTATIVE/USER

- .1 None is anticipated on this project.

1.21 TRAINING PLANS

- .1 Refer to Section 01 91 41- Commissioning (Cx) - Training.

1.22 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION