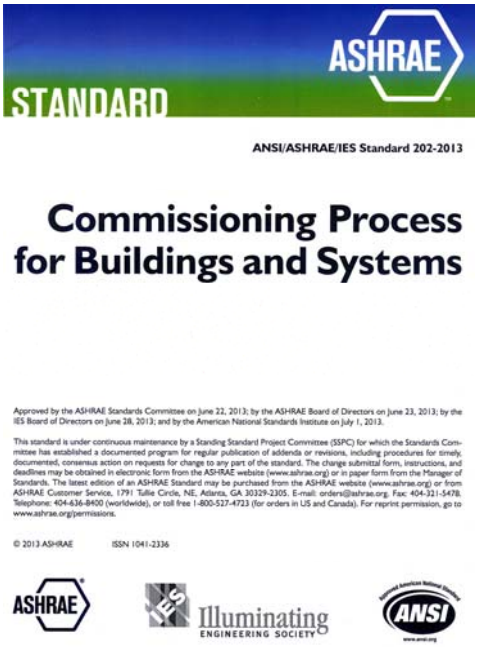
THE COMMISSIONING PROCESS AND ASHRAE STANDARD 202

Instructor:
Walter T. Grondzik, PE

Fellow ASHRAE, LEED-AP
Ball State University
Department of Architecture
Muncie, IN 47306
gzik@polaris.net



Copyright Materials

Copyright ©2014 by ASHRAE. All rights reserved.

No part of this presentation may be reproduced without written permission from ASHRAE, nor may any part of this presentation be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, photocopying, recording, or other) without written permission from ASHRAE.

AIA/CES Registered Provider

ASHRAE is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

USGBC Education Partner

The Commissioning Process and ASHRAE Standard 202

by ASHRAE

GBCI cannot guarantee that course sessions will be delivered to you as submitted to GBCI. However, any course found to be in violation of the standards of the program, or otherwise contrary to the mission of GBCI, shall be removed. Your course evaluations will help us uphold these standards..

Approval date: 08/07/2013

Approved for:

3

General CE hours

0

LEED-specific hours

LEED GREEN ASSOCIATE ☐

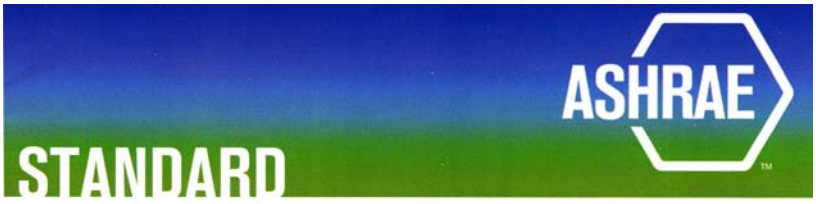
LEED AP BD+C ☐

LEED AP HOMES ☐

LEED AP ID+C ☐

LEED AP ND ☐

LEED AP ☐



ANSI/ASHRAE/IES Standard 202-2013

Commissioning Process for Buildings and Systems

Learning Objectives

- Understand the purpose and scope of ASHRAE Standard 202—and the commissioning process it describes
- Appreciate the role and usage of the various commissioning process documents that provide the structure for Standard 202
- Relate mandatory commissioning process activities to the several phases of the building acquisition process

Learning Objectives (continued)

- Understand the roles of the prescribed commissioning process documents in guiding a successful process and outcome
- Identify the roles typically assumed by the various participants in the commissioning process
- Appreciate the importance of commissioning to the delivery of a high-performance building

Disclaimer

This course describes an ASHRAE standard that may be adopted by a jurisdiction as part of a government-enforced codes process. While every attempt is made to provide accurate information, enforcement of code provisions lies in the hands of the Authority Having Jurisdiction. It is impossible to predict how any individual AHJ may interpret the requirements of Standard 202 and/or how such interpretations may be enforced. Those involved with a code-mandated commissioning process must discuss expectations with the AHJ.

Course Outline

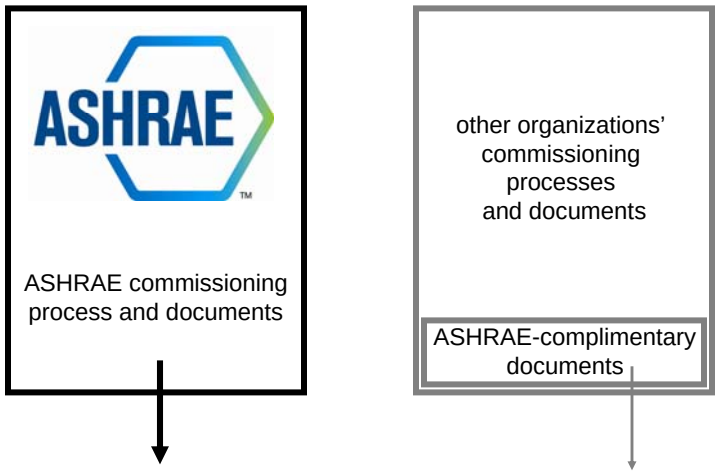
- The Commissioning Process and Standard 202
- Foundational Commissioning Process Documents
- Design-Related Commissioning Process Documents
- Construction Related Commissioning Process Documents
- Occupancy-Related Commissioning Process Documents
- Summary

Section 1:

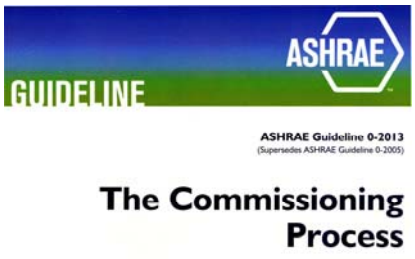
The Commissioning Process and Standard 202

- Standard 202 and Related Commissioning Guidelines
- The Intent of ASHRAE Standard 202
- Understanding the Commissioning Process
- The Benefits of Commissioning
- Overview of Standard 202 Documentation Requirements

Standard 202 and Related Guidelines



Standard 202 and Guideline 0



how related?

ASHRAE STANDARD 202

- written in code language
- intended to present the minimum acceptable characteristics of a **viable** commissioning process
- allows for adaptation to a specific project context
- systems and assemblies to be commissioned may be selected by the owner (unless otherwise dictated by a referring code or guideline)

ASHRAE GUIDELINE 0

- written in guideline language
- intended to present the minimum acceptable characteristics of an **ideal** commissioning process
- allows for adaptation to a specific project context
- systems and assemblies to be commissioned are intended to be selected by the owner

Standard 202 and Related Guidelines

may inform 202 implementation

ASHRAE Guideline 0.1: process (new project)
ASHRAE Guideline 0.2: process (existing project)

will support 202 implementation

ASHRAE Guideline 1.1: HVAC&R details (new)
ASHRAE Guideline 1.2: HVAC&R details (existing)
ASHRAE Guideline 1.3: Operator Training support
ASHRAE Guideline 1.4: Systems Manual support
ASHRAE Guideline 1.5: Smoke Control details

may conflict with 202

IESNA DG-29: Lighting Systems details
NIBS Guideline 3: Enclosure Systems details

ASTM E2813: Enclosure Systems process

Standard 202 → Purpose

1. Purpose:

The purpose is to identify the minimum acceptable Commissioning Process for buildings and systems.

ANSI/ASHRAE/IES Standard 202-2013

Standard 202 → Scope

2. Scope:

This standard provides procedures, methods, and documentation requirements for each activity for project delivery from predesign through occupancy/operations, including

a. overview of Commissioning Process activities,

b. description of each step's minimum activities,

c. minimum documentation requirements, and

d. acceptance requirements.

ANSI/ASHRAE/IES Standard 202-2013

Standard 202 → Utilization

4.1 Introduction:

… scope will depend upon how the project will be designed, built, and operated … scope shall be defined in the Owner's Project Requirements and the Cx Plan … process described is written for a generic project and must be adapted to each project … can be supplemented by companion technical documents and guidelines … can be applied to both new and renovation projects

extracted from ANSI/ASHRAE/IES Standard 202-2013

Standard 202 → Utilization

4.2 Requirements:

a. provide the minimum activities in the design, development, construction, operation, and modification of physical buildings, systems, and assemblies

b. establish process activities and sequence of activities

c. establish deliverables and documentation

paraphrased from ANSI/ASHRAE/IES Standard 202-2013

4.2.2 Commissioning Process Activities and Deliverables

Activity	Deliverable
Initiate Cx Process	Roles and Responsibilities
Decide Project Requirements	Owner's Project Requirements
Develop Cx Plan	Cx Process Plan
Design Approach to Requirements	Basis of Design
Set Contractor Cx Requirements	Cx Specifications
Review Design to Requirements	Design Review Report
Review Submittals	Submittal Review Report
Observe and Test	Construction Checklists and Reports
Resolve Issues	Issues and Resolution Log
Assemble Systems Manual	Systems Manual
Conduct Training	Training Plans and Records
Postoccupancy Operation	End of Warranty Cx Report
Assemble Cx Report	Cx Report

Standard 202 → Utilization

← **4.2 Requirements**

note linkage between activity and deliverable (document)

ANSI/ASHRAE/IES Standard 202-2013

Standard 202 → Utilization

4.3 Acceptance:

… each activity and deliverable shall include an acceptance step as defined in the OPR and Cx Plan … acceptance of the commissioning deliverable by the owner or client … the standard does not require the CxA to accept designer's or contractor's work on behalf of the owner or jurisdiction

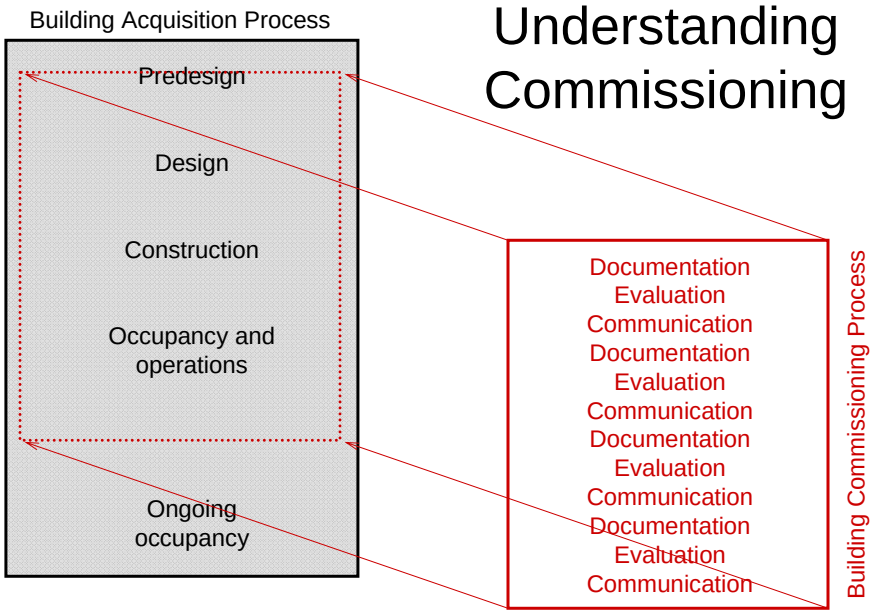
excerpted from ANSI/ASHRAE/IES Standard 202-2013

Understanding the Commissioning Process

The following sections of this course will attempt to provide an understanding of the commissioning process as laid out in Standard 202, but briefly the process involves:

→ Documentation
→ Evaluation
→ Communication

as a process that *overlays* the building acquisition process



Understanding Commissioning

The Benefits of Commissioning

Perhaps delete this slide?
Course not "selling" Cx

or

why bother with this commissioning process overlay?

Why Is Commissioning Needed?

Stuff happens on most projects (the "stuff" being any number of issues that are potentially detrimental to the owner's project interests)

These issues may include:

- Poorly identified owner needs/wants
- Poorly executed work:
  - → Design work
  - → Construction work
  - → Operations/maintenance work
- Poor communications among participants

Perhaps delete this slide?
Course not "selling" Cx

Issues within the Project Phases

Perhaps delete this slide?
Course not "selling" Cx

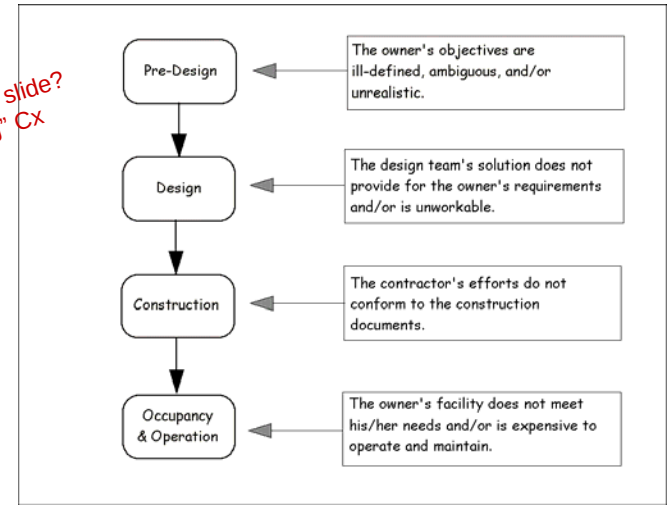


image © Walter Grondzik; used with permission

Issues at the Project Transitions

Perhaps delete this slide?
Course not "selling" Cx

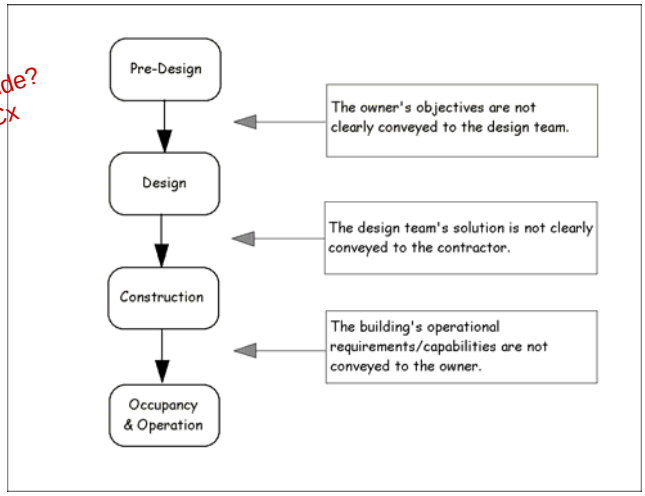


image © Walter Grondzik; used with permission

CX Intervention at the Project Phases

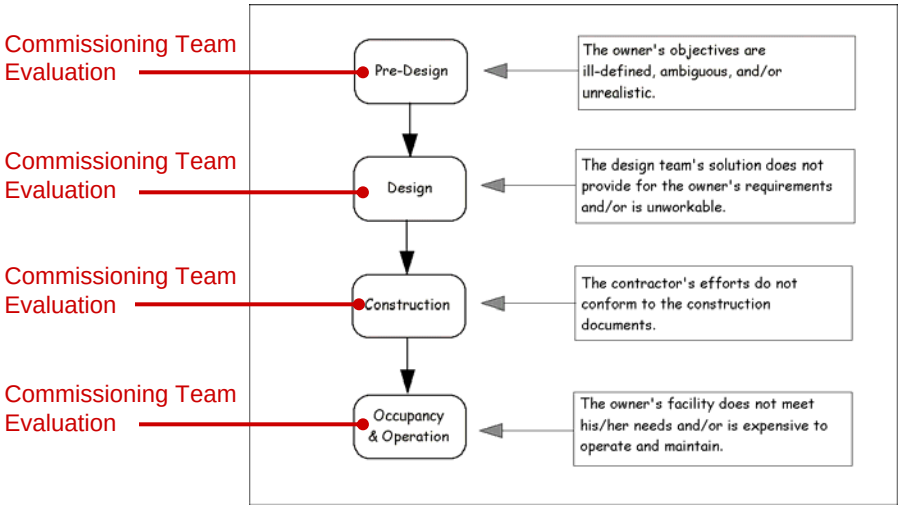


image © Walter Grondzik; used with permission

CX Intervention at the Transitions

Commissioning Process Documentation and Commissioning Team Communications

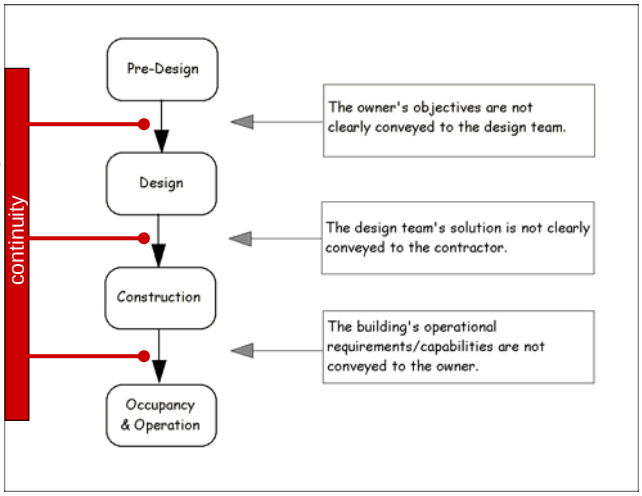


image © Walter Grondzik; used with permission

The Benefits of Commissioning

- A project that works (fully) upon initial occupancy
- A project that generally reflects the owner's needs and desires
- A project that has benefited from the collaborative efforts of the diverse participants
- A project with clear performance benchmarks
- A project that is well-documented
- Facility staff that are prepared to properly operate and care for systems and assemblies

Perhaps delete this slide?
Course not "selling" Cx

Successful Commissioning Is Not Without Cost

Costs will vary depending on:

Perhaps delete this slide?
Course not "selling" Cx

- Type of project
- Complexity of the project
- System(s) being commissioned
- The quality of the envisioned commissioning process (service versus commodity) ← code versus guideline?
- The commissioning authority (provider) selected
- The demands and expectations of the owner

A Successful Commissioning Process Will Display

→ Explicitly stated expectations and responsibilities

→ Good document development and utilization

→ Evaluation of design and construction artifacts

→ Successful and non-confrontational communications

TABLE A1 Commissioning Process Documentation Matrix

Activity	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Project Initiation	Owner's Project Requirements	Owner, CxA, O&M, Users, Design Team	Owner, CxA, or Design Team	Owner	CxA, Design Team	Design Team may not be hired yet.
	Initial Cx Plan	Owner, Design Team, CxA	Owner or CxA	Owner	CxA, Owner, Design Team, Construction Team	Design Team may not be hired yet.
	Systems Manual Outline	Owner, O&M, CxA	Owner or CxA	Owner	Design Team, Construction Team	May be included in OPR
	Training Requirements Outline	Owner, O&M, Users, CxA, Design Team	Owner or CxA	Owner, CxA	Design Team, Construction Team	May be included in OPR
	Issues and Resolution Log Format	Owner, CxA	Owner or CxA	Owner	CxA, Design Team	May be only format at this time
	Cx Report Format	Owner, CxA	CxA	Owner	Design Team, Owner	
	Owner's Project Requirements Update	Owner, CxA, O&M, Users, Design Team	CxA or Designer	Owner	CxA, Design Team	
Design	Basis Of Design	Design Team	Design Team	Owner, CxA	Design Team, CxA	
	Construction Specifications for Cx	Design Team, CxA, Owner	Design Team or CxA	Owner	Contractors, CxA, Design Team	May also be provided by project manager/owner's representative
	Systems Manual Outline (Expanded)	Design Team, CxA, O&M, Contractor	Design Team or CxA	Owner, CxA	Design Team, Contractor	Contractor may not be hired yet.
	Training Requirements	Owner, CxA O&M, Users,	Owner, CxA, O&M	Owner	Design Team	Contractor input
	Requirements in Specifications	CxA, Design Team	Design Team, CxA	Owner	Design Team	
	Design Review Comments	CxA	CxA	Design Team, Owner	Design Team	
	Issues and Resolution Log	CxA	CxA	N/A	CxA, Design Team	

Note: The term *contractor* is understood to refer to any of several entities that provide construction services. Depending upon the project, this could include, among others, the owner's representative, construction manager, contractors, and subcontractors. Abbreviations: CxA: Commissioning Authority; O&M: operations and maintenance; OPR: Owner's Project Requirements.

An Overview of Standard 202 Documents

document title or description linked to commissioning process activity (actually "phase")

predesign

design

TABLE A1 Commissioning Process Documentation Matrix *(Continued)*

Activity	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Construction	Issues Report	CxA	CxA	Owner	Design Team, Owner	
	Design Cx Process Report	CxA	CxA	Owner	Owner	
	Owner's Project Requirements Update	Owner, O&M, Users, Design Team, Construction Team	CxA or Designer	Owner	CxA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CxA, Owner	Design Team, CxA	
	Cx Plan Update	Design Team, CxA, Owner, Contractor	CxA	CxA, Owner, Design Team, Contractor	CxA, Owner, Design Team, Contractors	
	Submittal Review Comments	CxA	Design Team	Design Team	Contractor	
	System Coordination Plans	Contractor, Design Team	Contractor	CxA, Design Team	Contractor, CxA	
	Evaluation Checklists	CxA, Contractor, Design Team	CxA	CxA, Design Team	Contractor	
	Evaluation Reports	Contractor	CxA	CxA, Owner	Contractor	
	Test Procedures	CxA, Contractor, Design Team	CxA	CxA, Design Team	Contractor	
	Test Data Reports, Test and Balance Report	Contractor	CxA	CxA, Owner	Contractor	
	Cx Meeting Agendas and Minutes	CxA	CxA	All	All	
	Training Plans	Design Team, CxA, O&M, Contractor	Contractor or CxA	Owner, CxA	O&M, Users, Contractor	
	Systems Manual	Design Team, CxA, O&M, Contractor	Contractor	Owner, CxA	O&M, Users	
	Issues and Resolution Log	CxA	CxA	N/A	CxA, Design Team, Contractor	
	Issues Report	CxA	CxA	Owner, Design Team	Design Team, Owner, Contractor	
	Preliminary Construction Cx Report	CxA	CxA	Owner	Owner	Prior to occupancy
	Final Construction Cx Report	CxA	CxA	Owner	Owner	

Note: The term *contractor* is understood to refer to any of several entities that provide construction services. Depending upon the project, this could include, among others, the owner's representative, construction manager, contractors, and subcontractors. Abbreviations: CxA: Commissioning Authority; O&M: operations and maintenance; OPR: Owner's Project Requirements.

An Overview of Standard 202 Documents

document title or description linked to commissioning process activity (actually "phase")

construction

An Overview of Standard 202 Documents

TABLE A1 Commissioning Process Documentation Matrix *(Continued)*

Activity	Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Occupancy/ Operations	Owner's Project Requirements Update	Owner, O&M, Users, Design Team	CxA or Designer	Owner	CxA, Design Team, Contractors	
	Basis of Design Update	Design Team	Design Team	CxA, Owner	Design Team, CxA	
	Maintenance Program	Owner, O&M, Contractor, CxA	Owner or CxA	Owner, CxA	O&M, Users	
	Test Procedures	Contractor, CxA, O&M, Design Team	CxA	Design Team, CxA	Contractor	
	Test Data Reports	Contractor	CxA	CxA, Owner	Contractor, O&M	
	Issues and Resolution Log	CxA	CxA	N/A	CxA, Design Team, Owner Contractors	
	Issues Report	CxA	CxA	Owner	Design Team, Owner, Contractors	
	Cx Report	CxA	CxA	Owner	Owner	Final report
	Recommissioning Plan	O&M, Users, CxA	CxA or Owner	Owner	Owner	

Note: The term *contractor* is understood to refer to any of several entities that provide construction services. Depending upon the project, this could include, among others, the owner's representative, construction manager, contractors, and subcontractors. Abbreviations: CxA: Commissioning Authority; O&M: operations and maintenance; OPR: Owner's Project Requirements.

document title or description linked to commissioning process activity (actually "phase")

postoccupancy

Questions?

Before leaving this introduction to
The Commissioning Process
and Standard 202

Next section: Foundational Commissioning Process Documents

Section 2:

Foundational Commissioning Process Documents

(Initiating the Commissioning Process)

- Navigating Code Language Requirements for a Complex Process
- Services Contracts
- Owner's Project Requirements (OPR)
- The Commissioning Plan

Foundational Commissioning Process Documents

A note about the course focus on documents:

This course is structured around commissioning process documents because attempts by code officials to enforce the provisions of Standard 202 are believed most likely to focus on documents. Reviewing documents (physical artifacts) as a means of ensuring the adequacy of a complex and continuous process (spread across time, spread across geographic locations, and distributed among many participants) seems logical.

Foundational Commissioning Process Documents

A note about excerpts from Standard 202:

Excerpts from Standard 202 that appear in this course are NOT always verbatim. Editorial freedom has been used to attempt to better convey information without changing the underlying meaning of the standard. For full and precise requirements—obtain and use Standard 202.

Flexible Mandatory Requirements

The means by which Standard 202 can provide flexibility of application while being code-enforceable lies in two key documents developed during the predesign phase:

→ The Commissioning Plan

→ The Owner's Project Requirements (OPR)

These scoping documents are supported by the professional services contract between the owner and the commissioning authority.

Note: Standard 202 uses the term Commissioning Authority; this may change to Commissioning Provider

Initiating the Commissioning Process

- The owner selects the Commissioning Authority
- The owner determines the scope of the commissioning process (what is to be commissioned)
- The owner selects members for the commissioning process team
- The owner incorporates commissioning process activities into project team responsibilities
- The owner establishes a commissioning process budget

with the assistance of the Commissioning Authority as necessary and appropriate

Owner Responsibilities

- Select and engage a *qualified* commissioning process provider (Commissioning Authority)
- Provide direction, reviews, and acceptance throughout the commissioning process
- Establish scope of commissioning (what systems and assemblies are included)
- Incorporate commissioning process requirements into design team professional services contracts
- Incorporate commissioning process requirements into construction services contracts
- Ensure owner's staff participation as necessary to address OPR and Cx Plan implicit expectation

Foundational Documents

Design Team Professional Services Contracts

The owner shall include … the Cx activities contained in this standard and the project Cx Plan.

services contract provisions

Foundational Documents

Construction Team Contracts

The owner shall include … the Cx activities contained in this standard and the project Cx Plan.

services contract provisions

Foundational Documents

Owner's Project Requirements (OPR)

For new construction or major renovations, the owner shall ensure development of the OPR as described in Section 6 of this standard prior to development of the architectural program.

The owner shall require a final updated and approved OPR at substantial completion.

more on the OPR coming up

Foundational Documents

The Commissioning Plan

The owner shall require the development of the OPR as described in Section 7 of this standard and associated documents that define the project team's roles and responsibilities, communication protocols, Cx procedures, documentation, activities, and the schedule of those activities.

more on the Cx Plan coming up

REPEAT:
Flexible Mandatory Requirements

The means by which Standard 202 can provide flexibility of application while being code-enforceable lies in two key documents developed during the predesign phase:

→ The Commissioning Plan

→ The Owner's Project Requirements (OPR)

Does the process comply with its self-defined* scope and roadmap (through the evidence provided by process documents)?

*or, perhaps, externally mandated

Foundational Documents

Checklists

The owner shall require, by agreement, the Cx Team including the Cx Authority and design and construction service providers to develop, utilize, and complete Cx procedures and written observation and testing checklists in accordance with the Cx Plan.

services contract provisions

Foundational Documents

Basis of Design

For construction or renovation projects requiring design, the owner shall require, by agreement, the development and updating of the Basis of Design by the designers as described in Section 8 of this standard.

services contract provisions

Foundational Documents

Commissioning Specifications

For construction or renovation projects requiring contract documents, the owner shall require, by agreement, the design/construction team to include Cx specifications in the project contract documents. The Cx specification shall include the meeting of all requirements defined in the OPR applicable to the contracted parties and follow the Cx process contained in the project's Cx Plan …

services contract provisions

Foundational Documents

Commissioning Design Reviews

For construction or renovation projects requiring design, the owner shall require, by agreement, the design team to review, respond to, and participate in an issue resolution process to resolve issues identified during the Cx design preview process in Section 10 of this standard.

The owner … shall review the Cx Process design review comments, participate in an issue resolution process, and *provide direction to the team* when needed to meet the OPR.

services contract provisions

Foundational Documents

Construction Submittal Reviews

For construction or renovation projects requiring design and/or submittals, the owner shall require, by agreement, that the construction submittals for systems and assemblies being commissioned be reviewed in accordance with Section 11 of this standard.

services contract provisions

Foundational Documents

Observation and Testing

The owner shall require, by agreement, that project observation and testing be performed and documented as required in the Cx Plan and Section 12 of this standard..

services contract provisions

Foundational Documents

Issues and Resolution Log

The owner shall require the development and utilization of … issue and resolution logs as required in the OPR and Section 13 of this standard. The owner shall review Cx issues log …, participate in collaborative team resolution, and provide direction when needed.

services contract provisions

Cx Progress Reports separated from above (Section 5.2.11) for clarity

Foundational Documents

Commissioning Progress Reports

The owner shall require, by agreement, the development and delivery of a Cx Progress Report and that deliverables be provided in accordance with Section 17 of this standard. The owner shall ensure that specific entities are designnated for the development and assembly of the Cx Progress Report.

services contract provisions

Cx Progress Reports separated from Section 5.2.11 as they are addressed in 5.2.16

Foundational Documents

Systems Manual

The owner shall require, by agreement, the development and delivery of a project Systems Manual and that deliverables be provided for the Systems Manual in accordance with Section 14 of this standard. The owner shall ensure that specific entities are designated for the development and assembly of the Systems Manual and the Facility Guide.

services contract provisions

Foundational Documents

Training

The owner shall require, by agreement, that the Cx Team, including the design and construction parties as applicable, perform training defined in the OPR or Cx Plan as described in Section 15 of this standard.

services contract provisions

Foundational Documents

Postoccupancy and Initial Operations

The owner shall require, by agreement, that the Cx Process Activities as described in Section 16 of this standard be performed. This shall include …

… more on these activities coming up

services contract provisions

Foundational Documents

Warranty Period Commissioning

The owner shall require, by agreement,

a. Cx Authority performance of Cx during the warranty period
b. Updating the Systems Manual based on modifications to operations to meet the OPR
c. Updating the OPR to meet changes in the owner's objectives and criteria

services contract provisions

Owner's Project Requirements

Context:

- Foundation for design, construction, and operations
- Basis for CX Plan (and schedule)
- Evolves throughout a project
- Primary benchmark for systems and assemblies success

Owner's Project Requirements

General Requirements:

- **During predesign**, the owners along with the CX Team shall facilitate development and documentation of the OPR
- OPR shall list and define the systems and assemblies to be commissioned
- OPR shall describe the sampling strategies accepted by the owner
- Commissioned systems and assemblies shall have defined performance and acceptance criteria

Owner's Project Requirements

More General Requirements:

- The OPR shall be included in the contract documents as an information-only attachment or as required by owner's contract requirements
- The OPR shall be updated regularly throughout the project and Cx Process to reflect changes necessitated by owner, designer, and construction team decisions, issues resolutions, and/or operational decisions
- The OPR shall be reviewed by the Cx Authority and approved by the owner during predesign

Owner's Project Requirements

Specific Requirements:

The OPR shall address the following for commissioned systems:

a. Facility objectives, size, location, user requirements, and owner directives

b. Environmental, sustainability, and efficiency goals and benchmarks

c. Indoor environment requirements, including temperature, humidity, and ventilation

d. Space usage and occupancy/operations schedules

Owner's Project Requirements

e. Cx process scope and requirements, listing of equipment, systems, and assemblies requiring commissioning

f. Equipment, systems, and assemblies requirements, expectations, and warranty provisions

g. Maintainability, access, and operational performance requirements

h. Installation evaluation and testing requirements

i. Project documentation and systems manual requirements and formats

Owner's Project Requirements

j. Training requirements for owner's operation and maintenance personnel and occupants

k. Applicable codes and standards in addition to local building codes

l. Project schedules

m. Special project requirements

n. The content, organization, and milestones of BoD submittals for the design and construction process

o. The number, format, and scheduling of design and submittal reviews

Owner's Project Requirements

p. Sampling procedures, if permitted, for all reviews, evaluations, and testing

q. Cx Progress Report formats and distribution intervals

Commissioning Plan

Context:

- Shall be a written document
- Shall provide organization, documentation requirements, and tools to evaluate that the design, construction, and operation of the project or facility, systems, and assemblies meet the OPR

Commissioning Plan

General Requirements:

- The Cx Authority shall, with input from the owner's project team, develop the initial Cx Plan at the initiation of the project.
- The plan shall be updated and expanded during design and construction as the project evolves
- The Cx Plan (initial) shall be approved by the owner and include a process for approval of subsequent revisions

Commissioning Plan

Specific Requirements:

The Cx Plan shall include the following information:

a. Overview of the Cx Process developed specifically for the project
b. Roles and responsibilities for the Cx Team throughout the project
c. Documentation of general communication channels, including the distribution of the Cx Plan during the design and construction process

Commissioning Plan

d. Detailed descriptions of Cx Process activities and a schedule of activities
e. Project design documentation evaluation procedures
f. General description of Cx Process activities that will occur during construction and occupancy/operations
g. Guidelines and format that will be used to develop the Cx Process documentation, including systems manual and training plans

Commissioning Plan

h. Listing and format for Cx Process evaluation checklists and testing forms, issues and resolutions log, and Cx Progress Reports that will be used during the project to communicate and track critical Cx Process information

i. List of project commissioned systems and assemblies and description of evaluation procedures

j. The framework of procedures to follow whenever Cx Process evaluation does not meet the OPR

"Evaluation"

The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems and their performance are confirmed with respect to the criteria required in the Owner's Project Requirements

3. Definitions; *ANSI/ASHRAE/IES Standard 202-2013*

Questions?

Before leaving this discussion of
the critical foundations that underlie a
Standard 202-compliant Commissioning Process

Next section: Design-Related Commissioning Process Documents

Section 3:
Design-Related Commissioning Process Documents

- Basis of Design
- Commissioning Specifications
- Design Review
- Other Documents

Basis of Design

Context:

- The Basis of Design is written document
- The BoD shall provide detailed information on the design team's approach to meeting the OPR
- Intended to provide the owner with a better understanding of design issues
- Used to secure the owner's approval of critical design decisions

Basis of Design

General Requirements:

- The Basis of Design shall be developed by the design team in accordance with the OPR
- The BoD shall be updated and expanded during design and construction as the project evolves
- The design team shall submit the BoD to the owner and Cx Authority for review at each milestone defined by the OPR and Cx Plan

Basis of Design

More General Requirements:

- The Cx Authority shall document and track issues related to the BoD sing the Cx issues and resolution log, including issues identified by the owner and members of the design team
- The design team shall work with the owner and Cx Authority to resolve Cx issues
- Each submission of the the BoD shall be formally reviewed and accepted by the owner to facilitate the next step in the design process

Basis of Design

Function:

- To describe in detail the design team's technical approach to each of the owner's requirements
- To provide a platform for the review of the design and changes as the project progresses
- To coordinate applicable technical and code requirements

Basis of Design

Review Requirements:

The owner and the Cx Authority shall evaluate each BoD submission for the following:

a. Design and design assumptions in agreement with the OPR
b. Requirements for updating of the BoD
c. Requirements for sustainable design certification when required
d. Consideration of design alternatives at each phase

Basis of Design

Review Requirements (continued):

e. Requirements that systems, assemblies, and equipment be located and installed to be commissionable and maintainable
f. Opportunities for improved performance

Commissioning Specifications

(Contractor, Supplier, and Manufacturer Commissioning Requirements)

Context:

The responsibilities of the contractors, suppliers, and manufacturers, including those contracted directly to the owner, shall follow the contract documents, including the Cx Process defined by the Cx specifications

these responsibilities must be developed during the design phase

Commissioning Specifications

Requirements:

- Cx specifications shall be developed for all systems and assemblies being commissioned and included in the construction documents
- Applicable Cx Process specifications and requirements shall be included in all contracts with contractors, subcontractors, suppliers, service providers, and manufacturers

Commissioning Specifications

Requirements (continued):

- Contractors, subcontractors, suppliers, service providers, and manufacturers shall provide the required documentation as defined in the contract documents. Examples include: submittals, shop drawings, installation, operations, maintenance and close-out documents, code compliance, and existing-conditions documentation.
- The owner shall approve the Cx specifications included in the construction documents.

Design Review

Context:

A Cx design document review shall be performed to verify compliance with the OPR

Design Review

Requirements:

- The Cx Authority shall perform a review of the commissioned systems and assemblies in the design documents to evaluate compliance with the OPR
- The Cx Authority shall provide a design review (Cx Report) with comments, questions, and observations to the owner and design teams for compliance with the OPR

Design Review

Requirements (continued):

- The design team, owner, and/or other responsible party shall respond to the Cx Authority document review report with necessary answers and document modifications
- Revised documents shall be back-checked by the Cx Authority. Unresolved issues shall be reported to the owner for direction to the design and Cx Team

Design Review

Requirements (continued):

- A copy of the document review report(s) and response(s) shall be included in the final Cx Report.
- The owner shall approve the Cx document review report and the design team's response before the start of construction

Other Documents

Standard 202 requires:

- That the OPR be updated throughout the commissioning process to reflect necessary changes – including during the design phase
- That the Cx Plan be updated throughout the commissioning process to reflect necessary changes – including during the design phase
- That Commissioning Progress Reports be submitted throughout the commissioning process – as per the Cx Plan and OPR

Questions?

Before leaving this discussion of
design phase commissioning documents
(and activities)

Next section: Construction-Related Commissioning Process Documents

Section 4:
Construction-Related Commissioning Process Documents

- (Commissioning) Submittal Review
- Construction Observation and Testing
- Issues and Resolutions Documentation
- Systems Manual
- Training Plan
- Other Documents

Submittal Review

Context:

For construction or renovation projects requiring contractor or supplier submittals, a submittal documents review for commissioned systems and assemblies shall be performed to evaluate compliance with the OPR.

The commissioning submittal review does not replace the designer of record submittal review.

Submittal Review

Requirements:

- A designated Cx Team member shall review project submittals for systems and assemblies to be commissioned for compliance with the OPR
- The Cx Authority shall identify construction submittals to be provided by the contractor for the systems being commissioned
- The Cx Authority shall review the construction submittals concurrently with the designers and provide comments to the designer

Submittal Review

Requirements (continued):

- The designer shall consider the Cx Authority's comments and provide direction to the contractor in accordance with the designer's best professional judgment. A copy shall be provided to the Cx Authority.
- The submittal review report shall include a listing of the submittals reviewed, the date reviewed, and a summary of the submitted equipment/material properties that appear not to meet the OPR.
- Sampling to complete submittals review shall conform to the owner approved OPR and Cx Plan.

Submittal Review

Requirements (continued):

- A copy of the submittal document review report(s) and response shall be included in the final Cx Report.
- The Cx Authority shall maintain a record of all Cx submittal reviews and submit a written report to the owner or design authority. Any reviewed submittals that do not comply with the OPR shall be provided to the owner to determine if the system or equipment shall be accepted or rejected.

Submittal Review

Requirements (alternate project structure):

In the event that the owner does not retain the designer for construction administration services, the owner shall:

a. Require the Cx Authority to review the commissioned systems construction submittals concurrently with the owner's representative and provide comments to the owner or owner representative.

b. Consider the Cx Authority's comments and provide direction to the contractor in accordance with the owner's best professional judgment. Provide a copy to the Cx Authority.

Observation and Testing

Context:

The proper installation, coordination, Cx testing, and interaction among commissioned systems and assemblies shall be evaluated.

Observation and Testing

Prerequisite:

The Cx Authority shall conduct a commissioning kick-off and scoping meeting with the Cx Team to explain Cx procedures and coordinate commissioning activities at the beginning of the construction process and at other times as necessary.

Observation and Testing

General Requirements:

- The systems and assemblies to be commissioned, identified in the OPR and Cx Plan, shall be confirmed to comply with the OPR and the contract documents
- There shall be a uniform and effective process for documentation of testing to provide Cx testing of and interaction between commissioned equipment, systems, and assemblies
- The Cx Team shall refer to applicable Cx technical resources tailored to the project

Observation and Testing

General Requirements:

- Any commissioned system or assembly that fails to meet requirements and that cannot be resolved in a timely manner shall be given an issue number and recorded in the issues and resolution log to facilitate follow-up
- All checklists and test procedure results shall be compiled into the final Cx Report
- A summary of the testing shall be reported to the owner in a written Cx Progress Report following completion of the testing or at intervals noted in the Cx Plan. Review of the testing summary shall have concurrence or acceptance by the owner.

Observation and Testing

Specific Requirements:

Checklists and test procedures with necessary report forms shall be developed before equipment or assembly installation. All completed checklists and test reports shall be included in the final Cx Report.

a. project-specific construction checklists and Cx Testing procedures shall be established for review by owner and appropriate team members

b. The test procedures shall list the entities responsible for executing each of the tests

Observation and Testing

Specific Requirements (continued):

c. Whenever a test data result is required for a specific system or assembly, there shall be an item in the associated construction checklist for the test data to be submitted to the Cx Authority

d. Sampling procedures shall be utilized if required and defined in the OPR, the Cx Plan, or Cx Specifications

Observation and Testing

More Specific Requirements:

Evaluation of the systems and assemblies by the Cx Team shall include the following:

a. Vital information on the equipment or materials being supplied. Information shall detail what equipment/material was specified and submitted. What was actually delivered on the site shall be documented and verified.

b. The condition of the equipment at the time it is delivered at the site and prior to its installation.

Observation and Testing

More Specific Requirements (continued):

c. Proper installation of the systems and assemblies. Evaluation shall focus on the physical installation of the systems and assemblies, on their ability to meet the contract documents requirements, and on accessibility for Cx, testing, and maintenance operations.

d. Successful Cx Testing results of systems and assemblies.

Issues and Resolutions

Context:

Issues identified during the Cx Process shall be documented and any open or continuing items listed in an issues and resolution log and Cx Progress Reports.

Issues and Resolutions

Requirements:

- The Cx Authority and Cx Team shall develop a formal issues and resolution log with supporting documentation
- The active issues and resolution log will have all open and continuing items, with status and responsible person or organization for resolution
- A formal issues and resolution log shall be maintained throughout the project until all issues are resolved or accepted by the owner

Issues and Resolutions

Requirements (continued):

- The issues and resolution log and Cx Progress Reports shall be distributed to the Cx Team at intervals prescribed in the in the Cx Plan
- The owner shall review and accept the final issues and resolution log.
- Upon acceptance, the log will be included in the final Cx Report.

Systems Manual

Context:

The Systems Manual documentation shall be provided to the owner for use in building operation and the training of personnel

Systems Manual

Requirements:

- The Systems Manual shall provide the information needed to understand, operate, and maintain the building's systems and assemblies.
- The Systems Manual is the repository of design, construction, and testing information, including updates and corrections to systems and assemblies as they occur during construction. The Cx Team shall be responsible for updating the Systems Manual during the Cx Process, including design, construction, and operation as required in the OPR, Cx Plan, and contract documents.

Systems Manual

Requirements:

- The contents of the preliminary Systems Manual, Sections 2 through 4, shall be reviewed and evaluated by the Cx Authority prior to training of operational and maintenance personnel and occupants in accordance with the OPR.
- The owner shall approve the final Systems Manual for use in building operations.

Systems Manual

Requirements:

- The following shall be included in the Systems Manual:

Section 1—
Executive Summary

Section 2—
Facility Design and Construction

2.1 Copy of OPR Document

2.2 Copy of BoD Document

2.3 Copy of Building/Project Design and Record Documents

Systems Manual

Requirements:

- The following shall be included in the Systems Manual:

(continued)

Section 3—
Building, Systems and Assemblies Information for Commissioned Systems and Assemblies

3.1 Copy of Building and Equipment Specifications
3.2 Copy of Approved Submittals including Final Controls Sequences of Operation
3.3 Copy of Manufacturer's Operation and Maintenance (O&M) Data
3.4 Copy of Warranties
3.5 Contractor and Supplier Listing and Contact Information

Systems Manual

Requirements:

•The following shall be included in the Systems Manual:

(continued)

Section 4—
Facility Operations

4.1 Facility Guide including:

- Operating Plan
- Building and Equipment Operating Schedules, Setpoints, Ranges, and Limitations
- Commissioned Systems Control Sequences of Operation
- Emergency Procedures

Systems Manual

Requirements:

- The following shall be included in the Systems Manual:

(continued)

Section 5—
Training

5.1 Copy of Training Plan and Materials
5.2 Training Records

Systems Manual

Requirements:

- The following shall be included in the Systems Manual:

(continued)

Section 6—
Final Commissioning Report

6.1 Copy of Final Cx Plan
6.2 Copy of Commissioning Design and Submittal Review Reports
6.3 Copy of Testing and Startup Reports, Evaluation Checklists, and Testing Checklists Completed for Commissioned Systems and Assemblies
6.4 Copy of all Cx Progress Reports
6.5 Copy of Issues and Resolution Log
6.6 Item Resolution Plan for Open Items

Training Plan

Context:

The O&M personnel and occupants shall be trained on the systems being commissioned, in accordance with the OPR, to operate and maintain the building systems and assemblies. The Training Plan is considered an essential element in designing, preparing, and delivering the training to the participants.

Training Plan

Requirements:

The Training Plan shall include the following items:

a. Outline of instructional topics related to the systems, subsystems, equipment, and assemblies. These topics shall address the design, construction, operation, and maintenance of specific systems, assemblies, and equipment.

b. Learning objectives and training delivery methods for each instructional topic

Training Plan

Requirements (continued):

c. The planned location of the training sessions (classroom, on site, off site) and the minimum duration of each training session, in hours, to be completed as required in the OPR, Cx Plan, or construction documents

d. Instructor's qualifications

e. Training materials requirements to be employed during the instructional process

f. Training report, records, and recording requirements

Training Plan

Requirements (continued):

- Archiving of instruction, delivery of instruction, and training materials shall be provided as specified in the contract documents and per the OPR. A copy of the Training Plan, training materials, and records shall be included in the final Systems Manual as shown in Section 14 of the standard.
- The Training Plan, the execution of the Training Plan, and the delivery of instruction shall be reviewed for acceptance by the Cx Authority and owner. The Training Plan shall be submitted and accepted prior to the delivery of any instruction. Evaluation or survey of the participants shall be as defined in the OPR and contract documents.

Other Documents

Standard 202 requires:

- That the OPR be updated throughout the commissioning process to reflect necessary changes – including during the construction phase
- That the Cx Plan be updated throughout the commissioning process to reflect necessary changes – including during the construction phase
- That Commissioning Progress Reports be submitted throughout the commissioning process – as per the Cx Plan and OPR

Questions?

Before leaving this discussion of construction phase commissioning documents (and activities)

Next section: Occupancy-Related Commissioning Process Documents

Section 5:
Occupancy-Related Commissioning Process Documents

- Postoccupancy Operations
  - Systems Manual update
  - Testing Documentation update
  - Issues and Resolution Log update
  - Training Report update
- Commissioning Report

Postoccupancy Operation

Context:

Postoccupancy operation commissioning, including delayed and seasonal testing and warranty issues, shall be provided, prior to the time of warranty completion, to deliver buildings and construction projects that meet the owner's needs.

The postoccupancy operations activities of the Cx Process begin at substantial completion.

Postoccupancy Operation

Requirements:

- The Cx Process activities shall continue through the end of the contractual warranty period.
- The seasonal, delayed, and incomplete testing of facility systems and assemblies shall be completed. The Cx Authority shall determine when the Cx Testing shall be performed based on weather conditions, load conditions, or occupant interactions that are required to complete the activities for all systems and assemblies being commissioned.

Postoccupancy Operation

Requirements (continued):

- The general contractor or owner shall coordinate contractor callbacks to resolve issues identified during the Cx Process and provide written documentation to the Cx Authority that the issues have been resolved and/or the owner has accepted the final conditions.
- Additional training shall be performed during the postoccupancy and operations activities in accordance with the Training and Cx Plans.

Postoccupancy Operation

Requirements (continued):

- During the postoccupancy operations activities, the operation, maintenance, and modification of the facility systems and assemblies, and their associated documentation, shall be evaluated to comply with the updated OPR.
- By the conclusion of the postoccupancy operation commissioning activities, *the Systems Manual, testing documentation, issues and resolution log, training report, and final Cx Report shall be updated* and submitted for acceptance.

Commissioning Report

Context:

A Cx Report shall be provided to summarize the Cx Process and the building operation for delivery to the owner and other required recipients.

Commissioning Report

Requirements:

- Intermediate Cx Progress Reports shall be issued as required in the OPR, the Cx Plan, and the applicable jurisdictional requirements.
- The Final Cx Report shall include the final Cx Plan and the results of the implementation of that plan. The report shall include an executive summary describing the Cx Process and identifying the systems and assemblies commissioned. The report shall identify the location of the final OPR and BoD documents or contain a copy if these documents are not otherwise available. The location of the project record drawings shall be identified.

Commissioning Report

Requirements:

- The Cx Authority shall submit the Cx Report to the owner and others as required by the OPR and jurisdictional requirements for review and acceptance.

Commissioning Report

Specific Requirements:

The final Cx Report shall include the following:

1. Executive summary
2. Copy of the final Cx Plan
3. Copy of design and submittals review reports
4. Completed copy of the approved supplier, contractor, and Cx Authority evaluations, and Cx startup and test forms, including those utilized during the occupancy and operations activity
5. Copy of all Cx Progress Reports
6. Copy of issues and resolution log including the descriptions of the issues and the measures taken to correct them; a discussion of systems or assemblies that do not perform in accordance with the OPR.
7. For all incomplete issues, delayed or seasonal tests including a resolution plan approved by the owner identifying who is responsible for resolution.

Questions?

Before leaving this discussion of occupancy and operations phase commissioning documents (and activities)

Next section: Summary

Section 6:
Summary

- Review of Process
- Critical Definitions
- Questions

Review of Process

establish scope and depth of minimum deliverables for a specific project

4.2.2 Commissioning Process Activities and Deliverables

Activity	Deliverable
Initiate Cx Process	Roles and Responsibilities
Decide Project Requirements	Owner's Project Requirements
Develop Cx Plan	Cx Process Plan
Design Approach to Requirements	Basis of Design
Set Contractor Cx Requirements	Cx Specifications
Review Design to Requirements	Design Review Report
Review Submittals	Submittal Review Report
Observe and Test	Construction Checklists and Reports
Resolve Issues	Issues and Resolution Log
Assemble Systems Manual	Systems Manual
Conduct Training	Training Plans and Records
Postoccupancy Operation	End of Warranty Cx Report
Assemble Cx Report	Cx Report

minimum (generic) commissioning process requirements

under
4. Utilization

4.2
Requirements

Critical Definitions

Owner's Project Requirements (OPR):

A written document that details the requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information

provides the evaluation benchmarks for the commissioning process -- and defines scope

Critical Definitions

Evaluation:

The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems and their performance are confirmed with respect to the criteria required in the Owner's Project Requirements

evaluation is the core of the commissioning process

Critical Definitions

Test 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 Owner's Project Requirements

typically, a quantitative evaluation

Critical Definitions

Design Review (commissioning):

A review of the design documents to determine compliance with the Owner's Project Requirements, including coordination among systems and assemblies being commissioned, features and access for testing, commissioning, and maintenance, and other reviews required by the OPR and Commissioning Plan

typically, a qualitative evaluation

Critical Definitions

Acceptance:

A formal action, taken by a person with appropriate authority (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed

typically, by the owner

commissioning is an owner's quality assurance process

Summary Questions?

Walter T. Grondzik, PE, LEED-AP

Ball State University
Department of Architecture
gzik@polaris.net

Evaluation & Certificate

- Please fill out the online course evaluation form here: http://ali.ashrae.org/2014summerconference/
- Comments and suggestions are welcome. You will receive your Certificate of Attendance when you finish the evaluation form. Please include Florida, North Carolina, USGBC or AIA numbers if applicable.
- NOTE: You must submit your license numbers to Kelly Arnold (karnold@ashrae.org) within 5 days after the course date to ensure you receive the proper continuing education credit.
- If you have any questions about ASHRAE courses, please contact Martin Kraft, Managing Editor, at mkraft@ashrae.org

ASHRAE Career Enhancement Curriculum Program

Expand your knowledge of **IAQ** and **Energy Savings Practices** through a select series of ASHRAE Learning Institute courses

- Receive up-to-date instruction on new technology from industry experts
- Gain valuable HVAC knowledge
- Accelerate your career growth
- Receive a certificate for successful completion of the course series

Visit www.ashrae.org/careerpath to learn more.

Commissioning Process Management Professional Certification

- Because you're interested in building commissioning, you may also be interested in the Commissioning Process Management Professional certification program.
- Do you want to stand out from the crowd? Become ASHRAE certified.
- Assure employers and clients that you have mastered the body of knowledge that subject matter experts have identified as reflecting best practices.
- An ASHRAE certification also serves as a springboard for continued professional development.
- Please visit the following URL to complete your application: www.ashrae.org/CPMP