

## Appendix P-4a: Design and Construction Commissioning Supporting Information

### Introduction

Design and Construction Commissioning refers to the process that shall begin in pre-design and conclude after the correction period or after completion of a full year of operation, whichever is later. 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. 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 scope of the requirements of guideline P-4 is intended to align with the typical scope of Commissioning Agent.

The following are narrative descriptions of the activities (rows) in Appendix P-4d Design and Construction Commissioning Matrix.

### 1. GENERAL

#### 1.01 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.4, I.5
    - Electrical Systems, including Lighting and Daylighting Controls: And other elements related to performance of Guidelines : S.5, E.1, E.2, E.3, I.6, I.9
    - Indoor Air Quality Elements and Systems: And other elements related to performance of Guidelines : I.1, I.2, I.3, I.4, I.5
  - The following systems are recommended to be included in the commissioning process and in the Systems Commissioning Plan:
    - Plumbing Systems : In addition to required flow rate commissioning above as needed to support operational achievement of guidelines: S.7, S.8, S.13
    - Interior materials (specification, installation): As needed to support operational achievement of guidelines: I.2, M.1, M.
    - Envelope integrity: In addition to required water infiltration commissioning above as needed to support operational achievement of guidelines: I.3, M.1, M.2
    - IEQ: Vibrations/acoustics/noise: In addition to occupant surveys above, perform physical measurements as needed to support operational achievement of guidelines: I.7, I.8
    - Plumbing Systems: Flow Rate
    - Envelope Integrity: Test Building Envelope for Water Infiltration

- Design Intent Document for systems to be commissioned (as created by the design team, see appendix P-3a )
- Basis of Design for systems to be commissioned (as created by the design team, see appendix P-3a )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
- 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.

- Agency Planning
  - Brief description of commissioning process for budgeting purposes.
- Pre-Design/Programming & Pre-Design/Site Selection
  - Brief description of commissioning process for budgeting purposes.
  - Systems to be commissioned
  - Inclusion of Design Intent Document and Basis of Design for those systems (as created by the design team)
  - Reference the Energy Standard and the estimated Carbon Footprint per the Sustainable Building 2030 program<sup>1</sup>
- Schematic Design Phase
  - Systems Commissioning Plan
    - General list of system types to be commissioned
    - Include Design Intent Document for those systems (as created by the design team)
    - Include Basis of Design Document for those systems (as created by the design team)
    - Review and comment for Energy Standard and Carbon Footprint updates for the Design Intent Document and Basis of Design Document. Review and comment as necessary. Review and comment upon the completion of the Building Strategy Checklist from Guideline E.1D.
    - 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
- Design Development
  - Systems Commissioning Plan
    - Detailed list of systems (using design document names/numbers) to be commissioned
    - Include updated Design Intent Document for those systems
    - Include updated Basis of Design Document for those systems

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<sup>1</sup> Refer to the Sustainable Building 2030 Compliance and Reporting Instructions:  
[http://www.mn2030.umn.edu/download/Welcome\\_SB2030\\_Instructions.pdf](http://www.mn2030.umn.edu/download/Welcome_SB2030_Instructions.pdf)

- Review and comment as necessary on any Energy Standard and Carbon Footprint updates. Review and comment upon the completion of the Building Strategy Checklist from Guideline E.1D.
- 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
- Construction Documents
  - Systems Commissioning Plan
    - Updated detailed list of systems (using design document names/numbers) to be commissioned
    - Review updated Design Intent Document for those systems
    - Review updated Basis of Design Document for those systems
    - Incorporate any Energy Standard and Carbon Footprint updates into the Design Intent Document and Basis of Design Document. Review and comment as necessary. Coordinate with the completion of the Building Strategy Checklist from Guideline E.1D.
    - 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
    - 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
- During Project Construction
  - Same as Construction Documents 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) to be commissioned
    - Updated Design Intent Document for those systems
    - Basis of Design for those systems
    - Provide suggested Energy Standard and Carbon Footprint updates for the Design Intent Document and Basis of Design Document. Review and comment as necessary. Coordinate with the completion of the Building Strategy Checklist from Guideline E.1D. Customized system installation checklists and test procedures to be completed prior to system acceptance by the owner
- Correction Period
  - Same as Construction but updated to reflect any system modifications or additions approved during at the time of systems turnover to the owner. This document is intended to include representation of the final approved and tested condition of the systems being commissioned. Sections that may need to be changed include:
    - Updated Design Intent Document
    - Review any Energy Standard to the Design Intent Document and Basis of Design Document
    - Customized system installation checklists and test procedures to be 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 Pre-Design Phase and going through the Construction Documents 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 Design Intent Document criteria.

The end-of-Correction Period 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 Design Intent Document criteria have been achieved. If the owner accepts systems that do not meet the Design Intent Document criteria, the Report shall document which deviations were approved by the owner. The report shall also include, but not be limited to, the following:

- Design Intent Document
- Other System Requirements and Parameters
- Specifics of Equipment and Systems Operation
- Test Procedures
- Testing Record
- O&M Training Record
- Commissioning Team Participants

### **1.03 Compliance and Outcome Documentation**

Review documentation submitted as required by the B3 Guidelines at the end of each phase of the design and construction process using the B3 Guidelines Tracking Tool ([www.msbgtracking.com](http://www.msbgtracking.com)). This includes Sustainable Building 2030 documentation (i.e., Energy Standard, Carbon Footprint, energy usage predictions, Building Strategy Checklists, Meter Plan, Drawings & Schedules, Energy Model Verification Form, and annual energy use data). Refer to the Sustainable Building 2030 Compliance and Reporting Instructions for additional details.

## **2. SYSTEMS COMMISSIONING**

### **2.01 Engage Commissioning Team (as coordinated with the Integrated Design Process, see Appendix P-3a and P-3b)**

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 Design Intent Document (as coordinated with the Integrated Design Process and as created by the design team, see Appendix P-3a and P-3b)**

- The Design Intent Document (DID) shall quantify functional performance expectations and parameters for each system to be commissioned. The DID provides the common understanding that focuses design, construction, and commissioning activities on the desired outcome. The DID 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 DID shall be updated every time the owner accepts an alternate 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 DID shall include an updated SB2030 Energy and Carbon Standard for the project related to Guidelines E-1, E-4, E-5 and E-8.
- During the Correction Period and On-Going Operations, the DID helps the owner/operators understand the original design intent. It also provides the benchmark for maintenance, repair, and replacement decisions.

### **2.03 Coordination with Basis of Design (as coordinated with the Integrated Design Process and as created by the design team, see Appendix P-3a and P-3b)**

- The Basis of Design (BOD) is a narrative description of how the systems will be designed in order to achieve the design intent acceptance criteria
- If energy modeling is part of the project, the Energy Modeler provides the energy model's inputs and outputs to the Designers and uploads the inputs and outputs to the on-line B3 Guidelines Tracking Tool. The Designers and the Sustainable Building 2030 reviewers review the energy model's inputs and outputs in parallel to confirm that the energy model parameters match the system configurations outlined in the BOD.
- In addition, the Energy Modeler shall estimate the annual building energy consumption by energy-type which becomes part of the Systems Operations Manual. The Energy Modeler shall upload the annual energy consumption estimate to the on-line B3 Guidelines Tracking Tool. Refer to Section 5: Systems Operations Manual in Appendix P-5a: Operations Commissioning Supporting Information for more details on the initial allocation of building energy diagrams, refer to the SB2030 program for energy model requirements.

### **2.04 Commissioning Design Review**

At least once during each of the Schematic Design, Design Development, and Construction Documents Phases, review the design progress against the goals of the Design Intent Document. 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:
  - Design Intent 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 Requirements (Appendices P-5a and P-5b)**

Cooperate with the Operations Commissioning Team by incorporating design features required to perform Operations Commissioning. Refer to Appendix P-6 Operations Commissioning Support Information and Appendix P-5b Operations Commissioning Matrix for an understanding of what these features might be.

#### **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 end of 50% Construction Documents. These shall be submitted for all computer-based control systems, e.g., HVAC, lighting controls, etc.

#### **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 by the owner.

**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 a Systems Operations Manual to be delivered to the Owner. Please refer to Appendix P-5a Operations Commissioning Supporting Information’s Section 6 “Systems Operations Manual.”

**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.