

# Appendix P-1b1: Design and Construction Commissioning Process

Based on B3 Guidelines—Version 3.2r01

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## Introduction

Design and Construction Commissioning refers to the process that begins in pre-design and concludes at project closeout. The Design and Construction Commissioning process is the means to verify and document that the facility systems operate in accordance with their design intent and that the operations staff fully understands the system operational procedures and are prepared to continue operating the system per the design intent and the project requirements. This includes documenting system operational goals and design parameters, specifying verification and testing in the contract documents, confirming the successful completion of the verification process, documenting the system operational procedures and training the operations staff. The Design and Construction Commissioning Process is coordinated by the Commissioning Leader and executed by the Commissioning Team.

The following are narrative descriptions of the activities (rows) in Appendix P-1b2 Design and Construction Commissioning Matrix. This document is intended to be used alongside the processes and definitions described in ANSI/ASHRAE/IES Standard 202 – 2013.

Note also that there are moisture safe enclosure testing or enclosure consultant requirements under guideline I.2C that are not listed as commissioning activities in this document, though these activities may follow a similar process.

# Design & Construction Commissioning Plan Scope

## 1.01: The Design & Construction Commissioning Plan

The Design & Construction Commissioning Plan consists of the following elements:

- Systems Commissioning Plan
  - List of required systems to be commissioned:
    - Mechanical HVAC Comfort, Energy, and Renewable Energy Systems, Testing Adjusting and Balancing: And other elements related to performance of Guidelines E.1, E.2, E.3, E.4, I.3, I.4
    - Electrical Systems, including Lighting and Daylighting Controls: And other elements related to performance of Guidelines S.5, E.1, E.2, E.3, E.4, I.5
    - Indoor Air Quality Elements and Systems: And other elements related to performance of Guidelines I.3, I.4
  - List of recommended systems to be commissioned:
    - Plumbing Systems : Flow rate commissioning and any other elements needed to support operational achievement of guidelines S.2
    - Interior materials (specification, installation): As needed to support operational achievement of guidelines I.1, M.1, M2, M.4
    - Envelope integrity: In addition to required water infiltration commissioning above as needed to support operational achievement of guidelines I.2
    - IEQ: Vibrations/acoustics/noise: In addition to occupant surveys above, perform physical measurements as needed to support operational achievement of guideline I.6
    - Envelope Integrity: Engage Building Commissioning above required enclosure air tightness testing or use of a building enclosure consultant
  - Owners Project Requirements (per guideline P.1A)
  - Basis of Design for systems to be commissioned (per Guideline P.1C)
  - Description of commissioning activities
  - List of commissioning team members by project role
  - Assignment of roles and responsibilities of each team member
  - Description of commissioning documentation requirements
  - Customized system installation checklists and functional performance test procedures to be completed prior to system acceptance by the owner
  - Correction Period User Comfort and Satisfaction Assessment Plan

The Design and Construction Commissioning Plan is a living document that grows in detail over time, as systems are specified and design details are refined. The following is a description of how the Commissioning Plan shall evolve over the course of the project.

- Pre-design
  - Brief description of commissioning process for budgeting purposes.
  - Systems to be commissioned
  - Inclusion of Owner's Project Requirements Document and Basis of Design for those systems
- Design Phase Documentation
  - Draft Commissioning Plan
    - List of system types to be commissioned
    - Include updated Owner's Project Requirements

- Include updated Basis of Design Document for those systems
- Description of commissioning activities
- List of commissioning team members; by project role, not by name
- Assignment of roles and responsibilities of each team member
- Description of commissioning documentation requirements
- Description of commissioning activities
- List of commissioning team members by project role
- Assignment of roles and responsibilities of each team member
- Description of commissioning documentation requirements
- Final Design Documentation
  - Commissioning Plan
    - Updated detailed list of systems (using design document names/numbers) to be commissioned
    - Review updated Owner’s Project Requirements for those systems
    - Review updated Basis of Design Document for those systems
    - Description of commissioning activities
    - List of commissioning team members by project role
    - Assignment of roles and responsibilities of each team member
    - Description of commissioning documentation requirements
    - List of commissioning activities to be incorporated into the construction schedule, including recommended integration with typical contractor installation, startup, and turnover milestones
    - Customized system installation checklists and functional performance test procedures to be completed prior to system acceptance by the owner
- Closeout
  - Same as Final Design but updated to reflect any system modifications or additions approved during Construction. Sections that may need to be changed include:
    - Updated detailed list of systems (using design document names/numbers) that have been commissioned
    - Updated Owner’s Project Requirements
    - Basis of Design for those systems
    - Customized system installation checklists and test procedures completed prior to system acceptance by the owner

## 1.02: Commissioning Reports

Commissioning Reports shall be prepared at the end of each phase of design and construction documenting progress in and compliance with the Commissioning Plan for that phase. Each report should include recommendations for adjustments in the Commissioning Plan for the next phase.

Starting with the Design Phase and going through the Final Design Phase, the Commissioning Reports should include design review comments documenting the Commissioning Team’s evaluation of the ability of the facility, as defined or described at the Phase, to meet the Owner’s Project Requirement criteria.

The Closeout Commissioning Report shall be the final deliverable of the Design and Construction Commissioning Process. The Report shall state that the Design and Construction Commissioning Plan has been completed and the Owner’s Project Requirements have been achieved. If the owner accepts systems that do not meet the Owner’s Project

Requirement criteria, the Report shall document which deviations were approved by the owner. The report shall also include, but not be limited to, the following:

- Owner's Project Requirements
- Other System Requirements and Parameters
- Specifics of Equipment and Systems Operation
- Test Procedures
- Testing Record
- O&M Training Record
- Commissioning Team Participants

# System Commissioning Activities

## 2.01 Engage Commissioning Team

The Commissioning Team assists in planning, reviewing and coordination of commissioning activities with all disciplines involved in the building project. The Commissioning Team shall include the following members at a minimum. Contractors will not join the team until they are selected through the normal procurement process.

- Commissioning Leader
- Facility Operations Manager (FOM)
- Project Manager
- Designers
- Contractors
- Energy Modeler (if energy modeling is part of the project)
- Guideline Leader

The Commissioning Leader facilitates and coordinates the efforts of the commissioning team. For Design and Construction Commissioning, the commissioning leader shall have a distinct role from the design team but may be employed within a firm providing design services.

The Facility Operations Manager is accountable for facility performance during ongoing occupancy and will manage or perform ongoing operations and maintenance following construction. This person is available to participate throughout the design and construction process for continuity into final operation.

## 2.02 Coordination of Owner's Project Requirements (as required by guideline P.1A)

- The Owner's Project Requirements (OPR) shall quantify functional performance expectations and parameters for each system to be commissioned. The OPR provides the common understanding that focuses design, construction, and commissioning activities on the desired outcome. The OPR shall be written in objective and measurable terms. Quantify parameters such as space temperatures, humidity levels, lighting levels, sound levels, and ventilation rates when applied to the conditioned building spaces
- The OPR shall be updated every time the owner accepts an alternate requirement or performance criteria –due to owner desires, schedule, or budget. This might occur through normal design evolution, value engineering, change orders, or other supplemental instructions during construction.
- The OPR shall include an updated SB 2030 Energy and Carbon Standard for the project related to Guidelines E.1 and renewable energy requirements under E.2 and updated as the program and the project are refined.
- During the Correction Period and On-Going Operations, the OPR helps the owner/operators understand the requirements of the owner. It also provides the benchmark for maintenance, repair, and replacement decisions.

## 2.03 Coordination with Basis of Design (as required by guideline P.1C)

- The Basis of Design (BOD) is a narrative description of how the systems will be designed in order to achieve the Owner's Project Requirement acceptance criteria

## 2.04 Commissioning Design Review

At least once during each of the Design, Final Design, review the design progress against the goals of the Owners Project Requirements. Commissioning Design Review comments shall be documented in writing and responses prepared by the appropriate designers.

- **Performance Check:** Commissioning Team shall review design as documented to verify that it meets the physical outcomes and operational performance defined at that phase. Performance areas include, but are not limited to:
  - Owner’s Project Requirements acceptance criteria for all required and additional pursued Guidelines
  - Requirements for specific operational scenarios of the building
- **Measurability/ Testability Check:** Commissioning Team shall review design as documented to verify that it meets criteria for testing and verification of performance for Design and Construction Commissioning as well as Operations Commissioning monitoring during Ongoing Occupancy. Performance areas include, but are not limited to:
  - Measurements and testing required during all phases of Design and Construction Commissioning.
  - Measurement, monitoring, and control of energy, water, indoor environmental quality during Ongoing Occupancy.

### **2.05 Coordinate with Operations Commissioning and Energy Efficient Operations Manual**

Cooperate with the Operations Commissioning Team by incorporating design features required to perform Operations Commissioning. Refer to and coordinate with the completion of Guideline P.2A: SB 2030 Energy Efficient Operations Manual process.

### **2.06 List of I/O Data Points**

Submit a list of input and output (I/O) data points or sequence of operations as part of outcome documentation before the completion of the Final Design Phase. These shall be submitted for all computer-based control systems, e.g., HVAC, lighting controls which have programmable control logic.

### **2.07 Provide Cx Criteria & Scope for Construction Documents**

Provide a commissioning specification section for Division 1 of the project manual. The commissioning specification shall define and elaborate on the contractor’s responsibilities as defined in the Commissioning Plan. Incorporate the Commissioning Plan into the contract documents by reference in order to communicate the context of the commissioning specification and information regarding other team member responsibilities.

### **2.08 Review Contractors' Submittals**

Review contractor submittals for commissioned equipment and other commissioned design elements.

### **2.09 Verify Installation**

Complete customized system installation checklists, as included in the Commissioning Plan, prior to system acceptance by the owner.

### **2.10 Verify Functional Performance**

Complete customized system functional performance test procedures, as included in the Commissioning Plan, prior to system acceptance by the owner.

### **2.11 Verify Operations & Maintenance (O&M) Documentation**

Verify that the contractor creates and submits Operations & Maintenance manuals for the owner prior to construction completion and system acceptance.

### **2.12 Verify Operations & Maintenance (O&M) Training**

Verify that the contractor presents Operations & Maintenance training to the owner prior to construction completion and system acceptance by the owner.

### **2.13 Systems Operations Manual**

Prepare, coordinate, or verify the preparation of a Systems Operations Manual to be delivered to the Owner, including at least the parts listed under ASHRAE 202-2013 Part 14.2.3.

### **2.14 Deferred Verification**

Some of the system functional performance test procedures will not be practical or meaningful to complete prior to the Correction Period. This may be due to construction phasing, climate or other constraints. Those test procedures shall be completed at the earliest appropriate time, and the results of the tests shall be reported to the Owner and Project team. It shall be expected that deficiencies identified as part of this deferred testing executed after the Correction Period will be resolved by the project team as if they had been identified prior to the end of the Correction Period.

### **2.15 Ten Month O&M Review**

At 10 months into the correction period, review building operation with Operations and Maintenance staff, and create a plan for resolution of outstanding commissioning-related issues.