

Guideline No.: GB/002

Issue Date: 22/03/2009

Title: Guideline for General Deliverables for Commissioning Authorities (CxA)
Issued by: Green Building Department

COMMISSIONING

Commissioning creates an Owner-Advocate quality review entity whose goals are to verify that the facility systems meet the functional and operational needs of the building's Owners and occupants. In plain language: to make very clear what the Owner's needs and wants are, and verify that these come to pass. It is an excellent way for an Owner to increase their confidence level during the period between conceptual planning and final construction. The Commissioning Agent maintains a clear line of sight from project beginning to end, maintaining focus on the measurable Project Intent items, providing early detection and Owner counsel if the project begins to veer off course. Commissioning (CxA) can be applied to any building component or manufacturing process, but is usually applied to Mechanical and Electrical (most commonly HVAC and control) building systems since these are the "moving parts – maintenance" systems and have historically been the most problematic. A cornerstone of Commissioning work is early detection since the steps used in each phase of a design and construction project build upon each other. The sooner a correction is made in the sequence of events, the better for all parties involved since it avoids delays and re-work. Sampling techniques are used to spot check work processes along the way, smoothing out many of the bumps in the road. Special attention is given to correct issues that may otherwise 'build-in' problems to the building or its operations. Commissioning isn't rocket science – it uses experience, diligence, common sense, and empathy. By considering the points of view and needs of each party in the design and construction team, coordination is greatly improved. Introducing CxA to the design process helps assure the design team remains focused on the original project goals as they delve into all the details. Introducing CxA to the construction process usually reduces RFI's and change orders, which benefits everyone involved and reduces schedule impacts. To achieve sustained benefits, CxA maintains a focus on service access, clear and accurate documentation, and ample user training.

Commissioning Authority (CxA) Scope of Services:

The commissioning Authority carries out several tasks at various phases of the project that can be outlined as under:

Commissioning Plan Development

- 1) CxA will conduct a scoping meeting where the commissioning process is reviewed with the commissioning team members. The plan must contain the following elements:
 - a) Project Description
 - b) Commissioning Overview
 - c) Commissioned Systems List & Level of Rigor for Each System
 - d) Design & Construction Stakeholders Data & Organizational Responsibility Matrix.
 - e) Identification of Stakeholders: Architect / Engineer, Owner's O&M Staff, Owner's Project Managers, Construction Managers and the Commissioning Agent.
 - f) Specific Responsibilities of each Stakeholder
 - g) Definition of the commissioning roles and lines of communications for each member of the project team.

- h) Definition of the commissioning process scope, in accordance with LEED Requirements.
- i) Scope to include Pre-functional Checklists, Functional Testing Requirements, Final Documentation Checklists and Owner Training
- j) Verification.
- k) Meetings & Communications Protocols
- l) Time Schedule of O&M Manuals, Training & Warrantees
- m) Appendix – Including any Abbreviations or Definitions

Prior to Construction

- 1) Review and assist the Owner/developer in completing the scope of Commissioning services
- 2) The CA will work with the Architectural and Engineering team to develop a design intent document.
- 3) The CA will perform a focused review of design documents at Schematic Design, Design Development, 50% CDs, 90% CDs and Final Contract Documents.
- 4) The CA will finalize a Commissioning Plan as noted above in accordance with LEED Requirements.
- 5) The CA will develop a commissioning specification with the design team that includes, but is not limited to:
 - a) Sample Pre-functional checklists and acceptance criteria for systems to be commissioned.
 - b) Sample Functional test procedures and acceptance criteria for systems to be commissioned.
 - c) Training planning and documentation requirements.
 - d) O&M Manual requirements and submission process.
- 6) Assist design team in completing commissioning specifications to be included in the construction documents.
- 7) The CA will work with the designers to coordinate the general/technical specifications with commissioning specification.
- 8) The CA will attend/participate in sustainable workshops as required during design.
- 9) Develop a preliminary Commissioning Plan using the current construction documents and the Basis of design document issued by the design team. Commissioning plan will be developed using an existing plan as a template.
- 10) Coordinate a controls integration meeting where the electrical and mechanical engineers and the CxA discuss integration issues between equipment, systems and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.
- 11) The CA will review training requirements of O&M staff and outline a training plan.

During Construction

- 1) Coordinate and direct the commissioning 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, frequently updated timelines and schedules and technical expertise.
- 2) Coordinate the commissioning work and, with the contractor and Owner/developer, ensure that commissioning activities are being scheduled into the Contractor's Master schedule.
- 3) Plan, conduct, and attend commissioning meetings as needed. Maintain and distribute minutes.
- 4) Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures. 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 testing procedures.

- 5) Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the Design Professional reviews.
- 6) Review requests for information and change orders for impact on commissioning and Design Team's Basis of Design Document.
- 7) Review coordination drawings to ensure that trades are coordinating work in a reasonable and logical manner.
- 8) With necessary assistance and review from installing contractors, write the functional performance test (FPT) procedures for equipment and systems. This will include manual functional testing, energy management control system trending and may include stand-alone data-logger monitoring. Submit to Owner/developer for review and approval.
- 9) Revise, as necessary, the construction phase commissioning plan developed during design, including scope and schedule, based upon approved submittals, RFI responses, Clarifications etc. that impact any aspect of the plan.
- 10) Review Commissioning plan with Owner/developer to confirm that the plan is acceptable to the Owner/developer.
- 11) Write and distribute construction checklists for commissioned equipment.
- 12) Develop an enhanced start-up and initial systems checkout plan with contractors for selected equipment.
- 13) Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
- 14) Witness (spot check) HVAC piping pressure test and flushing, sufficient to be confident that proper procedures were followed. Include testing documentation in the Commissioning Record.
- 15) Witness (spot check) ductwork testing sufficient to be confident that proper procedures were followed. Include documentation in the Commissioning Record.
- 16) Document construction checklist completion by reviewing completed construction checklists and by selected site observation.
- 17) Document systems startup by reviewing start-up reports and by selected site observation.
- 18) Approve air and water systems balancing by spot testing and by reviewing completed reports and by selected site observation. CxA may witness balancing work performed by balancing contractor in lieu of spot testing with their own equipment.
- 19) Analyze functional performance trend logs and monitoring data to verify performance.
- 20) Assist Contractor in coordinating FPT's, performed by installing contractors. Witness and document manual FPT's. Coordinate retesting as necessary until satisfactory performance is achieved. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction check listing by the installing contractors, and spot-checked by the commissioning provider during functional testing. 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.
Functional testing shall be done using conventional manual methods, control system trend logs, and read-outs or stand-alone data loggers, to provide a high level of confidence in proper system function, as deemed appropriate by the commissioning provider and the Owner/developer.
- 21) Prepare test plans for, assist with execution of, and document tests of commissioned equipment overseen by regulatory authorities and ensure that such tests meet the testing rigor desired by the Owner/developer.

- 22) Maintain a master issues log and a separate record of functional testing. Report all issues as they occur directly to the Owner/developer. Provide directly to the Owner/developer written progress reports and test results with recommended actions.
- 23) Review equipment warranties to ensure that the Owner/developer's responsibilities are clearly defined.
- 24) Oversee and approve the training of the Owner/developer's operating personnel.
- 25) Review and approve the preparation of the O&M manuals for commissioned equipment.
- 26) Compile a Commissioning Record, which shall include:
 - A. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning provider regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
 - a) Equipment meeting the equipment specifications
 - b) Equipment installation
 - c) Functional performance and efficiency,
 - d) Equipment documentation, and
 - e) Operator training.
 - B. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process 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.
 - C. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests, and trend log analysis.
- 27) Compile a Systems Concepts and Operations Manual that consists of the following: Basis of Design (which includes Owner/developer objectives and design narrative by designer); Performance metrics, if completed during design; space and use descriptions, coordinated shop drawings and schematics for major systems (by designer); 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, recommendations for recommissioning frequency by equipment type, energy tracking recommendations, and recommended standard trend logs with a brief description of what to look for in them.
- 28) When the commissioning process has been successfully completed, recommend acceptance to the Owner/developer of the commissioned equipment and systems for the purpose of achieving Substantial Completion.
- 29) CxA shall witness all required seasonal or deferred testing and deficiency corrections performed by the Contractor's Testing Engineer & Subcontractors. Return to the site at 10 months into the 12 months warranty period. Review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

Post Construction Warranty Phase

- 1) CxA will conduct seasonal or deferred testing as needed.
- 2) The CxA will conduct a ten month warranty on-site review.
- 3) CxA will amend the final Commissioning Report and Systems Operating Manual as required.
- 4) The CxA will review record documents for accuracy and completion.
- 5) The CxA will provide necessary services during this phase to ensure LEED requirements are fulfilled

Systems to be commissioned:

- A. Central building automation system
- B. All equipment of the heating, ventilating and air conditioning systems
- C. Scheduled or occupancy sensor lighting controls
- D. Daylight dimming controls
- E. Refrigeration systems
- F. Emergency power generators and automatic transfer switching
- G. Uninterruptible power supply systems
- H. Life safety systems (fire alarm, egress pressurization, fire protection)
- I. Electrical
- J. Plumbing
- K. Vertical transport