

ADDENDA

**ANSI/ASHRAE/IES Addendum b to
ANSI/ASHRAE/IES Standard 202-2013**

Commissioning Process for Buildings and Systems

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FOREWORD

Addendum b does not change the basic Commissioning Process or its requirements. Some definitions are updated, and abbreviations are defined and standardized throughout, including the use of "Commissioning Provider (CxP)." Clarifications are added in some sections to answer questions and to address field conditions experienced since the standard was first published.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~striking through~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum b to Standard 202-2013

Revise Section 3 as shown. The remainder of Section 3 is unchanged.

3. 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.

Basis of Design (BoD): a document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

checklists: project and element-specific checklists that are developed and used during all phases of the Commissioning Process to verify that the Owner's Project Requirements are being achieved. Checklists are used for general evaluation, testing, training, and other design and construction requirements.

Commissioning Provider (Cx Provider): an entity identified by the owner who leads, plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

Commissioning Process (Cx-Process): a quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Commissioning Team (Cx Team): the individuals and agencies who, through coordinated actions, are responsible for implementing the Commissioning Process.

construction checklist: a form used by the Commissioning Project Team to verify that appropriate materials and components are ~~on~~-on-site, ready for installation, correctly installed, functional, and in compliance with the Owner's Project Requirements. Also see *checklists*.

construction documents: this includes a wide range of documents, which will vary from project to project, and with the owner's needs and regulations, laws, and jurisdictional requirements. Construction documents usually include the project manual (specifications), plans (drawings), and general terms and conditions of the contract.

Construction Team: the Construction Team consists of the professionals responsible for providing materials and labor to construct the systems and assemblies in the project. Where a construction project follows a design/build approach, the Construction Team includes licensed design professionals who are part of the Design Team.

contract documents: this includes a wide range of documents, which will vary from project to project and with the owner's needs, regulations, laws, and jurisdictional requirements. Contract documents frequently include price agreements; construction management process; subcontractor agreements or requirements; requirements and procedures for submittals, changes, and other construction requirements; timeline for completion; and the construction documents.

coordination drawings: drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

Current Facility Requirements (CFR): a written document that details the current functional requirements of an existing facility and the expectations of how it should be used and operated. This includes goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information to meet the requirements of occupants, users, and owners of the facility.

commissioning (Cx): abbreviation for "Commissioning Process." See *Commissioning Process*.

Commissioning Process Activities (Cx Process Activities): components of the Commissioning Process Cx.

Commissioning Plan (Cx Plan): a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process Cx.

Commissioning Progress Report (Cx Progress Report): a written document that details activities completed as part of the Commissioning Process Cx and significant findings from those activities, and that is continuously updated during the course of a project.

Cx Provider (CxP): an entity identified by the owner who leads, plans, schedules, and coordinates the CxP Team to implement the Cx.

Cx Provider Team (CxP Team): the CxP Team is the team of specialists and related support staff who are responsible for the management of actions and the generation of deliverables

by the CxP as outlined in the contract between the Owner and the CxP and in the Cx Plan. The CxP Team may consist of several companies, including subcontractors to the CxP who acts as the contact to the owner.

Commissioning Testing (Cx Testing): the evaluation and documentation of the equipment and assemblies, delivery and condition, installation, proper function according to the manufacturer's specifications, and project documentation to meet the criteria in the Owner's Project Requirements.

design checklist: a form developed by the Commissioning CxP Team to verify that elements of the design are in compliance with the Owner's Project Requirements. Also see *checklists*.

design review (code or regulatory): a review of a document conducted by staff or designated entity of an authority having jurisdiction to determine whether the content of the document complies with regulations, codes, or other standards administered by the jurisdiction.

design review (commissioning) (Cx Design Review): a review of the design documents to determine compliance with the Owner's Project Requirements, including coordination between systems and assemblies being commissioned, features and access for testing, commissioning and maintenance, and other reviews required by the OPR and Commissioning Cx Plan.

design review (constructibility): the review of effective and timely integration of construction knowledge into the conceptual planning, design, construction, and field operation of a project to achieve project objectives efficiently and accurately at the most cost-effective levels to reduce or prevent errors, delays, and cost overruns.

design review (peer): an independent and objective technical review of the design of the project or a part thereof, conducted at specified stages of design completion by one or more qualified professionals, for the purpose of enhancing the quality of the design.

Design Team: the Design Team consists of the licensed professionals responsible for producing the complete set of permit documents required for construction.

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.

existing-building Commissioning Process Cx: a quality-focused process for attaining the Current Facility Requirements of an existing facility and its systems and assemblies being commissioned. The process focuses on planning, investigating, implementing, verifying, and documenting that the facility and/or its systems and assemblies are operated and maintained to meet the Current Facility Requirements, with a program to maintain the enhancements for the remaining life of the facility.

facility guide: a basic building systems description and operating plan with general procedures and confirmed facility operating conditions, setpoints, schedules, and operating pro-

cedures for use by facility operations to properly operate the facility.

final Commissioning Report (final Cx Report): a document that records the activities and results of the Commissioning Process Cx and that is developed from the final Commissioning Cx Plan with all of its attached appendices.

issues and resolution log: a formal and ongoing record of problems or concerns and their resolutions that have been compiled by members of the Commissioning CxP Team during the course of the Commissioning Process Cx.

ongoing Commissioning Process Cx (OCx): a continuation of the Commissioning Process Cx well into occupancy/operations to continually improve the operation and performance of a facility to meet current and evolving CFR or Owner's Project Requirements. Ongoing Commissioning Process Cx activities occur throughout the life of the facility; some of these will be close to continuous in implementation, and others will be either scheduled or unscheduled as needed.

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, including project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, training requirements, documentation requirements, and supporting information. (The term *project intent* or *design intent* is used by some owners for their Commissioning Process Owner's Project Requirements.)

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

Project Team: the Project Team consists of select members of all the teams defined in this standard. The Project Team provides a venue for coordinating actions and information flows between all staff who are involved in the project and Cx Activities.

recommissioning: an application of the Commissioning Process Cx requirements to a project that has been delivered using the Commissioning Process Cx. (See *existing building Commissioning Process Cx*.)

retrocommissioning: the Commissioning Process Cx applied to an existing facility that was not previously commissioned. (See *existing building Commissioning Process Cx*.)

systems manual: a system-focused composite document that includes the design and construction documentation, facility guide and operation manual, maintenance information, training information, Commissioning Process Cx records, and additional information of use to the owner during occupancy/operations.

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.

testing: the process of verifying that a material, product, assembly, or system meets defined performance criteria. The methods and conditions under which performance is verified are described in one or more test protocols. (*Informative Note:* See Appendix for a more complete list of testing related terms.)

training plan: a written document that details the expectations, schedule, duration and deliverables of Commissioning Process Cx Activities related to training of project operating and maintenance personnel, users, and occupants.

Revise Section 4 as shown. The remainder of Section 4 is unchanged.

4. UTILIZATION

4.1 Introduction. The application of this standard can be for the delivery of all or selected systems and assemblies in a project. The scope will depend upon how the project will be designed, built, and operated. The scope shall be defined in the Owner's Project Requirements, contract documents and the Cx Plan and performed based on the extent of the commissioning Cx effort defined and procured. The process described in this standard is written for a generic project and must be adapted to each project. This standard describes the Cx Process and can be supplemented by companion technical documents and guidelines to describe the specific details to properly implement the Cx Process relative to a specific facility, system, or assembly. This standard can be applied to both new and renovation projects.

4.2 Requirements

4.2.1 The requirements of this standard are to

- a. provide the minimum activities for the application of the Cx Process in the design, development, construction, operation, and modification of physical buildings, systems, and assemblies,
- b. establish Cx Activities and their sequence, and
- c. establish deliverables and documentation for the process application.

4.2.2 Commissioning Process Cx 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

Activity	Deliverable
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 Progress Report
↓	↓
Assemble Cx Progress Report	Cx Progress Report

4.3 Acceptance. The process for each activity and deliverable shall include an acceptance step as defined in the OPR and reflected in the contract documents and associated Cx Plan. This step shall formalize the acceptance of the commissioning Cx deliverable by the owner or client. Under this standard, the Cx Provider CxP is not required to accept designer's or contractor's work on behalf of the owner or jurisdiction.

Revise Section 5 as shown. The remainder of Section 5 is unchanged.

5. INITIATING THE COMMISSIONING Cx PROCESS

5.1 General

5.1.1 Introduction. At the initiation of the Cx Process, the owner is responsible for determining the Cx scope of the Cx Plan (that is, the systems and assemblies to be included), selecting the CxP Process Team leader, selecting and the CxP Process Team for the project, incorporating ensuring Cx activities are incorporated into project team agreements that define the Project Team's Cx roles and responsibilities, and the establishment establishing of the Cx budget, and developing the Owner's Project Requirements (OPR).

5.1.2 Project Team Selection Commissioning Process Providers. The owner is responsible for selecting qualified Project Team members Cx process professionals. The Cx Provider CxP directs the Cx Process and shall be an objective advocate of the owner.

5.1.3 Providing Direction and Acceptance. The owner shall provide direction, reviews and acceptance as required throughout the project and the Cx process.

5.2 Commissioning Cx Requirements

5.2.1 Roles and Responsibilities. The owner shall include in the ~~d~~Design Team and ~~e~~Construction Team's contracts, ~~or their defined roles and responsibilities, in the Cx activities contained in this standard and the project Cx Plan Cx.~~

~~5.2.2 Commissioning Scope.~~ The owner shall determine the systems and assemblies to be included in the project team's scope.

~~5.2.3 Owner's Project Requirements.~~ 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.

~~5.2.34 The Commissioning Cx Plan.~~ The owner shall require the development of the Cx Plan as described in Section 7 of this standard and associated documents that define the ~~p~~Project Team's roles and responsibilities, communication protocols, Cx procedures, documentation, activities, and the schedule of those activities.

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

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

5.2.6 Commissioning Specifications. For construction or renovation projects requiring contract documents, the owner shall require, by agreement, the ~~d~~Design/~~e~~Construction Team to include Cx specifications in the project contract documents: prior to execution of contractor or construction manager final or gross maximum price (GMP) agreements. The Cx specification shall include the meeting of all roles and responsibilities for each Project Team member involved and the associated submittal requirements and procedures; demonstration and training requirements and documentation; testing procedures; and acceptance criteria, as defined in the OPR applicable to the contracted parties, and that the Project Team will follow the Cx Process contained into execute the project's Cx Plan as detailed. The Project Team shall include project-specific observations and testing requirements in each specification division included in Section 9 of this standard the Cx scope.

5.2.7 Commissioning Cx Design Reviews. For construction or renovation projects requiring design, the owner shall require, by agreement, the ~~d~~Design Team to review, respond to, and participate in ~~an~~ issues resolution ~~activities~~ process to resolve issues identified during the Cx ~~d~~Design ~~r~~Review process defined in Section 10 of this standard. The owner or designated representative shall review the Cx ~~Process~~ ~~d~~Design ~~r~~Review comments, participate in ~~an~~ issues resolution ~~process~~ activities, and provide direction to the team when needed to meet the OPR.

5.2.8 Construction Submittals Review. For construction or renovation projects requiring design and/or submittals, the owner shall require, by agreement, that the construction sub-

mittals for systems and assemblies being commissioned be reviewed in accordance with Section 11 of this standard.

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

5.2.10 Issues and Resolution Log and Cx Progress Reports. The owner shall require the development and utilization of Cx Progress Report and issues and resolution logs as required in the OPR and Section 13 of this standard. The owner shall review the Cx issues log and Cx Progress Reports, participate in collaborative team resolution, and provide direction when needed.

5.2.11 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.

5.2.12 Training. The owner shall require, by agreement, that the ~~Cx~~ Project Team, including the ~~d~~Design Team and ~~e~~Construction Team parties as applicable, perform training defined in the OPR, contract documents or Cx Plan as described in Section 15 of this standard.

5.2.13 Postoccupancy Initial Occupancy and Initial Operations. The owner shall require, by agreement, that the Cx ~~Process~~ ~~a~~Activities described in Section 16 of this standard be performed. This shall include additional training, seasonal tests, problem resolution, site visits, updating drawings and specifications, or other requirements performed during the ~~postoccupancy~~ Initial Occupancy and initial Operations period Phase defined for the project in the OPR, contract documents, and Cx Plan.

5.2.14 Warranty Period Commissioning. The owner shall require, by agreement,

- ~~Cx~~ Provider CxP performance of Cx during the warranty period,
- updating the systems manual based on modifications to operations to meet the OPR, and
- updating the OPR to meet changes in the owner's objectives and criteria.

5.2.15 Commissioning Progress Cx Progress Report. 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 designated for the development and assembly of the Cx Progress Report.

Revise Section 6 as shown. The remainder of Section 6 is unchanged.

6. OWNER'S PROJECT REQUIREMENTS

6.1 Introduction. The OPR forms the foundation for the design, construction, and occupancy and operation of the facility and is the basis for the Cx Plan and schedule. The OPR document evolves throughout each project. It is the pri-

mary tool for benchmarking success and quality at all phases of project delivery and throughout the life of the facility.

6.2 Requirements

6.2.1 During predesign, the owner, along with the ~~Cx Project~~ Project Team, shall facilitate development and documentation of the OPR.

6.2.2 The OPR document shall list and define the systems and assemblies to be commissioned, including sampling strategies accepted by the owner. The systems and assemblies being commissioned shall have defined project performance and acceptance criteria.

6.2.3 The OPR document shall address the following for the 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
- e. Clearly defined 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 Cx Progress Reports, systems manual requirements and formats
- j. Training requirements for owner's operation and maintenance personnel and occupants, emergency response personnel, and occupants, including level of training required, qualifications of trainers, and documentation requirements
- k. Designer BoD milestone submission requirements
- l. Applicable codes and standards in addition to local building codes
- m. Project schedules
- n. Special project requirements
- o. The content, organization, and milestones of BoD submittals for the design and construction process
- p. The number, format, and scheduling of design and submittal reviews
- q. Sampling procedures, if permitted, for all reviews, evaluations, and testing
- r. Cx Progress Report formats and distributed intervals

6.2.4 The OPR shall be included in the contract documents as an information-only attachment or as required by owner's contract requirements.

6.2.5 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 at the direction of the owner.~~

6.3 Acceptance

6.3.1 The OPR shall be reviewed by the ~~Cx Provider~~ CxP and approved by the owner during predesign. Updates to the OPR made during subsequent project activities shall also be formally accepted by the owner.

Revise Section 7 as shown. The remainder of Section 7 is unchanged.

7. COMMISSIONING ~~CX~~ PLAN

7.1 Introduction. The Cx Plan shall be a written document and provide organization, documentation requirements, and tools to evaluate and document that the design, construction, and operation of the project or facility, systems, and assemblies meet the OPR.

7.2 Requirements

7.2.1 The ~~Cx Provider~~ CxP shall, with input from the owner's ~~pProject~~ Project Team, develop the initial Cx Plan at the initiation of the project. The Cx Plan shall be updated and expanded during design and construction as the project evolves.

7.2.2 A copy of the final Cx Plan shall be included in the final Cx Report.

7.2.3 The Cx Plan shall include the following information:

- a. Overview of the ~~Cx Process~~ Activities developed specifically for the project
- b. Roles and responsibilities for the ~~Cx Project~~ Team throughout the project
- c. Documentation of general communication channels, including the distribution of the Cx Plan during the design and construction process
- d. Detailed description 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 design, construction, and occupancy/operations
- g. Guidelines and format that will be used to develop the ~~Cx Process~~ documentation, including systems manual and training plans
- h. Listing and format for ~~Cx Process~~ Design Review, evaluation checklists and testing forms, issues and resolution log, and Cx Progress Reports that will be used during the project to communicate and track critical ~~Cx Process~~ Activity information
- i. List of project commissioned systems and assemblies and description of evaluation procedures
- j. The framework for procedures to follow whenever ~~Cx Process~~ evaluation does not meet the OPR

7.3 Acceptance

7.3.1 The Cx Plan shall be approved by the owner and include a process for approval of the subsequent revisions.

Revise Section 8 as shown. The remainder of Section 8 is unchanged.

8. BASIS OF DESIGN (BOD)

8.1 Introduction. The BoD is a written document that shall provide detailed information on the ~~dDesign~~ Team's

approach to meeting the OPR to provide the owner with a better understanding of design issues and to secure the owner's approval of critical design decisions.

8.2 Requirements

8.2.1 The BoD shall be developed by the ~~d~~Design ~~t~~Team in accordance with the OPR. The BoD shall be updated and expanded during design and construction as the project evolves. The function of the BoD shall be to:

- a. ~~D~~describe the building systems and assemblies the Design Team is proposing to meet the OPR for the ~~O~~owner's approval;
- b. ~~D~~describe in detail the ~~d~~Design ~~t~~Team's technical approach to each of the owner's requirements, which are part of the Cx scope.
- c. Provide a platform for the review of the design and changes as the project progresses.
- d. Coordinate applicable technical and code requirements.

8.2.2 The ~~d~~Design ~~t~~Team shall submit the BoD to the owner and ~~Cx Provider CxP~~ for review at each milestone defined by the OPR and Cx Plan.

8.2.3 The owner and ~~Cx Provider CxP~~ shall evaluate each BoD submittal 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 goals and certification when required
- d. Consideration of design alternatives at each phase
- e. Requirements that systems, assemblies, and equipment be located and installed to be commissionable and maintainable
- f. Opportunities for improved performance

8.2.3.1 The ~~Cx Provider CxP~~ shall document and track issues related to the BoD using the Cx issues and resolution log, including issues identified by the owner and members of the ~~d~~Design ~~t~~Team.

8.2.4 The ~~d~~Design ~~t~~Team shall work with the owner and ~~Cx Provider CxP~~ to resolve Cx issues.

8.3 Acceptance

8.3.1 Each submission of the BoD shall be formally reviewed and accepted by the owner to facilitate the next step in the design process.

Revise Section 9 as shown. The remainder of Section 9 is unchanged.

9. CONTRACTOR, SUPPLIER, AND MANUFACTURER COMMISSIONING REQUIREMENTS

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

9.2 Requirements

9.2.1 Cx specifications shall be developed for all systems and assemblies being commissioned and shall be included in the ~~construction documents~~contract documents.

9.2.2 The applicable Cx ~~Process~~ specifications and requirements shall be included in all contracts with contractors, subcontractors, suppliers, service providers, and manufacturers for systems and assemblies being commissioned.

9.2.3 Contractors, subcontractors, suppliers, service providers, and manufacturers shall provide the required documentation as defined in the contract documents. Examples of these include submittals; shop drawings; installation, operations, and maintenance training agendas and associated training materials and close-out documents; code compliance; and existing-conditions documentation.

9.3 Acceptance

9.3.1 The owner shall approve the Cx ~~S~~specifications included in the ~~construction documents~~contract documents.

Revise Section 10 as shown. The remainder of Section 10 is unchanged.

10. DESIGN REVIEW

10.1 Introduction. A Cx ~~d~~Design ~~d~~ocument ~~r~~Review shall be performed to ~~verify~~ evaluate compliance with the OPR.

10.2 Requirements

10.2.1 The ~~Cx Provider CxP~~ shall perform a review of the commissioned systems and assemblies in the design documents to evaluate compliance with the OPR. Cx Design ~~r~~Review shall be completed and issues resolved prior to the issuing of ~~construction documents~~contract documents for systems being commissioned. The OPR and the Cx Plan shall define any sampling strategies for Cx ~~d~~Design ~~r~~Review.

10.2.2 The ~~CxA CxP~~ shall ~~provide a~~ conduct Cx ~~d~~Design review (Cx Report) Reviews as contained in the Cx scope and develop corresponding reports with comments, suggestions, clarification questions, and observations in a Cx Progress Report to the owner and ~~d~~Design ~~t~~Teams ~~for~~ evaluating compliance with the ~~Owner's Project Requirements~~ OPR. This Cx ~~d~~Design ~~r~~Review (commissioning) shall not be considered a design review (peer) or a design review (code or regulatory).

10.2.3 The ~~d~~Design ~~t~~Team, owner, and/or other responsible party shall respond to the ~~CxA document CxP Design ~~r~~Review~~ report with necessary answers-responses and document modifications ~~for~~ agreed to revisions to the project design documents. Revised documents shall be back-checked by the ~~CxA CxP~~. Any unresolved issues shall be reported to the owner for direction to the design and ~~Cx Project~~ Team on final disposition and direction.

10.2.4 A copy of the ~~document review~~ Cx Design Review report and response shall be included in the final Cx Report.

10.3 Acceptance

10.3.1 The owner shall approve the ~~CxP-Provider docu-~~ ment-Design ~~r~~Review report and the ~~d~~Design ~~t~~Team's response before the start of construction.

Revise Section 11 as shown. The remainder of Section 11 is unchanged.

11. COMMISSIONING SUBMITTAL REVIEW

11.1 Introduction. 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.

11.2 Requirements

11.2.1 A designated ~~Cx~~ Project Team member shall review project submittals for systems and assemblies to be commissioned for compliance with the OPR.

11.2.2 The ~~Cx Provider~~ CxP shall identify construction submittals to be provided by the contractor for the systems being commissioned.

11.2.3 The ~~Cx Provider~~ CxP shall review the construction submittals concurrently with the designers and provide comments to the designer.

11.2.4 The designer shall consider the ~~Cx Provider's~~ CxP'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 Provider~~ CxP.

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

- a. Require the ~~Cx Provider~~ CxP to review the construction submittals for the systems being commissioned concurrently with the owner or owner's representative and provide comments to the owner or owner representative.
- b. Consider the ~~Cx Provider's~~ CxP's comments and provide direction to the contractor in accordance with the owner's best professional judgment. A copy shall be provided to the ~~Cx Provider~~ CxP.

11.2.6 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. Any sampling review process used on the submittals shall conform to the owner-approved OPR and Cx Plan.

11.2.7 A copy of the submittal document review report and response shall be included in the final Cx Report.

11.3 Acceptance

11.3.1 The ~~Cx Provider~~ CxP shall maintain a record of all Cx submittal reviews and shall submit a written report to the owner and design authority. If it is determined that any reviewed submittals do not comply with the OPR, that submittal shall be provided to the owner to determine if the system or equipment shall be accepted or rejected.

Revise Section 12 as shown. The remainder of Section 12 is unchanged.

12. CONSTRUCTION OBSERVATION AND TESTING

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

12.2 Requirements

12.2.1 The systems and assemblies to be commissioned, identified in the OPR and Cx Plan, shall be confirmed to comply with the OPR and with the contract documents.

12.2.2 Checklists and test procedures with necessary report forms shall be developed ~~before~~ after submittal approval and utilized during 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.
- 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 Provider~~ CxP.
- d. Sampling procedures shall be utilized if required and defined in ~~the OPR, the Cx Plan, or the Cx Specifications.~~

12.2.3 There shall be a uniform and effective process for documentation of testing to provide Cx ~~T~~esting of and interaction between commissioned equipment, systems, and assemblies. The term ~~Cx Project Team~~ shall refer to applicable Cx technical resources tailored to their specific projects.

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

12.2.5 Evaluation of the systems and assemblies by the ~~Cx~~ Project 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.
- 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.

12.2.6 Executing Test Procedures

- a. Once construction checklists and test procedures are established, the responsible entities shall execute relevant test protocols and repeat testing as necessary until equipment, systems, or assemblies being tested pass all tests.
- b. The ~~Cx Provider~~ CxP directs, witnesses, and documents the tests conducted by the ~~Cx~~ Project Team as required by the Cx Plan.
- c. Completed test reports shall be submitted to the ~~p~~ Project ~~t~~ Team for review and to the ~~Cx Provider~~ CxP for evaluation.

12.2.7 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.

12.2.8 All checklists and test procedure results shall be compiled into the final Cx Report.

12.3 Acceptance

12.3.1 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 summary reports shall have a response of concurrence or acceptance by the owner.

Revise Section 13 as shown. The remainder of Section 13 is unchanged.

13. ISSUES AND RESOLUTIONS DOCUMENTATION

13.1 Introduction. 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.

13.2 Requirements

13.2.1 The ~~Cx Provider~~ CxP and the CxP Team shall develop a formal issues and resolutions log with supporting documentation.

13.2.2 The active issues and resolution log will have all open and continuing items, with status and responsible person or organization for resolution.

13.2.3 A formal issues and resolutions log shall be maintained throughout the project until all issues are resolved or accepted by the owner.

13.2.4 The issues and resolutions logs and Cx Progress Reports shall be distributed to the ~~Cx Project~~ Team at intervals prescribed in the Cx Plan.

13.3 Acceptance

13.3.1 The owner shall review and accept the final issues and resolution log. Upon acceptance, this will be included in the final Cx Report.

Revise Section 14 as shown. The remainder of Section 14 is unchanged.

14. SYSTEMS MANUAL

14.1 Introduction. The systems manual documentation shall be provided to the owner for use in building operation and the training of personnel.

14.2 Requirements

14.2.1 The systems manual shall provide the information needed to understand, operate, and maintain the building's systems and assemblies.

14.2.2 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 Project~~ Team shall be responsible for updating the systems manual during the ~~Cx Process~~, includ-

ing design, construction, and operation as required in the OPR, Cx Plan, and contract documents.

14.2.3 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

2.2 Copy of Building/Project Design and Record Documents

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

Section 4—Facility Operations

4.1 Facility Guide, including Operating Plan; Building and Equipment Operating Schedules, Set Points, Ranges, and Limitations; Commissioned Systems Control Sequences of Operation; and Emergency Procedures. The Facility Guide shall contain operating instructions, which are the facility's operating criteria and procedures, for systems controls (HVAC&R, lighting), security, fire, safety, emergencies, and maintenance programs, including the assemblies commissioned.

Section 5—Training

5.1 Copy of Training Plan and Materials

5.2 Training Records

Section 6—~~Final Commissioning Cx Progress Reports~~

6.1 Copy of Final Cx Process Plan(s)

6.2 Copy of Commissioning Design and Submittal Review Reports

6.3 Copy of Testing and Start-up Test Reports, Evaluation-Construction Checklists, and testing checklists and Test Procedures Used for Evaluation Completed for Commissioned Systems and Assemblies

6.4 Copy of All Cx Progress Reports

6.5 Copy of Issues and Resolution Logs

6.6 Item Resolution Plan for Open Items

6.7 Preliminary Cx Report Prior to Issue of Certificate of Occupancy.

6.8 Final Cx Report at the Completion of the Cx

14.3 Acceptance

14.3.1 The contents of the preliminary systems manual, Sections 2 through 4, shall be reviewed and evaluated by the ~~Cx Provider~~ CxP prior to training of operational and maintenance personnel and occupants in accordance with the OPR.

14.3.2 The owner shall approve the final systems manual for use in building operations.

Revise Section 15 as shown. The remainder of Section 15 is unchanged.

15. TRAINING

15.1 Introduction. 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.

15.2 Requirements

15.2.1 The training plan shall include the following items:

- a. Level of training for O&M staff, emergency response personnel, and occupants.
- b. 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.
- c. Learning objectives and training delivery methods for each instructional topic.
- d. The planned location of the training sessions (classroom, on site, and off site) and the minimum duration of each training session, in hours, to be completed as required in the OPR, Cx Plan, or ~~construction contract~~ documents.
- e. Instructor's qualifications.
- f. Training materials requirements to be employed during the instructional process.
- g. Training report, records, and recording requirements.

15.2.2 Archival 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 this standard.

15.3 Acceptance

15.3.1 The training plan, the execution of the training plan, and the delivery of instruction shall be reviewed for acceptance by the ~~Cx Provider~~ CxP 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.

Revise Section 16 as shown. The remainder of Section 16 is unchanged.

16. POSTOCCUPANCY OPERATION

16.1 Introduction. 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 Cx Activities of the ~~Cx Process~~ begin at substantial completion.

16.2 Requirements

16.2.1 The ~~Cx Process~~ Activities shall continue through the end of the contractual warranty period.

16.2.2 The seasonal, delayed, and incomplete testing of facility systems and assemblies shall be completed. The ~~Cx Provider~~ CxP 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.

16.2.3 The general contractor or owner shall coordinate contractor callbacks to resolve issues identified during the ~~Cx Process~~ and provide written documentation to the ~~Cx Provider~~ CxP that the issues have been resolved and/or that the owner has accepted the final conditions.

16.2.4 Additional training shall be performed during the postoccupancy and operations activities in accordance with the training and Cx Plans.

16.2.5 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.

16.2.6 By the conclusion of the postoccupancy operation ~~commissioning activities~~ Cx Activities, the systems manual, testing documentation, issues and resolution logs, training report, and a final Cx Report shall be updated and submitted for acceptance.

Revise Section 17 as shown. The remainder of Section 17 is unchanged.

17. COMMISSIONING REPORT

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

17.2 Requirements

17.2.1 Intermediate Cx Progress Reports shall be issued as required in the OPR, the Cx Plan, and the applicable jurisdictional requirements.

17.2.2 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.

17.3 The final Cx ~~Process~~ progress ~~Report~~ shall include the following:

- a. Executive summary.
- b. Copy of the final Cx ~~Process~~ plans.
- c. Copy of design and submittals review reports.
- d. Completed copy of the approved supplier, contractor, and ~~Cx Provider~~ CxP evaluations, and Cx start-up and test forms, including those utilized during the occupancy and operations activity.
- e. Copy of all Cx Progress Reports.
- f. Copy of all issues and resolution logs including the descriptions of the issues and the measures taken to cor-

rect them. A discussion of systems or assemblies that do not perform in accordance with the OPR.

- g. For all incomplete issues, delayed or seasonal tests including a resolution plan approved by the owner identifying who is responsible for resolution.

17.4 Acceptance

17.4.1 The ~~Cx Provider~~ CxP shall submit the final Cx Report to the owner and others as required by the OPR and jurisdictional requirements for review and acceptance.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

About ASHRAE

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Through research, Standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

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