

## **PART 1      GENERAL**

### **1.1      REFERENCES**

- .1      National Fire Protection Association (NFPA)
  - .1      NFPA-13-02, Installation of Sprinkler Systems Handbook.
  - .2      NFPA-14-02, Automatic Sprinkler Systems Handbook.
  - .3      NFPA-20-03, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .2      Public Works and Government Services Canada (PWGSC)
  - .1      PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.

### **1.2      GENERAL**

- .1      Provide a fully functional facility:
  - .1      Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
  - .2      Facility user and O M personnel have been fully trained in aspects of installed systems.
  - .3      Optimize life cycle costs.
  - .4      Complete documentation relating to installed equipment and systems.
- .2      Term "Cx" in this section means "Commissioning".
- .3      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 the 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.
- .4      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.
- .5 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 DEVELOPMENT OF 100% CX PLAN**

- .1 Cx Plan to be 95% completed before added into Project Specifications. Cx Plan to be 100% completed within eight (8) weeks of award of contract to take into account:
  - .1 Approved shop drawings and product data.
  - .2 Approved changes to contract.
  - .3 Contractor's project schedule.
  - .4 Cx schedule.
  - .5 Contractor's, sub-contractor's, suppliers' requirements.
  - .6 Project construction team's and Cx team's requirements.
- .2 Submit completed Cx Plan to Departmental Representative and obtain written approval.

### **1.4 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 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .3 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

### **1.5 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 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
  - .2 PWGSC Quality Assurance Commissioning Manager: 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 PWGSC 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.

## 1.6 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 Is 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.
      - .5 Modifications of fire alarm systems.
      - .6 Modifications to voice communications systems.
  - .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx three (3) months prior to starting date of Cx for review and approval.

## 1.7 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment:
  - .1 HVAC and exhaust systems:
    - .1 HVAC systems.
    - .2 General exhaust systems.
    - .3 Exhaust systems and related systems.
  - .2 IAQ environmental control systems:

- .1 Indoor conditions in areas listed herein.
  - .2 Indoor air quality (IAQ) in areas listed herein.
- .2 Commission electrical systems and equipment:
  - .1 High voltage systems:
    - .1 Low voltage below 750 V.
    - .2 Low voltage equipment.
  - .2 Lighting systems - Lighting equipment.
    - .1 Distribution circuits.
    - .2 Lighting equipment.

## **1.8 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.

## **1.9 DELIVERABLES RELATING TO THE CX PROCESS**

- .1 General:
  - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form are 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 Start-up, 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 of following witnessed by PWGSC Design Quality Review Team:
- .10 Tests performed by Owner/User.
- .11 Training Plans.
- .12 Cx Reports.
- .13 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

#### **1.10 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 all 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 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.
    - .5 Perform routine checks.

- .3 Pre-Cx activities - LIFE SAFETY SYSTEMS
  - .1 Include equipment and systems identified above.
  - .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .4 Pre-Cx activities - ELECTRICAL:
  - .1 Low voltage distribution systems under 750 V:
    - .1 Requires independent testing agency to perform pre-energization and post-energization tests.
  - .2 Emergency power generation systems
    - .1 Test transfer switches in case of simultaneous loss of load.
  - .3 Lighting systems:
    - .1 Emergency lighting systems:
      - .1 Verification of lighting levels and coverage by disrupting normal power.
  - .4 Security, surveillance and intrusion alarm systems: to include verification by Departmental Representative.

#### 1.11 **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:
- .3 Departmental Representative will 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 Failure of randomly selected item shall result in rejection of PV report or report of system start-up and testing.

#### 1.12 **ACTIVITIES DURING WARRANTY PERIOD**

- .1 Since 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.

**1.13 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.

**END OF SECTION**