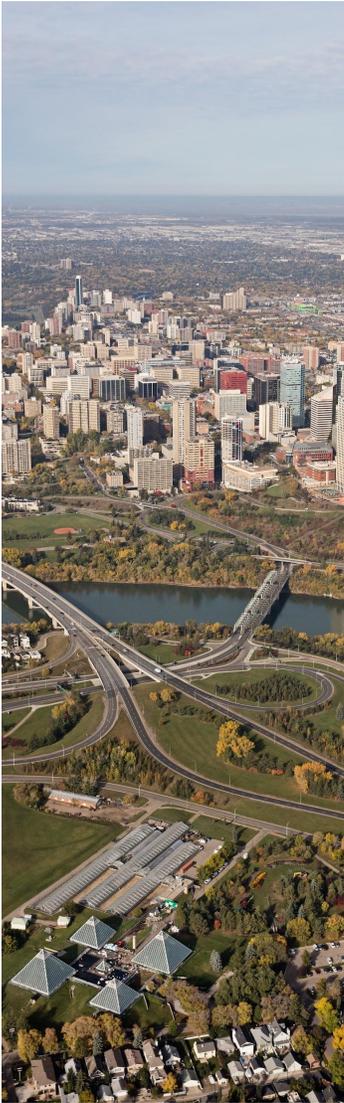


INTEGRATED INFRASTRUCTURE SERVICES

Facility Engineering Services

Facility Planning & Design

Facility Infrastructure Delivery



Facility Commissioning Manual

Volume 1

COE-IM-GUIDE-0027

Building Systems Commissioning Process and Guidelines v3.0

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Edmonton

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Professional Work Product (PWP) Responsibility Matrix	
Authenticator (Seal)	Validator (Permit)
	

1 Introduction

1.1 Purpose and Scope

- .1 This document is intended to be used for the following purposes:
 - .1 A reference for Cx Providers, delivering Commissioning Process services for new building projects, rehabilitations and renewals, retro commissioning existing facilities or re-commissioning of existing systems owned or operated by the City of Edmonton (CoE).
 - .2 A resource for the City of Edmonton when reviewing and evaluating the work performed by Cx Providers on City Projects.
- .2 This document is divided into the following sections:

Section 1 – Introduction:
Establishes the scope of the document and gives general contact information.

Section 2 – Commissioning Process:
Describes the information flow on a typical project, standard deliverables expected at each phase and an overview of minimum document standards to be followed.

Appendices – Commissioning Process Guidelines:
Describes requirements specific to the City of Edmonton that are to be considered.
- .3 Except where otherwise noted, the information contained in this document is to be used as a guide. The Cx Provider is expected to follow their professional judgment as well as all applicable codes and regulations. Projects may have specific requirements that supersede some material presented in this document. These requirements will be communicated to the Cx Provider at the outset of the project or during design as the need arises. When a deviation from these guidelines is either required or requested by the Cx Provider or CoE, it shall be documented in writing.
- .4 Commissioning Manual - Volume 2 contains guidelines for the Building Envelope Commissioning Process.

1.2 Sources

ASHRAE Guideline 0-2019 – The Commissioning Process
ASHRAE Standard 202-2018 – Commissioning Process for Buildings and Systems
Building Commissioning Association – New Construction Building Commissioning Best Practice 2018
LEED v4 or newer
Canada Standards Association Z320-11 Building Commissioning
Natural Resources Canada – 1st Edition Commissioning Guide for New Buildings
CAN/ULC-S1001-11 - Standard for Integrated Systems Testing of Fire Protection & Life Safety Systems

1.3 Definitions

Basis of Design (BOD)	A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. (Also known as the Design Criteria).
Commissioning	See Commissioning Process.
Commissioning Process (Cx)	A quality focused process for enhancing the delivery of a project. The process focuses on evaluating and documenting that commissioned systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner's Project Requirements (OPR) and contract documents.
Cx Provider (CxP)	An entity identified by the City of Edmonton who leads, plans, schedules, and coordinates the CxP Team to implement the Commissioning Process.
Cx Provider Team (CxP Team):	The team of specialists and related support staff who are responsible for the management of actions and the generation of deliverables by the CxP as outlined in the contract between the CoE and the CxP and in the Cx Plan. The CxP Team may consist of several companies, including subcontractors to the CxP who acts as the contact to the Owner.
Issues & Resolutions Log	A formal and ongoing record of problems or concerns and their resolutions that have been raised by members of the CxP Team during the course of the Commissioning Process.
Commissioning Process Plan (Cx Plan)	A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
Cx Progress Report	A written document that details activities completed as part of the Cx and significant findings from those activities, and is continuously updated during the course of a project.

Cx Design Review	A collaborative detailed review of design documents for items pertaining to the following: Owner’s Project Requirements (OPR); Basis of Design (BOD); constructability, operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems’ sequence of operations including building automation system features; Cx specifications and the ability to functionally test the systems.
Cx Specifications	The contract document that details the objective, scope and implementation of the Cx in alignment with the Cx Plan.
Project Team	A team composed of the CxP team, City of Edmonton, Design Team, Construction Manager/General Contractor, Contractors, maintenance and operations personnel, and occupants. Individuals, each having the authority to act on behalf of the entity they represent, explicitly organized to implement the Cx through coordinated action.
Cx Checklists	Forms used to verify that appropriate equipment materials and components are on-site, ready for installation, correctly installed, functional, and in compliance with the OPR and the design. Checklists are usually developed by the CxP and used by the Contractor
Construction Manager (CM)	The City of Edmonton’s Representative managing the construction project. Often the construction manager and the general contractor are the same entity.
Construction Contract Documents	The Construction Contract Documents consist of the Construction Documents, the Construction Contract between the contractor and the City, Construction Contract conditions and any amendments agreed upon between the parties.
Construction Contractor	The general contractor’s or subcontractor’s authorized representative.
Current Facility Requirements (CFR)	A written document that details the current functional requirements of an existing facility and the expectations of how it should be used and operated. This includes goals, measurable performance criteria, cost considerations, Benchmarks, success criteria, and supporting information to meet the requirements of occupants, users, and owners of the facility.
Deferred Testing	Tests and verifications that are performed after substantial completion, due to ambient load and/or occupancy conditions, not allowing a thorough test during the initial testing period.

Design Team The professionals (architects, engineers and consultants) responsible for developing the project's design concepts, interim and final drawings, specifications and Basis of Design (BOD).

Existing Building Cx (EBCx): A quality-focused process for attaining the CFR of an existing facility and its systems and assemblies being commissioned. The process focuses on planning, investigating, implementing, verifying, and documenting that the facility and/or its systems and assemblies are operated and maintained to meet the CFR, with a program to maintain the enhancements for the remaining life of the facility. EBCx includes both retro-commissioning and re-commissioning processes.

Final (Cx) Report A document that records the activities and results of the Commissioning Process and it includes all final Cx related documents.

Functional Performance Testing (FPT) The process of verifying that a material, product, assembly, or system meets defined performance criteria. The methods and conditions under which performance is verified are described in one or more test protocols.

Cx Verification and Testing: The evaluation and documentation of the equipment and assemblies, delivery and condition, installation, proper function according to the manufacturer's specifications, and project documentation to meet the criteria in the OPR and contract documents.

Functional Performance Test (FPT) Procedure A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems to verify compliance with the OPR and the contract documents. Test sheets are usually developed by the CxP and used by the Contractor.

Operations and Maintenance (O&M) Manual	Refer to the Project specification, Division 1, for definition of format and contents - generally this is a manual to describe key components of each system or piece of equipment and explain how they should be operated and maintained.
Systems Manual	A system-focused composite document that includes the design and construction documentation, Facility Guide and operation manual, maintenance information, training information, Cx records, and additional information of use to the CoE during occupancy and operations.
CoE	City of Edmonton
Owner Project Requirements (OPR)	A written document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, Benchmarks, success criteria, and supporting information.
Ongoing Cx (OCx):	A continuation of the Cx well into occupancy and operations to continually improve the operation and performance of a facility to meet current and evolving CFR or OPR. Ongoing Cx Activities occur throughout the life of the facility; some of these will be close to continuous in implementation, and others will be either scheduled or unscheduled as needed.
Recommissioning:	An application of Cx requirements to a project that has been delivered using Cx. See Existing Building Cx.
Retrocommissioning	Cx applied to an existing facility that was not previously commissioned. See Existing Building Cx.
Sequence of Operations	A narrative describing how the mechanical, electrical, energy management, and control systems are intended to operate during start-up, shut-down, unoccupied, manual, fire, power failure, security lockdowns, and other modes of operation.
Training Plan	A written document that details the expectations, schedule, duration, and deliverables for Cx Activities related to training of project operations and maintenance personnel, users, and occupants.

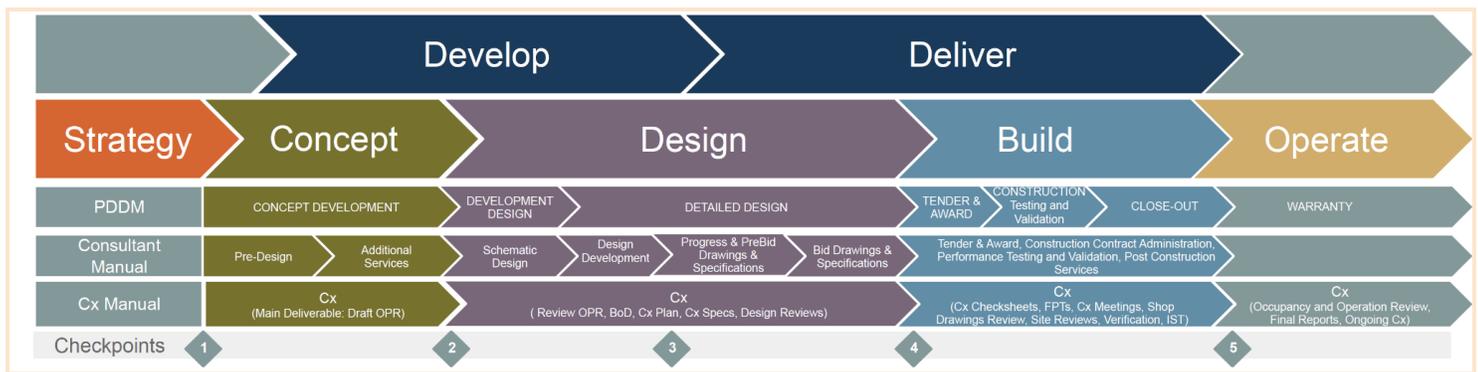
1.4 Contact Information

- .1 The latest version of this document is available online under resources of the [City Design and Construction Standards](#) on the City of Edmonton website

2 Commissioning Process

2.1 Project Development and Delivery Model (PDDM)

- .1 The Project Development and Delivery Model (PDDM) is the approach that the City takes to enhance capital infrastructure project oversight. This process involves structured reviews of projects at key points throughout the Project life cycle. Below is an illustration of the approximate alignment of Design Team and Cx Provider deliverables with the City’s internal PDDM checkpoint system.



2.2 Project Communication

2.2.1 General

- .1 The CoE will assign a Project Manager for deliverables up to Design Development and a Project Manager for Working Drawing to Post Construction. At the end of Design Development, a transition will occur in which the Project Manager assigned will switch.
- .2 The Commissioning Firm is to appoint one individual to act as the Cx Provider team lead (CxP) and be the primary contact to lead the CxP team to deliver the Cx. If the CxP team consists of multiple sub-consultants in multiple firms, all official correspondence and submissions to the CoE should be through the CxP.

- .3 Internal discussions between the CxP and their sub-consultants are to be documented internally. It is the responsibility of the CxP to alert the CoE of any internal discussions that may affect the project scope, budget, schedule, etc.
- .4 Cx meeting minutes and similar documentation are the responsibility of the CxP and should be distributed to the CoE and distribution listed as defined by the City Project Manager.

2.3 Commissioning Process Deliverables

2.3.1 Introduction

- .1 This section outlines typical deliverables at key project milestones. It is understood that all projects are different and the contents of this section may not wholly apply to all projects. For example, a larger project may be phased in such a way that more or less is required from the CxP at each separate phase.
- .2 Specific submissions required are identified herein. In addition to the deliverables identified herein, it is the responsibility of the CxP to prepare any submittals required by external authorities.
- .3 The CxP is responsible for ensuring they are aware of the project deliverables and prepare these submissions on time, with all required information contained therein.
- .4 All submissions will be reviewed by CoE staff and the Design Team associated with the project. All review comments will be forwarded to the CxP by the CoE.
 - .1 The CxP is to respond to all review comments in writing to the CoE.
 - .2 In some cases, the CxP may be required to re-submit based on the nature of the comments.
- .5 Deliverables submitted to the CoE shall follow naming conventions as outlined in the Commissioning Manual.

2.3.2 Concept and Design Phase

The CxP shall provide Cx services as required for Building Systems Commissioning Process and shall be responsible for carrying out the tasks described within this section.

All deliverables to be documented and a copy shared with the CoE Project Manager and Engineering Services. The deliverables include initializing, developing and updating all project specific Cx documents, and Cx tasks shall be carried out for equipment/systems listed in [Appendix A](#).

For all projects requiring Building Systems Cx the CoE expects that all of these tasks will be completed unless any proposed changes to the task list are clearly identified in the CxP's proposal and subsequently agreed to, in writing, by the CoE.

For projects targeting LEED® certification, the CxP shall include in their proposal and estimate all work related to achieving all of the following latest LEED Energy and Atmosphere (EA) "Prerequisite Fundamental Commissioning and Verification" requirements. The Project administered through this Standing Arrangement will define in advance whether the Project shall implement:

- Option 1, Path 1: Enhanced Commissioning, or
- Option 1, Path 2: Enhanced and Monitoring Based Commissioning

Building Envelope commissioning is not considered to be a component of Building Systems Cx as defined within this document. For Building Envelope Commissioning requirements, refer to Commissioning Manual Volume 2. When coordination between the CxP responsible for Building Systems Commissioning Process and the CxP responsible for Building Envelope commissioning occurs, the expectation of the CoE is that both parties will coordinate and collaborate to ensure a seamless development of common deliverables to both scopes of work and, on occasion, provide support and feedback regarding related documentation.

.1 Owner's Project Requirements (OPR)

The OPR is a compilation of all documentation on the CoE's goals, objectives, and expectations for the project. The CoE & CxP are responsible for developing the preliminary OPR, the CxP is responsible for reviewing and updating this document to keep current throughout the project lifecycle and issuing to the CoE at each phase of project. The OPR should include all necessary references to relevant CoE requirement documents and Codes.

- .1 The preliminary OPR shall include the following information:
 - .1 Project description (summary including size and scope of project).
 - .2 Project milestones
 - .3 Owner directives, user and community requirements
 - .4 Applicable codes and standards
 - .5 Environmental and sustainability goals
 - .6 Occupancy requirements and schedules
 - .7 Project documentation requirements, including format for submittals, training materials, reports, and the Operation and Maintenance (O&M) manual.
 - .8 Level of controls integration and desired control interfaces.
 - .9 Equipment and system maintainability requirements,
 - .10 Systems integration and testing requirements, especially across disciplines.
 - .11 Cx scope and deliverables including allowable tolerance and sampling procedures (detailed commissioning process to be included in Cx Plan)
 - .12 Indoor environment requirements, including temperature, humidity, health, hygiene, IAQ and ventilation
 - .13 Lighting requirements.
 - .14 Acoustical requirements.
 - .15 Security requirements.
 - .16 Data and Communication requirements.
 - .17 Training requirements for CoE's personnel.
 - .18 Warranty requirements.

- .2 CxP shall obtain all information required to develop and maintain an accurate and project specific OPR. Each proposed update must be formally reviewed and approved by the CoE.
 - .1 The CoE will provide the following documents, when available, to aid the CxP in the development and maintenance of the OPR:
 - .1 Project Initiation,
 - .2 Project Charter,
 - .3 Consultant Manual, Vol 1 and Vol 2,
 - .4 Owner Directives/Mandates (relevant to the project),
 - .5 Functional Program
- .2 Basis of Design (BOD)
 - .1 The Design team is responsible for generating the BOD to meet the OPR.
 - .2 The CxP shall review the BOD and confirm that the proposed design meets the OPR.
- .3 Cx Plan
 - .1 The CxP is responsible for developing the Cx Plan, updating and issuing this record to the CoE for review during each phase of the project. The Cx Plan shall include, at a minimum, the following information:
 - .1 Overview of the Cx developed specifically for the project.
 - .2 Roles and responsibilities for the Project Team throughout the project.
 - .3 Documentation of general communication channels to be used throughout the project.
 - .4 Detailed description of the Cx activities and schedule. The following items to be included:
 - .1 Cx meetings
 - .2 Management of OPR
 - .3 Design review process
 - .4 Cx Specifications
 - .5 General description of Cx activities that will occur during the Construction and Occupancy/Operations Phases.
 - .6 Guidelines and format that will be used during the Design Phase to communicate and track critical Cx information.
 - .7 Project design document verification procedures.
 - .8 The framework for procedures to follow whenever Cx reveals non-compliance with the OPR and contract documents.
 - .9 Quality-based sampling procedures for verification of compliance with the OPR and contract documents during all project phases.
 - .10 Cx Check sheets and Test sheets samples.

- .2 Cx Plan to address all items identified in LEED Guidelines for EA prerequisite Fundamental Commissioning and Credit Enhanced Commissioning as well as all non-LEED commissioning items required for Building Systems Commissioning Process.
 - .1 For monitoring-based commissioning, the OPR, BoD and Cx Plan shall identify required submeters, acceptable values for tracked points, an action plan for identifying and correcting operational errors and deficiencies, as well as any other LEED requirements associated with this point.
- .4 Cx Issues & Resolutions Log
 - .1 The Cx Issues & Resolutions Log is to record all identified Cx related issues and the solutions. The CxP is responsible for creating and maintaining the Cx Issues & Resolution Log for the duration of the project. A copy of the Cx Issue & Resolution log is to be included in the Final Cx Report and shall include all issues that were closed through the Commissioning Process, as well as any remaining outstanding issues.
 - .2 Use Standardized issues log format throughout the project, refer to [‘The Cx Issues & Resolutions Log’](#) section for details.
- .5 Design Phase Kickoff Meeting
 - .1 CxP to schedule and chair an initial Kickoff Meeting with the Design Phase Project Team within fifteen (15) days of appointment or when directed by the CoE to establish the purpose and proposed process for Cx in the design phase and to review the Design Phase Cx Plan. The Design Phase Kickoff meeting is to include the following:
 - .1 Review of OPR and Cx Plan with the Project Team,
 - .2 Review of the various Cx activities and schedules,
 - .3 Review of the documentation requirements,
 - .4 Review of communication and reporting procedures,
 - .2 Meeting minutes to be distributed to all project Team members within 72 hours of each meeting.
- .6 Design Submission Review
 - .1 Perform Cx Design Reviews at Design Development, Progress Submission and Pre-Bid Submission and provide formal feedback to the Design Team. The Design Submission Review is to include a review of the Design documents for the following:
 - .1 General quality review of the documents, including legibility, consistency, and level of completeness.
 - .2 Coordination between disciplines.
 - .3 Discipline-specific review to address construction coordination and installation concerns, functionality, performance aspects, efficiency, maintainability, project phasing, indoor air quality, local environmental impacts and adherence to the OPR and contract documents. Specifically, focusing on the following:

- .1 Access for reading gauges, entering doors and panels, observing and replacing filters, coils, etc.
 - .2 Required isolation valves, balancing valves, dampers, interlocks, piping, etc. to allow for manual overrides, simulating failures, seasons and other testing conditions.
 - .3 Adequacy of Test Ports
 - .4 Sufficient monitoring points in the Building Automation System (BAS), beyond what is required to control the systems, to facilitate performance verification and O&M.
 - .5 Sufficient sub-meters as required to meet LEED monitoring commissioning credit requirements.
 - .6 Adequate trending and reporting features in the BAS
 - .7 Pressure and temperature (P/T) plugs at less critical areas or on smaller equipment where gauges and thermometers would be excessive.
 - .8 Specification of the location and criteria for the VAV duct static pressure sensor and chilled water differential pressure sensor.
 - .9 Adequate balancing valves, flow metering and control stations and control system functions to facilitate and verify reliable test and balance.
 - .10 Uniform inlet connection requirements to VAV terminal boxes
 - .11 HVAC fire and emergency power response matrix that lists all equipment and components (air handlers, dampers, valves, etc.) with their status and action during a fire alarm and under emergency power.
 - .12 Review control narrative and all associated modes of operation (normal, alternate, emergency, failures). Coordinate with both electrical and mechanical disciplines to review all control system design and ensure each discipline coordinated its needs with the other one.
 - .13 Review all electrical testing (specification) to ensure NETA practices are prescribed then followed,
 - .14 Ensure interconnection between system and monitoring services (C-Cure, Fire alarm, Coppertree/Kaizen monitoring system is factored in design and in the Cx plan)
 - .15 Wholistic review of each system design and intended operation, reporting any deficiencies or potential performance optimization opportunities.
 - .16 Review proposed construction phasing and confirm if all required provisions for Cx tasks have been factored into the design.
- .4 Integration and functionality of controls systems review for achieving the OPR and contract documents with a focus on the following:
- .1 Control logic.
 - .2 Detailed sequences of operations.
 - .3 Integration of dynamic equipment.

- .5 Clear integration of Cx Specifications with the rest of the design package.
- .6 Verification that the O&M documentation requirements and Training Requirements are incorporated into the Contract Documents.
- .7 Additional tasks as required to comply with the LEED Certification Process.
- .2 The Design Submission Review is to be recorded in the Cx Issues & Resolutions Log.
- .7 Cx Meetings
 - .1 Schedule and lead Cx Coordination Meetings with the Project Team, as needed for each design phase, at a minimum attend one meeting at each design milestone (Design Development, Progress Submission and Pre-Bid Submission) to ensure successful coordination of the design phase Cx activities. Scheduling of meetings to be coordinated with the CoE.
 - .2 Prepare and distribute Cx meeting minutes to all Team members within 72 hours of each meeting.
- .8 Controls and System Integration
 - .1 Coordinate and lead controls integration meetings, as required, between the Design Team, Owner, and Construction Manager to discuss integration issues between equipment, systems and disciplines to ensure that integration responsibilities are clearly described in the specifications. Review proposed control narrative to confirm if all specified tests are sufficient to validate proper system operations. The series of meetings should result in the following outcomes:
 - .1 Verification that the design of the BAS can achieve the control requirements of the OPR, BOD and related contract documents.
 - .2 Verification that the control systems requirements are clearly defined.
 - .3 Verification that the Sequences of Operation are clear and well documented.
- .9 Training Requirements
 - .1 Schedule and lead meetings with Design Team and CoE Operations & Maintenance personnel to define expectations and training requirements and ensure integration into Contract Documents. Provide meeting minutes of training requirement sessions to all attending members within 72 hours of each meeting.
 - .2 Review Design Team training requirements specifications to ensure it complies with Owner's expectations.
- .10 Cx Specifications
 - .1 Develop full Cx Specifications for all commissioned systems/equipment. Coordinate this with the Design Team and integrate the Cx Specifications into the overall project specification bid package. Cx Specifications to include:
 - .1 Detailed description of the responsibilities of all required parties,
 - .2 Details of the Cx Process

- .3 Reporting and documentation requirements, including formats
- .4 Alerts to coordination issues
- .5 Issue reporting and deficiency resolution
- .6 Cx Checklist and start-up requirements,
- .7 Functional Performance Testing (FPT) processes and procedures
- .8 Specific Functional Test requirements, including testing conditions and passing criteria for each piece of equipment/system being commissioned.
- .9 Training Requirements
- .10 Closeout
- .11 Develop draft Construction Cx Check Sheets
 - .1 Refer to Appendix B for sample Construction Cx Check Sheets.
 - .2 Construction Cx Check Sheet sample provided in Appendix B for security systems (C-Cure) shall be used. Proposed alternative formats shall include all content and intention as identified on the provided sample sheets, be submitted for formal review and must be approved in writing by CoE prior to implementation.
 - .3 Additional samples provided in Appendix B represent the minimum required information to be collected and expected level of the vigor for Construction Cx Check Sheets to be developed.
- .12 Develop draft Systems Functional Performance Test (FPT) Procedures
- .13 Cx Progress Report
 - .1 The Design Phase Cx Progress Report is to include the following:
 - .1 Intent
 - .2 Executive Summary
 - .3 Cx Overview
 - .4 OPR
 - .5 BOD Report
 - .6 Cx Plan
 - .7 Cx Specifications
 - .8 Cx Check Sheets
 - .9 Summary of the Design Review
 - .10 Cx Issues & Resolutions Log (to date)
 - .11 FPT Procedures
- .14 Design Phase Close-out
 - .1 Design Phase Cx is complete when the final design team Contract Documents are complete.

- .2 Required Documentation from this Phase includes:
 - .1 Cx Progress Report

2.3.3 Construction Phase

The Construction phase consists of the installation, startup and testing of system equipment. The main focus of this phase is to conduct inspections of all systems, components and equipment and the completion of the Construction Cx Check Sheets to verify correct installation and successful start-up.

Coordinate and direct the Cx activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties. Provide updated timelines, schedules and technical expertise as required.

Assist the contractor to generate a startup and testing focused schedule itemizing specific Cx milestones including but not limited to the following: contractor completed static checks, CxP static checks, equipment start-ups, TAB completion, prefunctional dynamic testing completion, CxP TAB check, Functional Performance Testing (FPT) and O&M Training Sessions.

Coordinate the Cx related work with the Design Team and construction contractor to ensure that Cx activities are being incorporated into the contractor's construction schedule.

- .1 Construction Phase Kickoff Meeting
 - .1 CxP to schedule and chair an initial Kickoff Meeting with the Construction Phase Project Team (including subcontractors) as directed by the City or at no later than 50% installation progress to establish the purpose and proposed process for Cx and to review the Construction Phase Cx Plan. The Construction Phase Kickoff meeting is to include the following:
 - .1 Review of Cx Plan with the Construction Project Team
 - .2 Review of the various Cx activities and schedules
 - .3 Review of the documentation requirements
 - .4 Review of communication and reporting procedures
 - .2 Construction Meetings
 - .1 Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the Cx. Assist in resolving any discrepancies.
 - .3 Cx Meetings
 - .1 Plan and conduct Cx progress Meetings, as required, but a minimum of one per month from eighteen (18) months prior to construction completion, with one (1) every two (2) weeks for the last four (4) months. The exact sequence of these meetings may change depending on the project and at the discretion of the CoE.
 - .2 Prepare and distribute Cx meetings minutes to all Project Team members within 72 hours of each meeting.
 - .4 Site Observations

- .1 Perform site visits, as necessary but at a minimum monthly from eighteen (18) months prior to construction completion, to conduct static Site Observation to observe component and system installations and verify that construction complies with the Contract Documents and the OPR, and to identify and document quality issues that may lead to functional issues. Provide feedback on the correct installation and serviceability of the equipment being installed. Site Observations are to be recorded in the Cx Issues & Resolutions Log. The exact sequence of these site visits may change depending on the project and at the discretion of the CoE.
- .5 Owner's Project Requirements (OPR)
 - .1 Review and update the OPR documentation as required to ensure relevancy and accuracy.
- .6 Cx Plan
 - .1 Revise, as necessary, the Cx Plan developed during design, including:
 - .1 A detailed overview of the Commissioning Process
 - .2 A list of all systems and assemblies to be verified and tested.
 - .3 Roles and responsibilities of all team members.
 - .4 Schedule of Cx activities including:
 - .1 Team meetings
 - .2 Development and completion of checksheets
 - .3 Static testing and Startup
 - .4 Training Sessions
 - .5 Shop drawings submittals
 - .6 O&M Manual submittal
 - .7 Functional Testing and test periods
 - .8 Special tests or Inspections
 - .9 Substantial Completion
 - .10 Occupancy
 - .11 Seasonal testing
 - .12 Interim Cx report
 - .13 Occupancy and Operation Review
Occupancy and Operation Review shall take place within the first ten 10 months as requested by the CoE after occupancy and operation.
 - .14 Final Cx Report
 - .5 Communication Protocols

- .6 Documentation and reporting requirements and procedures including, but not limited to, the following:
 - .1 Review of submittals
 - .2 Scheduling and holding of meetings
 - .3 Site visit procedures
 - .4 Issues identification, documentation, tracking and resolution
 - .5 Construction-Phase test preparation, implementation and follow-up
 - .6 The responsibilities of each member of the Project Team
 - .7 Responsibility of costs related to verification and testing, including retesting or verification activities
 - .8 O&M Manual development and review
 - .9 Training program
- .7 Occupancy/operations-Phase test preparation, implementation, and follow-up
- .8 Checksheets and Functional Test sheets for each equipment/system type
- .7 Cx Issues & Resolutions Log
 - .1 Maintain the issues log started during the Design Phase separate from the construction issues log. Report all issues as they occur directly to the CoE and project team. Coordinate with the project team and Construction Contractor to facilitate resolution of all issues contained in the log.
 - .2 Coordinate any required retesting following corrective action and resolution of issues. All corrective actions taken to resolve recorded issues are to be consistent with the OPR and contract documents. Where this is not feasible, approval from the CoE and EoR is required and the OPR is to be updated to reflect the change.
 - .3 Include an explanation of any unresolved issues in the Final Cx Report Executive Summary.
 - .4 The Cx Issues & Resolutions Log shall comply with the guidelines and must include the following:
 - .1 Unique numeric identifier by which the issue may be tracked
 - .2 Short, descriptive title of the issue
 - .3 Date and time of the identification of the issue
 - .4 Test number of the test being performed at the time of the observation, if applicable, for cross-reference
 - .5 Identification of system, equipment, or assembly to which the issue applies
 - .6 Location of the issue

- .7 Description of the observed design, installation, or performance issue, including any information that may be helpful in diagnosing or evaluating the issue
 - .8 Recommended corrective action
 - .9 Identification of the Project Team member responsible for resolution of the issue
 - .10 Expected date of resolution
 - .11 Date of completion of resolution
 - .12 Description of corrective action taken. Including description of diagnostic steps taken to determine the root cause of the issue and the value of resolving the Cx issue for the owner, Design Team, contractor, or occupant
 - .13 Identification of changes to the OPR or BOD that require action (if any)
 - .14 Statement that the resolution was completed and the system or assembly is ready for retest, if applicable
 - .15 Name of the person who resolved the issue
- .8 Submittals and Shop Drawings
- .1 Review Contractor submittals and shop drawings as applicable to systems being commissioned for compliance with the OPR, the Construction Contract Documents and concurrent with the Architectural and Engineering reviews. Document any concerns in a written report.
 - .2 CxP shall provide a list of the submittals and shop drawings requiring Cx review to the CoE and Contractor.
 - .3 Submittals and shop drawings should happen concurrently with the Consultant team review
 - .4 Review the controls submittals in depth. Review the hardware, software, control points and sequence of operation, document and report any concerns.
 - .5 Review equipment warranties to ensure compliance with the OPR and contract documents, clearly define the CoE's responsibilities.
 - .6 Review coordination drawings and/or records to ensure all trades are making a reasonable effort to coordinate.
 - .7 CCure (Security) & Camera startup and testing documents should be collected and verified by the CxP.
 - .8 Document any concerns in the Cx Issues & Resolutions Log.
- .9 Addendums, Requests for Information (RFIs) and Contemplated Change Orders (COOs)
- .1 Review RFIs and COOs for impact on Cx the OPR and contract documents.
- .10 Cx Progress Reports
- .1 Prepare Cx Progress Reports following each site visit. Cx Progress Reports shall include at a minimum:

- .1 Any issues or discrepancies found.
 - .2 An evaluation of the operating condition of the systems at the time of the test completion.
 - .3 Cx Checklist completion verification and summary results from the Cx Issues & Resolutions Log (including descriptions of issues and the measures that were taken to correct them and the uncorrected operational issues that were accepted by the CoE).
 - .4 Test procedures used and raw data obtained if applicable.
 - .5 Deferred tests, the prerequisite conditions required, and the estimated schedule for the re-tests if applicable.
- .11 Cx Check Sheets
- .1 Develop project specific Cx Check Sheets. The check sheets shall be developed to verify that appropriate components are onsite, ready for installation, correctly installed, contractor started-up to verify general operation, adjusted and balanced, and then as a system verified as complete (during system FPT). Manufacturer pre-start and start-up checks to be incorporated into the Cx Check Sheets. Provide Check Sheets to the Contractor by the Cx kick off meeting. Refer to [Appendix B](#) for Sample Cx Check Sheets.
 - .2 Perform the following Prefunctional Check tasks:
 - .1 Review all specialty equipment vendor start-ups and gather all associated vendor start-up reports.
 - .2 Review HVAC piping pressure tests and flushing to be confident that proper procedures were followed. Review documentation and include it in the Cx Reports.
 - .3 Review ductwork testing and cleaning to be confident that proper procedures were followed. Review documentation and include it in the Cx Reports.
 - .4 Verify selected major systems startup and document other systems startup by reviewing start-up reports and by selected site observation. Any issues arising from the start-up procedure must be included in the Cx issues log and monitored until they are closed out.
 - .5 Review and verify completed air and water systems balancing reports and field audit the reports with the balancer.
 - .6 Document completion and accuracy of Cx Check Sheets by reviewing Contractor completed sections and verifying with selected site observations. CxP shall complete sections assigned to them and ensure all initial portions of the Cx Check Sheets have been submitted and verified prior to commencement of Functional Performance Testing (FPT). Any issues arising must be included in the Cx Issues & Resolutions Log and monitored until they are closed out.
- .12 Controls and System Integration
- The following work to be completed prior to commencing FPT of systems:
- .1 Review and validate Building Automation System (BAS) controls, complete end to end point verification from physical point location to graphical representation.

- .2 Review all sensor calibrations by comparison of onsite physical measurement with points schedule in specification and make sure that provided reports include the value measured on-site, the value displayed on the BAS graphics, date tested. and name of testing person.
 - .3 CxP to review and verify controls contractor check sheets for each input/output point indicating (on graphics) the expected point value, measured point value, and acceptable deviation tolerance per the design.
- .13 Functional Performance Tests (FPTs)
- .1 Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed functional performance testing procedures
 - .2 Write the FPT procedures to demonstrate the approved sequence of operation for each system. Submit for CoE and Contractor review two (2) months prior to Functional Performance Testing in the field. FPTs to:
 - .1 Operate the system and components through all of the written sequences of operation documented in the specifications and drawings, including start-up, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment.
 - .2 Review to include all protection and control systems including but not limited to advanced circuit breaker with relay protection scheme, power quality metering relays, and all related interconnection with BAS, if any.
 - .3 Coordinate, witness, verify and record results of FPTs and ISTs. FPTs and ISTs to be performed by installing Contractor(s). It is the responsibility of the CxP to coordinate retesting as necessary until satisfactory performance, as defined in the specifications and drawings, is achieved.
 - .4 Analyze functional performance trend logs and monitoring data to verify performance.
 - .5 Tests on respective HVAC equipment shall be executed, if possible, during both the heating and cooling season. However, some overwriting of control values to simulate conditions shall be allowed.
 - .6 Tests shall be completed utilizing a BAS workstation. Supplementary control system trend logs, readouts or standalone data loggers can assist in the Cx documentation process but shall not supersede Functional Performance Testing.
 - .7 One of the deliverables of the FPTs includes a procedure describing the sequence of operation and the date it was tested by the contractor and verified by the CxP. There shall be a minimum one procedure or test sheet for each sequence of operation.
 - .8 Produce test sheets and perform testing for mechanical and electrical equipment that are not on BAS.
- .14 M&V site verification:
- The following work to be completed in conjunction with FPT of systems:

- .1 The CxP to review the EEM's (Energy efficiency Measures) listed in the project's M&V (measurement and verification) plan to make sure that they are installed and performing as expected. The M&V plan will be provided by the City of Edmonton M&V working group.
 - .2 This includes a site visit and filling out a site verification form that the City of Edmonton M&V working group creates.
 - .3 Allow a minimum of 8 hours for the M&V verification work.
- .15 Integrated Systems Test (IST)
- .1 Include an Integrated Systems Test (IST) as per ULC S1001. The IST shall be conducted to confirm that the facility performs as required during specified failure scenarios and shall include Fire Alarm condition, Loss of Normal Power, and return to normal operation and shall include a test of annunciator systems and recovery procedures.
 - .2 If an emergency generator is included within the systems to be commissioned a generator failure or "Black Building" condition shall also be simulated. All battery backup systems shall be fully charged prior to testing.
 - .3 One of the deliverables for the IST is to include a verification letter confirming the ISTs have been completed.
- .16 Deferred Testing
- .1 Deferred testing due to seasonal constraints are to be completed during the Occupancy and Operation Phase. CxP to verify and document that deferred tests are performed by the responsible member of the Project Team.
- .17 Record Documents and Operation & Maintenance Information
- .1 Oversee the preparation of the O&M Manuals.
 - .2 Review the Project Record Drawings (As-Built Drawings), and the O&M Manuals for completeness of the documentation from the standpoint of operator training and instruction for startup, shutdown, operation and maintenance information. These documents are to be reviewed prior to the Personnel Training sessions as they form an integral component of the training sessions.
 - .3 Verify that O&M Manuals comply with the contract documents.
 - .4 The O&M Manual review shall be prepared on the reviewer's letterhead and must include the date of review.
 - .5 Prepare a Systems Manual document as required by LEED.
- .18 Personnel Training
- .1 Review the training of the CoE Operation and Maintenance personnel.
 - .2 Verify that training was carried out in accordance with the requirements of the construction documents.
 - .3 Conduct a review of the commissioned systems with the CoE's Operations and Maintenance staff after the Contractor training and before the facilities are turned over to the CoE for operation.

- .4 CxP is to provide an executive summary of training content covered in sessions as well as attendance log for each training session to the CoE.
- .19 Construction Phase Close-out
 - .1 Construction Phase Cx is complete when all construction Cx deliverables and documentation are complete and accepted by the CxP and the CoE.

2.3.4 Occupancy and Operation Phase

During the **Occupancy and Operation Phase**, the building systems are complete and fully functional.

- .1 Deferred Testing
 - .1 Coordinate and supervise required opposite season or Deferred Testing and deficiency corrections and provide the final testing documentation for the Final Cx Report and the O&M manuals.
- .2 Construction Phase Cx Follow-up
 - .1 Verify that construction Issues have been resolved including retesting, if required.
- .3 **Occupancy and Operation Phase Cx Review Meeting**
 - .1 Schedule and lead **Occupancy and Operation Phase Cx Review Meeting**
 - .1 Perform operations review with CoE Operations.
 - .2 Document any deficiencies in the Cx Issues & Resolutions Log
 - .3 Coordinate retests, as required, and verify items identified as deficient are resolved.
- .4 Lessons Learned Workshop
 - .1 Conduct a “lessons learned” workshop with the CoE to facilitate improvements to future CoE projects. Workshop to include:
 - .1 A review of the results of Cx for this project, its successes and failures
 - .2 A review of the functionality of the building
 - .3 A review of the building occupants comfort level
 - .4 Documented suggestions for improvement for inclusion into future project OPR.
- .5 Required documentation from this Phase includes the Final Cx Report which shall contain documentation from all of the phases of the Cx.
- .6 Final Cx Report
 - .1 The CxP is responsible for the creation of a Final Cx Report which shall include the following:
 - .1 A list of participants and their roles,
 - .2 Brief building description
 - .3 Overview of Cx scope
 - .4 General description of testing and verification methods

- .2 Provide a description of each deliverable, including a summary of edits that occurred during the Cx.
- .3 The Final Cx Report shall also include:
 - .1 Cx Meeting Minutes
 - .2 Submittal/Shop Drawing evaluation comments
 - .3 Site Observation Reports
 - .4 Control drawings, sequences of control (by Contractor), and a table of all set-points and implications when changing them, schedules, instructions for operation of each piece of equipment for emergencies, seasonal adjustment, startup and shutdown, instructions for energy savings operations and descriptions of the energy savings strategies in the facility
 - .5 Training Documentation
 - .6 Updated OPR
 - .1 Performance metrics, if completed during design
 - .7 Updated BOD
 - .8 Updated Cx Plan
 - .9 Updated Cx Issues & Resolutions Log
 - .10 Cx Progress Reports
 - .11 Completed Cx Check Sheets
 - .12 FPT Procedures and Results
 - .13 Start-up Reports
 - .14 Trend Log Analysis
 - .15 Procedures for tracking of outstanding Cx related issues that arise during the first year of operation.
- .7 Recommendations for re-commissioning frequency.
- .8 All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, Cx changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
- .9 **Occupancy and Operation Phase Close-out**
 - .1 **Occupancy and Operation Phase Cx is complete when all Cx Occupancy and Operation Issues are corrected or formally accepted by the CoE.**
 - .2 Required Documentation from this Phase includes:
 - .1 Final Cx Report
 - .2 Updated Cx Issues & Resolutions Log
 - .3 Retest forms documenting Deferred Testing results

.4 Lessons Learned Workshop Report

2.3.5 Closeout Submittals

- .1 Final documents to be submitted as an electronic copy in the form of an unsecured and searchable PDF complete with section bookmarks.

2.3.6 Limit of Responsibilities

- .1 The CxP is not responsible for establishing design concept(s), design criteria, compliance with Codes and Standards, design or general construction scheduling, or construction management. The CxP may assist with problem-solving or resolving non-conformances or issues, but ultimately that responsibility resides with the General Contractor and the Design Team. The CxP is not responsible for issuing change orders or other instructions to the field for corrective work.



APPENDIX A - SYSTEMS TO BE COMMISSIONED AND SAMPLING RATES

Systems to be Commissioned and Sampling Rates

The facility systems and sampling rate of systems to be commissioned are as follows:

ACTIVITY DESCRIPTION				SAMPLING RATE
MECHANICAL SYSTEMS				
1.			Heating Ventilation and Air Conditioning (HVAC)	
	1.		Heating Water and Glycol Heating Systems	
		1.	Boilers and Associated Equipment	100%
		2.	Heat Exchangers	100%
		3.	Pumps	100%
		4.	Water Treatment	100%
		5.	Terminal Heating Units	20%
		6.	Fan Coil Units	20%
		7.	Unit Heaters	20%
	2.		Cooling System(s)	100%
	3.		Air Systems	
		1.	Air Handling Units/Make-up Air Units	100%
		2.	Energy/Heat Recovery Units	100%
		3.	Supply and Exhaust Fans, Transfer or circulation fans	100%
		4.	Air Terminal Units	25%
		5.	Air Filtration Units	100%
		6.	Ductwork	20%
		7.	Duct Cleaning	10%
		8.	Fire Dampers	50%
		9.	Smoke Dampers	100%
		10.	Fume Hoods/Exhaust Hoods/Dust Collectors	100%
		11.	Kitchen Exhaust System	100%
		12.	Gas fired furnaces (some c/w DX cooling system)	100%
		13.	Gas-fired infrared tube heaters	100%
		14.	Electric Radiant Heaters	100%
	4.		Humidification System	100%
	5.		Variable Frequency Drives (VFDs)	100%
	6.		Air and Water Balancing	
		1.	Major pieces of equipment (Boilers, Chillers, AHUs, Pumps, Heat Exchangers)	100%
		2.	Terminal Units (Diffusers, VAV Boxes, Fan coils, baseboard convectors, etc)	20%
		3.	HVAC Noise Measurement	20%

ACTIVITY DESCRIPTION				<u>SAMPLING RATE</u>
2.			Plumbing Systems	
	1.		Domestic Cold Water System	
		1.	Meter	100%
		2.	Backflow Preventers	100%
	2.		Domestic Hot Water and Recirculation System	
		1.	Water Heating Equipment	100%
		2.	Pumps	100%
	3.		Plumbing Fixtures	20%
	4.		Sump Pumps	100%
	5.		Drainage Systems	
		1.	Sanitary Piping	10%
		2.	Storm Piping	10%
		3.	Specialized drainage fixtures for animal holding areas.	100%
	6.		Hose bibs for specialized Zookeeper use	50%
	7.		Commercial kitchen grease trap	100%
	8.		Downspout heat trace	100%
	9.		Irrigation systems	100%
3.			Pool Systems	
	1.		Pool Filtration Pumps	100%
	2.		Pool Filters	100%
	3.		Pool Sanitation Equipment	100%
	4.		Pool Heating Systems	100%
	5.		Pool spray features/waterslides/wave generator	100%
	6.		Ultraviolet Generator	100%
	7.		Pool Chemical Controller	100%
4.			Arena Systems	
	1.		Ice Plant Chillers	100%
	2.		Refrigeration/Brine/Glycol Pumps	100%
	3.		Cooling Tower/Condensers/Fluid Cooler	100%
	4.		Heat Exchangers	100%
	5.		Dehumidifiers	100%
5.			Building Automation Systems (BAS)	
	1.		Sequence of Operation	100%
ACTIVITY DESCRIPTION				<u>SAMPLING RATE</u>
	2.		Entire Gas detection system including all devices	100%
	3.		BAS Interfaces to Other Divisions	100%
	4.		Air Flow Stations	100%

	5.		connected physical point and end devices including	
		1.	Temperature/Humidity Sensors	20%
		2.	Pressure Sensors and Controllers	20%
		3.	Occupancy Sensors	20%
		4.	Carbon Dioxide Sensors	20%
		5.	Damper/Valve Actuators	20%
		6.	Meters	100%
6.			Fire Protection Systems	100%
	1.		Fire Extinguishers	20%
7.			Geo Field	
	1.		Confirm glycol percentage and water quality in GHX loop	100%
	2.		Confirm flows and head pressure in GHX loop	100%
8.			Compressed Air Systems	100%
	1.		Air Compressor	100%
		1.	Controls	100%
		2.	Pressure Relief Valve(s)	100%
	2.		Air Receiver	100%
		1.	Pressure Relief Valve(s)	100%
	3.		Air Dryer	100%
	4.		Piping and Accessories	
		1.	Filters	10%
		2.	Pressure Control/Regulator Valves	100%
		3.	Pressure Relief Valves	100%
ELECTRICAL SYSTEMS				
1.			Power Distribution	
	1.		Main Switch Gear	100%
	2.		Distribution Panel Boards	100%
	3.		Branch Circuit Panelboards	25%
	4.		Transformers	100%
	5.		UPS	100%
ACTIVITY DESCRIPTION				SAMPLING RATE
	6.		Motor Starters	50%
	7.		Variable Frequency Drives	100%
	8.		Receptacles	10%
2.			Lighting	
	1.		Interior Lighting	
		1.	Illumination Levels	20%
		2.	Lighting Controls/Occupancy Sensors/Daylight Sensors	100%
		3.	Interface with BAS	100%

	2.		Exterior Lighting	
		1.	Illumination Levels	50%
		2.	Lighting Controls	100%
		3.	Interface with BAS	100%
	3.		Exit Lights	100%
	4.		Emergency Lighting Battery Units	100%
	5.		Lighting control system	100%
3.			Fire Alarm System	
	1.		Integration with HVAC	100%
	2.		Integration with Elevators	100%
	3.		Connection to Fire Department	100%
4.			Electronic Systems	
	1.		Electronic Access Control	100%
	2.		Intrusion Detection, Security & CCTV	100%
	3.		Telephones	10%
	4.		Data	10%
	5.		Clocks	100%
	6.		Communications systems including testing of all cabling	100%
5.			Integrated System Test (IST)	100%
ARCHITECTURAL SYSTEMS				
1.			Door Hardware	
	1.		Electronic Door Hardware	100%
	2.		Overhead Coiling Doors/Grilles and Sensors	100%
	3.		Security Gates	100%
	4.		Operation of Doors and Hardware	100%



APPENDIX B - Cx CHECK SHEET SAMPLES



Owner: City of Edmonton
 Project No.: CP-00XXXX
 Date: YYYY-MM-DD

INTEGRATED INFRASTRUCTURE SERVICES
 Facility Engineering Services - Facility Planning & Design
Construction Cx Check Sheet (sample)

Project:	[Name of Project or Institution Detailed Description of Area Affected]			Name of Equipment: [Fan]
System:	System Number:	Location:	Service:	Name of Discipline Responsible: [Mechanical]
Page # of ##	Equipment Tag:	Spare Tag:	Instrument Tag:	Sub-Category:

TECHNICAL DATA	DATE: <u>MM/DD/YR</u>			
	SPECIFIED	SHOP DRAWINGS	INSTALLED	VERIFIED
Manufacturer	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Model	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Function	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Type	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
RPM	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Air Flow L/S	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Static Pressure (Pa.)	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Manufacturer	<u>--</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Horsepower	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Voltage	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Full Load Amps	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Service Factor	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Efficiency	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Serial No.	<u>--</u>	<u>--</u>	<u>Contractor</u>	<u>CxP</u>

STATIC CHECKS	DATE / CHECKED: <u>MM/DD/YR</u>	
Fan Housing	<u>Contractor</u>	Access <u>Contractor</u>
Bearing Type	<u>Contractor</u>	Air Flow Monitor <u>Contractor</u>
Local Disconnect	<u>Contractor</u>	Flex Connectors <u>Contractor</u>
Control From:	<u>Contractor</u>	Belt Alignment <u>Contractor</u>
Power From:	<u>Contractor</u>	Identification <u>Contractor</u>
Duct Connections	<u>Contractor</u>	
Damper(s)	<u>Contractor</u>	
Vibration Isolation	<u>Contractor</u>	

*Items in **RED** shall be filled in by the appropriate party as indicated. All submissions shall be verified and accepted by the Cx Provider(CxP) prior to commencement of any Functional Performance Test (FPT) procedures involving the related equipment.



Owner: City of Edmonton
 Project No.: CP-00XXXX
 Date: YYYY-MM-DD

INTEGRATED INFRASTRUCTURE SERVICES
 Facility Engineering Services - Facility Planning & Design
Construction Cx Check Sheet (sample)

Project:	[Name of Project or Institution Detailed Description of Area Affected]			Name of Equipment: [Pump]
System:	System Number:	Location:	Service:	Name of Discipline Responsible: [Mechanical]
Page # of ##	Equipment Tag:	Spare Tag:	Instrument Tag:	Sub-Category:

TECHNICAL DATA

DATE: MM/DD/YR

	SPECIFIED	SHOP DRAWINGS	INSTALLED	VERIFIED
Manufacturer	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Model	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Function	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Type	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Medium Pumped	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
RPM	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Capacity L/S	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Discharge Head kPa	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Impellor Size	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Manufacturer	<u>--</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Horsepower	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Voltage	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Full Load Amps	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Service Factor	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Motor Efficiency	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Serial No.	<u>--</u>	<u>--</u>	<u>Contractor</u>	<u>CxP</u>

STATIC CHECKS

DATE CHECKED: MM/DD/YR

Discharge Valve	<u>Contractor</u>	Strainer	<u>Contractor</u>
Suction Valve	<u>Contractor</u>	Flow Meter	<u>Contractor</u>
Check Valve	<u>Contractor</u>	Pressure Gauges	<u>Contractor</u>
Flex Connectors	<u>Contractor</u>	Alignment (Base Mntd)	<u>Contractor</u>
Pump Mounting	<u>Contractor</u>	Unit Disconnect	<u>Contractor</u>
Bypass Filter	<u>Contractor</u>	Power From:	<u>Contractor</u>
Chem. Pot Feeder	<u>Contractor</u>	Pump Arrangement	<u>Contractor</u>
Vibration Isolation	<u>Contractor</u>		

*Items in **RED** shall be filled in by the appropriate party as indicated. All submissions shall be verified and accepted by the Cx Provider(CxP) prior to commencement of any Functional Performance Test (FPT) procedures involving the related equipment



Owner: City of Edmonton
 Project No.: CP-00XXXX
 Date: YYYY-MM-DD

INTEGRATED INFRASTRUCTURE SERVICES
 Facility Engineering Services - Facility Planning & Design
Construction Cx Check Sheet (sample)

Owner:	[Name of Project or Institution Detailed Description of Area Affected]			Name of Equipment [CDP]
System:	System Number:	Location:	Service:	Name of Discipline Responsible: [Electrical]
Page # of ##	Equipment Tag:	Spare Tag:	Instrument Tag:	Sub-Category:

TECHNICAL DATA

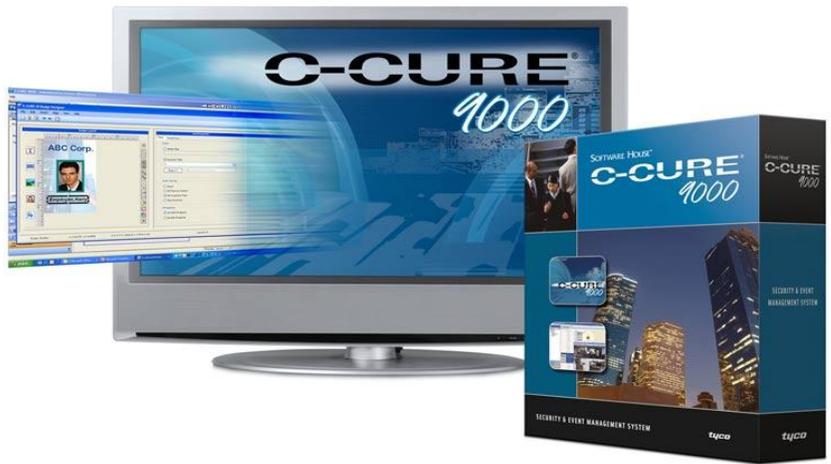
DATE: MM/DD/YR

	SPECIFIED	SHOP DRAWINGS	INSTALLED	VERIFIED
Manufacturer	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Model No.	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Phase / Voltage	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Bus Amperage	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Bus Bracing	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Bus Bar Plating	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Enclosure Color	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Door Hardware	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Drip Hood	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Conduit Size	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #1	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #2	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #3	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #4	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #5	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #6	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #7	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #8	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #9	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #10	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #11	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #12	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #13	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #14	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #15	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>
Circuit Breaker #16	<u>CxP</u>	<u>CxP</u>	<u>Contractor</u>	<u>CxP</u>

STATIC CHECKS

DATE / CHECKED: MM/DD/YR

All Fillers in Place	<u>Contractor</u>	Directory Complete	<u>Contractor</u>
Breaker Lockouts	<u>Contractor</u>	Interior Clean	<u>Contractor</u>
Conductors Torqued	<u>Contractor</u>	Lamacoid Attached	<u>Contractor</u>
Conductors Labelled	<u>Contractor</u>		



City Of Edmonton - C-Cure Commissioning Report

Facility Name	
Facility Address	
Site 3 & 3	
Posse Account #	

Panel Type	
Panel MAC Address	
Firmware Version	
Panel IP Address	
Panel SubNet Mask	
Panel Gateway	
Panel Location	
Panel Fed From: Electrical Panel/Circuit Number	

System Integrator	
System Integrator Representative	
Project Manager	
System Representative	
Date Of Testing	
Date Of Acceptance	

Notes:

C-Cure Reader Commissioning

Reader Name - Make & Model	Card Control		RDR Wiring		RDR Reads Cards		Arming RDR	
	YES	NO	RS485	Weigand	YES	NO	YES	NO
Eg: COM253_001 (RDR) Main Front Entrance South Office - HID RP40 Multiclass SE	<input type="checkbox"/>							
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C-Cure Input Commissioning

Input Name	Input Enabled		Input Triggers Event		Input Functions As Per Programming/Intent?		
	YES	NO	YES	NO	YES	NO	N/A
Eg: COM253_001 (DC) Main Front Entrance South Office	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
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