GUIDELINE

ASHRAE Guideline 0.2-2015

Commissioning Process for Existing Systems and Assemblies

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Includes real-world examples that illustrate application of the Cx Process to various facility, system, or assembly types. Requires Microsoft Word®.

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NOTE

Approved addenda, errata, or interpretations for this guideline can be downloaded free of charge from the ASHRAE Web site at www.ashrae.org/technology.

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(This foreword is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

The Commissioning (Cx) Process for existing systems and assemblies is an organized, quality-oriented process for planning, assessing, investigating, implementing, verifying, and documenting that improves the performance of facilities, systems, and assemblies to meet defined operational requirements and criteria for the facility over time.

The Existing-Building Commissioning Process

The Existing-Building Commissioning (EBCx) Process is used by Owners and/or other facility decision makers to optimize the operation of their facilities and systems for their specific Current Facility Requirements (CFR). The process is used to plan facility operation programs and goals and then compare existing conditions and operations to those goals. This evaluation allows the Owner to determine if any of the existing conditions require or warrant further attention. The process is also used to identify the causes of existing problems and shortfalls in achieving the CFR and to determine methods for resolving those problems. Most importantly, the process provides the Owner with a logical decision-making approach to evaluate, compare, prioritize, and implement recommendations for making their facilities operate as efficiently and effectively as is economically feasible given the Owner's specific requirements and resources. When physical changes to the facility are required as a consequence of the EBCx Process, all such modifications must meet applicable codes pertaining to the work being performed. Additionally, following the process allows Owners to maintain the benefits of these implemented recommendations over time.

The EBCx Process differs from the Cx Process for new buildings in that the Cx Team for existing buildings is selected and charged with evaluating existing-building systems and assemblies to determine their ability to meet the Owner's CFR, which may differ from the original design.

This guideline details a process that can be applied to any type of building, system, or assembly. The EBCx Process consists of distinct phases with specific objectives to be achieved during each phase in order to identify and correct operational and functional issues that prevent the building systems and assemblies from performing as currently required. The process involves the following phases: Planning, Assessment, Investigation, Implementation, Hand-Off, and Ongoing Commissioning (OCx). This guideline describes the responsibilities of the Cx Team and the documents and reports needed to provide a uniform, integrated, and consistent approach for maintaining, operating, and managing assets to meet the Owner's and other stakeholders' ongoing requirements.

The process detailed in this guideline is presented as linear. In reality, the process probably will be iterative and interactive, where many tasks and even some phases are performed more than once as needed for the specific facility and systems. The documents used and created in this guideline are living documents that will need to be updated throughout the EBCx Process.

The process places an emphasis on planning and on documentation of the CFR early on, with updates throughout as needed. Owners adopt the EBCx to achieve their stated objectives and criteria as defined in the CFR. The CFR must appropriately describe these criteria as understood at the beginning of the process and must be modified as new information is uncovered.

The Assessment, Investigation, and Implementation Phases are critical to making a difference in a facility, but the most overlooked phase is the OCx Phase, which is used for verifying and sustaining the actual performance of the facility over time. If the Owner does not continue to verify system performance improvements, those benefits are likely to deteriorate or disappear in future years. The development of facility staff training modules, including documents on how the building works (facility guide), are critical to maintaining long term performance in anticipation of the inevitable staff turn-over.

The Cx Process as presented herein allows the Owner to reduce the life-cycle cost of the facility. Following this integrated process should result in a fully functional facility, with complete documentation of its systems and assemblies, and trained operating and maintenance personnel.

EBCx Process Supporting Technical Guidelines

ASHRAE Guideline 0.2 presents details on the Cx Process for existing systems and assemblies without focusing on specific systems or assemblies. Supporting technical guidelines are being developed to provide specific and detailed information on how to implement the Cx Process for each major facility system or assembly. However, the EBCx can be implemented successfully without the supporting technical guidelines.

Supporting technical guidelines use a common content organization that is closely coordinated with Guideline 0.2 to avoid repeating Cx Process information that is conveyed in this guideline. This common content organization, with focus on system-specific information, forms a set of documents that can be employed together or in any combination to accommodate varying Owner requirements.

Annexes

Annexes are included with this guideline to assist users in applying the Cx Process for existing systems and assemblies and to aid in the development of the supporting technical guidelines. Most of the annexes include examples located online at ***www.ashrae.org/G02-2015****. The examples are based on specific project experience and are presented as a representative sample of current practice, which may not follow all of the procedures presented in this guideline. They illustrate application of the Cx Process to various facility, system, or assembly types. They are not intended to promote specific formats for the various deliverables related to the Cx Process but to help illustrate how the guideline can be put into practice.*

History of Cx Process Guidelines

Development of guidelines for the Cx Process began formally in 1982 when ASHRAE formed a committee to document best practices to achieve facilities that performed according to the needs of the Owner and other stakeholders. ASHRAE published

its original Cx guideline, ASHRAE Guideline 1, The HVAC Commissioning Process*, in 1989, and an updated version was published in 1996. These first guidelines were developed with an emphasis on HVAC&R equipment.*

In 1999, it was decided to develop a more inclusive set of guidelines that applied to all building systems. This effort resulted in a collaboration with the National Institute of Building Sciences (NIBS) and the concept of a general guideline for the Cx Process and a series of supporting technical requirements guidelines for different building systems. In 2005, ASHRAE published Guideline 0, The Commissioning Process*, to address the underlying quality-based Cx Process without reference to a specific system type. NIBS subsequently published the first supporting technical guideline, Guideline 3,* Exterior Enclosure Technical Requirements for the Commissioning Process, in 1996*. Shortly thereafter, ASHRAE replaced Guideline 1-1996, which had contained both general Cx Process requirements and HVAC technical requirements, with supporting technical guideline, ASHRAE Guideline 1.1-2007,* HVAC&R Technical Requirements for the Commissioning Process*.*

On completion of ASHRAE Guideline 0-2013, it was determined that unique requirements existed in the Cx Process for existing buildings that warranted a separate guideline to detail the EBCx, along with supporting technical requirements guidelines for different building systems. This resulted in both ASHRAE Guideline 0.2, The Commissioning Process for Existing Systems and Assemblies*, as well as an expansion of the commissioning guideline series.*

1. PURPOSE

1.1 The purpose of this guideline is to describe the procedures, methods, documentation, requirements, and physical activities of the Commissioning (Cx) Process for existing buildings, systems, and assemblies using the principles developed in ASHRAE Guideline 0, *The Commissioning Process*.

2. SCOPE

2.1 This guideline applies to existing buildings, systems, and assemblies.

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.

commissioning (Cx): see *Commissioning (Cx) Process*.

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

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

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

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

Commissioning (Cx) Process Progress Report: a written document that details activities completed as part of the Cx Process and significant findings from those activities. The report is continuously updated during the course of a project and usually incorporated into the Cx Plan as an ongoing annex.

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

Current Facility Requirements (CFR): a written document in which the Owner details the current functional requirements of a facility and the expectations of how it should be used and operated. This may include goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information to meet the requirements of occupants, users, and Owner(s) of the facility.

Existing-Building Commissioning (EBCx) Process: a quality-focused process for attaining the CFR of an existing building and/or its systems and assemblies. 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 CFR, with a program in place to maintain the enhancements for the remaining life of the facility.

facility guide (FG): a basic building systems description and operating plan with general procedures and confirmed facility operating conditions, setpoints, schedules, and operating procedures to properly operate the facility.

functional performance test protocol: a written collection of tests that, when executed in the test process, allow verification of the performance of a system or assembly.

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

Measurement and Verification (M&V) Plan: a plan for gathering relevant data over time to evaluate performance and benefits.

Multiple-Facility Program Plan: a strategic plan for enhancing multiple facilities.

Ongoing Commissioning (OCx) Process: a continuation of the Cx Process after the Hand-Off Phase to verify that a facility continues to meet current and evolving CFR (OPR for new construction). OCx Process 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).

recommissioning: an application of the Cx Process requirements to a project that has been delivered using the Cx Process (see *Existing-Building Commissioning [EBCx] Process*).

retrocommissioning: the Cx Process applied to an existing building that was not previously commissioned (see *Existing-Building Commissioning [EBCx] Process*).

systems manual: a system-focused composite document that includes the design and construction documentation, FG and operation manual, maintenance information, training information, Cx Process records, and additional information of use to the Owner during occupancy and operation.

test procedure: a written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Training Plan: a written document that details the expectations, schedule, budget, and deliverables of Cx Process Activities related to training of project operations and maintenance personnel, users, and occupants.

verification: the process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the CFR.

4. PROCESS OVERVIEW

4.1 Section 4 provide an executive summary of the Existing-Building Commissioning (EBCx) Process with sufficient information to allow users to determine the value of using the process to enhance the value of their assets, increase productivity, and reduce operating costs, including energy and maintenance costs.

4.2 This guideline builds on the quality principles of the Commissioning (Cx) Process that were developed for new buildings as described in Guideline 0-2013, *The Commissioning Process*. Key components of this process include the following.

4.2.1 Use a team.

4.2.2 Involve stakeholders of and in the facility.

4.2.3 Develop a conceptual plan for multiple facilities and/or projects.

4.2.4 Determine functional needs and requirements of the facility.

4.2.5 Document performance of current and required systems and assemblies.

4.2.6 Make obvious low-cost repairs.

4.2.7 Identify, analyze, and recommend improvements.

4.2.8 Implement approved recommendations and improvements.

4.2.9 Measure and verify performance and benefits.

4.2.10 Identify persistence of benefits and improvements.

4.2.11 Produce a functional systems manual for facility operations.

4.2.12 Provide training or retraining to operations and maintenance (O&M) staff and occupants.

4.2.13 Develop a lifetime Ongoing Commissioning (OCx) program.

4.3 This process offers both immediate benefits and long-term value. The immediate benefits of utilizing this process are the cost-effective modifications and improved functionality of the facility and its systems and assemblies. The long-term value stems from continuously updating documentation of the changing facility needs and requirements and effectively addressing the evolution of the facility through the OCx Process Program. These documents include Current Facility Requirements (CFR), EBCx Program Plan, EBCx Plan, a dynamic systems manual, maintenance staff and occupant training information, and the OCx Plan.

4.4 A good Cx Process will focus the level of effort and available resources around the key elements and systems that need to be addressed to meet the goals of the process. The level of effort and potentially the cost to implement all aspects of the EBCx Process could exceed the available resources if applied to every building system, component, and subcomponent. In most applications, it is more likely that the EBCx Process will be focused on specific areas or systems within a facility, address specific known issues, and have specific overall goals. In EBCx, not every system should or needs to be examined to provide benefit.

4.5 Another element of the process, *persistence*, refers to ensuring that improvements remain in place, as appropriate, over time, through training, documentation, and putting mechanisms in place to regularly check the performance and the improvements.

4.6 Table 1 summarizes the EBCx Process phases and lists the major activities and deliverables in each phase. The objectives of each phase are as follows.

4.6.1 The objectives of the Multiple-Facility Planning Phase are to clearly define the expectations of the EBCx Program and establish processes and procedures necessary to successfully implement the program across a group of buildings, systems, or assemblies. The decisions made here will be based on the defined goals and specific facility types to be included in the program. The final objective of the phase is to develop a master or strategic EBCx Program Plan to be used as a guideline for the execution of the program across the selected facilities.

4.6.2 The objectives of the Assessment Phase are to establish the CFR or ensure that an existing CFR includes all necessary information, to assess the facility's suitability for an EBCx Plan, and to develop a course of action to execute the EBCx Plan.

4.6.3 The objectives of the Investigation Phase are to understand and document existing conditions and performance to identify improvements that bring the facility into compliance with the CFR.

4.6.4 The objective of the Implementation Phase is to execute the recommendations selected from the Investigation Reports. Verify performance meets the CFR. Report the results of implementation.

4.6.5 The objectives of the Hand-Off Phase are to provide the completed documents from the EBCx to the Owner, pro-

TABLE 1 Phases, Activities, and Deliverables

Phases	Main Activities (Section #)	Deliverables
Multiple-Facility Planning (Section 5)	• Assemble EBCx Program Planning Team (5.2) • Document EBCx Program Goals and Objectives (5.3) • Assemble Information and Rank Facilities (5.4) • Develop EBCx Program Plan (5.5) • Obtain Owner Acceptance and Decision to Proceed (5.7)	• EBCx Program Plan
Assessment (Section 6)	• Define Owner's EBCx Goals and Objectives (6.2) • Select the Initial EBCx Team (6.3) • Develop CFR (6.4) • Develop the EBCx Plan (6.5) • Establish the Systems Manual Outline (6.6) • Perform Assessment (6.7) • Initiate EBCx Report with Assessment Report (6.8) • Obtain Owner Acceptance and Decision to Proceed (6.10)	• CFR • EBCx Plan • EBCx Report, including the Assessment Report • Updated EBCx Program Plan (if applicable and affected)
Investigation (Section 7)	• Update EBCx Team (7.2) • Conduct Investigation Planning Meeting (7.3) • Review Facility Documentation (7.4) • Update EBCx Plan (7.5) • Perform Site Investigation and Testing (7.6) • Perform Issues and Opportunities Analysis (7.7) • Update EBCx Report with Investigation Report (7.8) • Obtain Owner Acceptance and Decision to Proceed (7.10)	• Updated EBCx Plan • Updated EBCx Report, including the addition of the Investigation Report
Implementation (Section 8)	• Select Recommendations to Implement (8.2) • Implement Capital Projects (8.3) • Update EBCx Team (8.4) • Incorporate Informal Training (8.5) • Update EBCx Plan (8.6) • Implement Recommendations (8.7) • Verify Completed Recommendations and Performance (8.8) • Update the EBCx Documentation (8.9) • Obtain Owner Acceptance and Decision to Proceed (8.11)	• Updated EBCx Plan • Updated CFR • Updated EBCx Report, including the addition of the Implementation Report • Updated systems manual material
Hand-Off (Section 9)	• Develop OCx Plan (9.2) • Assemble Systems Manual (9.3) • Train Facility Personnel (9.4) • Verify Training Effectiveness (9.5) • Conduct Lessons-Learned Workshop (9.6) • Finalize EBCx Report (9.7) • Provide Project Documents to Owner (9.8) • Obtain Owner Acceptance and Decision to Proceed (9.10)	• EBCx Report, including the addition of the Lessons-Learned Report • Systems manual, including facility guide • OCx Plan
Ongoing Commissioning (OCx) (Section 10)	• Assemble the OCx Team (10.2) • Update the OCx Plan (10.3) • Verify Achievement of CFR (10.4) • Investigate Unacceptable Performance or Outcome (10.5) • Implement Recommendations (10.6) • Update Systems Manual (10.7) • Update Facility Personnel Training (10.8) • Write/Deliver OCx Report (10.9) • Obtain Owners Acceptance (10.11)	• Updated OCx Plan • Updated CFR • Updated systems manual • OCx Report (made periodically)

vide training to the Owner's personnel, and to incorporate lessons learned from the Cx Process into the day-to-day O&M procedures in the facility.

4.6.6 The overall objective of the OCx Program is to ensure that the benefits obtained from the EBCx Plan and any other building improvements are sustained over time and improved if possible. OCx involves performing critical elements of the process, repeatedly over a series of cycles, with periods typically lasting from months to years.

4.7 Table 1 and this guideline present the process as occurring in a linear fashion. In reality, the process is often iterative and interactive where many tasks and even some phases are performed more than once, as needed, for the specific facility and systems.

4.8 The complete list of deliverables in Table 1 may not be required or desired due to factors of project size, complexity, funding, time, etc. The decision regarding which deliverables to provide is performed by the EBCx Team, as they have the