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ADVANCED NEW BUILDING CONSTRUCTION COMMISSIONING - NBCX

ONLINE TRAINING

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GREEN BUILDING COMMISSIONING



4. DESIGN PHASE

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COMMISSIONING SPECIALIST CURRICULUM

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Learning Objectives

- Introduction
- Objectives
- Design Activities
- Commissioning Team

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During the design phase, the commissioning process verifies that the design documentation (plans, specifications, Basis of Design (BOD), etc.) is coherent, contains commissioning requirements, and meets the Owner’s Project Requirements (OPR).



Overview

-]The design phase refines and organises project details for construction papers. The design team’s OPR submission must inform these materials.
- The Owner or representative may need to approve an OPR update if questions and changes arise during this step. During design, the systems to be commissioned and the commissioning team’s contractor and manufacturer duties are selected.
- During the design process, the commissioning plan is updated to reflect the design and performance requirements of the commissioned systems, field observation, functional testing, performance requirements, and testing and reporting documentation formats.
- The CxP checks construction papers for OPR compliance and commissioning requirements throughout and after project design. CxP design reviews verify OPR compliance and are not PEER reviews. For design completeness, the designer should write about open issues.

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Objectives

- Communicate the commissioning requirements to other project team members.
- Verify, through review, that the design documentation is consistent with the OPR and BOD.
- Ensure that commissioning requirements are included in the construction documents.
- Build Engagement and cooperation among the project team members.

Commissioning Team

- Owner Representative
- User Representatives
- Commissioning Provider (CxP)
- Design Team
- Construction Team (engaged when known)

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Design Activities

1. Update the commissioning plan and scope. If a plan has not been developed, the CxP creates one as described in the pre-design phase, covering the design phase in final detail and, in sum, the construction phase. Updates to the plan during design should include more detail about the construction phase's responsibilities, process, new project team members, communication protocols, and schedule. Later in design, the CX plan is fully developed for construction. Any needed additions to the CXP's scope should be made at this time.
2. Hold a kick-off meeting for the design phase commissioning to go over the plan and activities with the commissioning team.
3. The design team develops a basis of design (BOD).
4. Review the OPR and BOD for completeness and clarity (by the CxP). The OPR and BOD should also be included as an attachment to the construction documents for contractor information, without being binding except for requirements also found in the drawings and specifications.
5. Ensure the OPR and BOD documents are updated and in alignment with each other to reflect any owner-approved changes made during the design process.
6. The CxP provides focused design checklists for the design team to facilitate important, but sometimes forgotten design concepts and items that encourage better practice. Consider the following or other appropriate checklists:

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Perform commissioning-focused reviews of the design submissions using experienced qualified personnel of the CxP or Owner.

- Design reviews shall be documented by comment statements appropriate for the level of completeness of the design. The CxP is respectful in his wording of comments.
- In summary, design reviews will accomplish the following:

1. Confirm the general quality and completeness of the documents.
2. Review for discipline-specific compliance with the OPR for commissioned systems and assemblies
3. Confirm the BOD is accurate and aligns with the OPR.
4. Confirm that it is feasible to commission the design.
5. Confirm adequate O&M documentation and training requirements.

- Commissioning reviews check that the OPR and BOD are satisfied to facilitate the commissioning process, including training and O&M documentation, continuing commissioning, and HVAC system equipment access, test ports, monitoring capabilities and points, and control features. Energy-efficiency, operation, control sequences, maintenance, training, and O&M documentation requirements are also checked against the OPR and BOD.
- At least for commissioned equipment, document quality should be reviewed as part of confirming the OPR and BOD to identify areas that are inconsistent, unclear, won't meet the OPR, or aren't good practise.

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Design Activities +

- Of particular importance is to perform a thorough review resulting in specific control logic and control systems integration requirements necessary to fully implement the sequences of operation. This should be completed prior to late construction documents when it becomes more difficult to make changes.
- Prior to construction documents phase design packages being submitted for review, the CxP encourages and facilitates integration meeting(s) held to coordinate systems and equipment that interact with each other such as M&V monitoring needs between the HVAC and electrical disciplines, interplay with the HVAC building automation system (BAS) and fire alarm and emergency power, lighting and access control with the BAS and integration of the building enclosure with the HVAC system.
- The ideal number and timing of reviews varies from project to project. Larger and more complex projects warrant more reviews. The CxP should discuss with the Owner the advantages and disadvantages of more review (potential impacts to the design schedule, costs, benefits, etc.). Many if not most projects warrant the following reviews with back-checks:

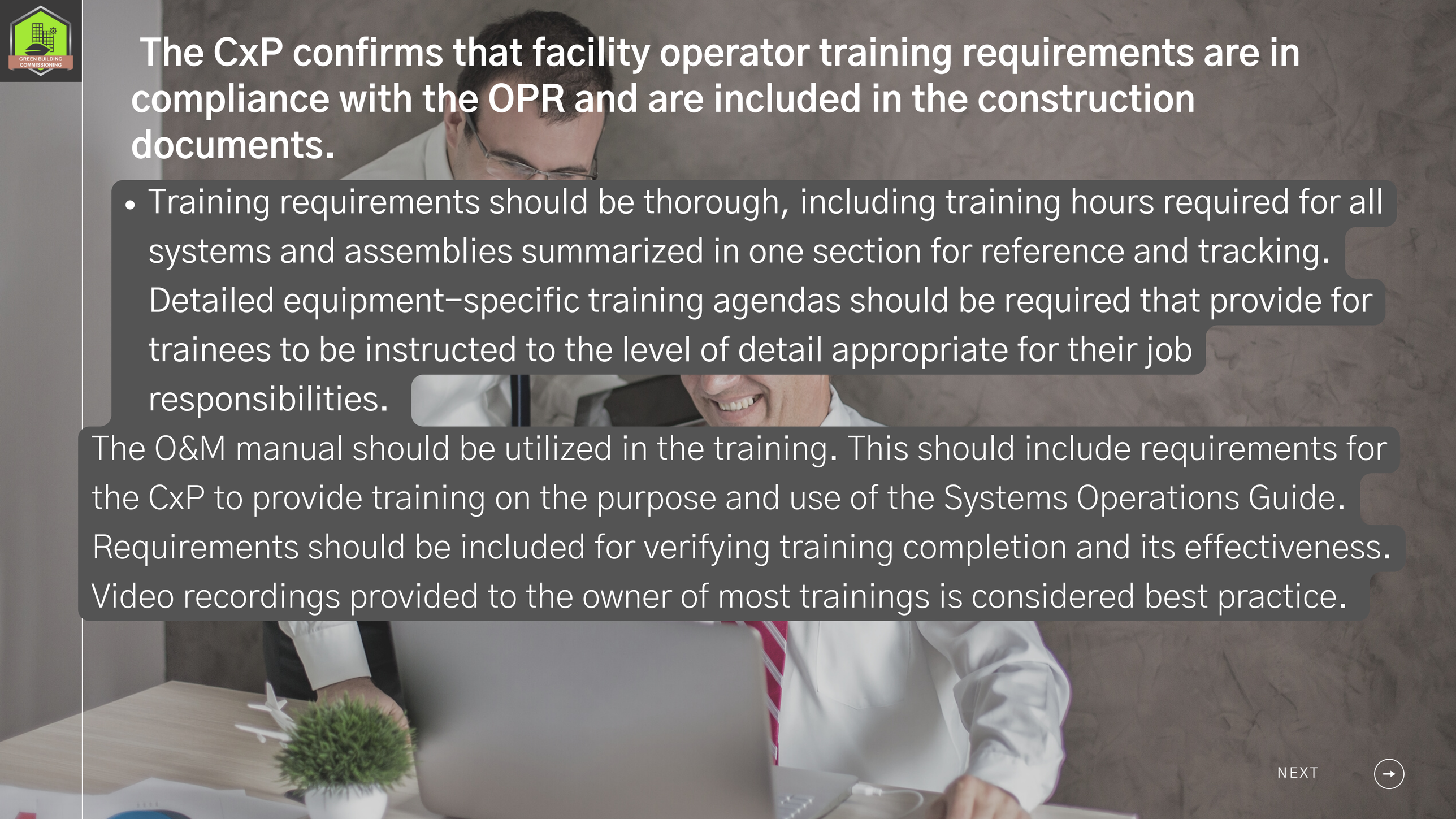
– 100% Schematic Design (primarily a review of the BOD) – 100% Design Development
– 50% and 90% Construction Documents

Design Activities +

- Fewer reviews may be warranted for smaller or simple projects. Larger or more complex projects may warrant a concepts review and additional reviews in design development.
- The design team should provide written response to each of the design review comments. These responses should be returned to the CxP and issues resolved, with the CxP, design team and Owner all understanding the agreed upon path forward on each comment. This resolution should be documented prior to the design team moving significantly into the next design phase in an Issues Log managed by the CxP.
- At the next design submission, the CxP back-checks the comments from the previous review, i.e., confirms that the agreed-upon resolution for each comment from the previous review has been incorporated into the plans and specifications.



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The CxP confirms that facility operator training requirements are in compliance with the OPR and are included in the construction documents.

- Training requirements should be thorough, including training hours required for all systems and assemblies summarized in one section for reference and tracking. Detailed equipment–specific training agendas should be required that provide for trainees to be instructed to the level of detail appropriate for their job responsibilities.

The O&M manual should be utilized in the training. This should include requirements for the CxP to provide training on the purpose and use of the Systems Operations Guide. Requirements should be included for verifying training completion and its effectiveness. Video recordings provided to the owner of most trainings is considered best practice.

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Develop commissioning specifications to ensure that commissioning requirements are included in the construction documents. The CxP creates or confirms the following:

- In the specifications, fully explain all contractor-related commissioning responsibilities. For clarity and information, summarily list the CxP, their subconsultants, and other non-contractor team member responsibilities without detailed explanation (Construction Manager (CM), Owner, design team). Clearly delineate between the contractor responsibilities and the responsibilities of the rest of the team.
- Sampling. Specifications should outline sampling requirements. Sampling may be used for design evaluation, submittal review, field installation observation, construction checklist verification, functional testing of numerous identical non-critical or non-life safety equipment and assemblies, trend log analysis, and O&M manual review. In the CxP call for bids, the owner should specify sampling, objectivity, and rigour (RFP). If not specified in the RFP, CxPs should state their sample level in their offers.
- Defining and following the testing scope is arguably the most important component in attaining commissioning performance goals. Incorporate equipment-specific functional testing scopes for each assembly, system, or piece of equipment. Test form content, format, rigour, sample, trending, etc. Define functional testing scope and rigour by identifying modes, circumstances, and acceptance criteria. Define commissioning functional testing, contractor quality control, and additional testing in the requirements (e.g., duct and pipe pressure testing, generator load bank testing, etc.)

Develop commissioning specifications to ensure that commissioning requirements are included in the construction documents. The CxP creates or confirms the following: +

- Normally require the manual testing rigor to include testing each sequence in the sequence of operations and other significant modes, capacity and load modulation extremes, interlocks, control strategies and alarms and packaged control features,
- Individually test all large, sophisticated, process critical, and life-safety equipment. Certain projects may be suitable for testing a sample of equipment or assemblies if they are small, numerous, and not sophisticated or vital for process or life-safety.
- After manual testing, trend developing automated system-monitored systems as part of functional testing. Trends will verify all key control loops, equipment staging, and time of day scheduling. Document trend graphs.
- If indicated by the CxP, supply bidders with one or more representative functional test forms and construction checklists to demonstrate the breadth and rigour expected and help the contractor quote the job.
- Work with the design team to align other specifications parts that include functional testing or commissioning-related activities with the formal commissioning sections. Section cross-reference.
- Explain how commissioning affects occupancy permits and project closure.
- Project documentation. The CxP specifies the scope of the project paperwork to be supplied to the Owner (Systems Operations Guide, Commissioning Record, and Contractor's Project Turnover Documents) and verifies that the contract documents meet the criteria.
- The CxP should include the BOD (if current, otherwise short revised design narratives), system single-line flow diagrams, final set points, diagnostic instructions, recalibration, and OCx guidelines in the Systems Operations Handbook.

Design Activities +

- Near the end of Design, the Cx Plan and design documents should be updated to be consistent with each other. The Cx Plan should include the details of the responsibilities and roles of the Contractor as well as those of the CxP, Owner and Designers which may or may not be articulated in detail in the specifications. The Cx Plan should also include the activities and responsible parties for the Occupancy Phase.
- The commissioning plan, OPR and BOD should be provided to the contractor during bidding for information, not obligation, as a supplement to the construction documents to augment the commissioning specifications.

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