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An Overview Of Building Commissioning in Codes

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International Code Council
Overview

- Codes and Standards
- Commissioning Provisions in the 2012 and 2015 IgCC and 2011 and 2014 ASHRAE 189.1
Objectives

Upon completion of this presentation, participants will be able to:

- Describe an overview of the code required commissioning (Cx) process.
- Identify key provisions relating to commissioning contained in the International Energy and Green Codes and ASHRAE Energy and Green standards.
- Identify the referenced industry standards and guidelines for commissioning.
Part I

Codes and Standards
“Codes” are documents that are adopted by the legal authority in your jurisdiction and:
- Establish minimum performance requirements to achieve life safety and property protection
- Are written in “mandatory” language indicating what must be done

“Standards” are documents referenced in the codes and indicate how to achieve what must be done.
International Building Code

- Applies to activities that require a permit
- Applies to construction activities that don’t require a permit
- Other I-Codes are a subset
15 Published 2018 I-Codes

- IZC
- ICCPC
- IGCC
Standards

- Referenced standard is version specific
- Last chapter of I-Codes
Standards


Conflicts

- Conflicts within the Code
  - Section 102.1
    - More Restrictive
    - General vs. Specific Requirements
- Conflict with another ordinance
- Conflict with a standard
What are Codes?

- Model Code versus Law
- Local Ordinances
- Other Laws
Example Adoption Ordinance

  - 903.2.8 This provision of the IBC is **not adopted**.
  - 1013.1.1 Exit Signs. Exit signs **shall not be located more than 4 feet above exit door**.

- Other 2015 ICC codes adopted by ordinance
  - IECC, IEBC, IRC, IPC, IMC, IFGC, ISPSC and IFC

- Other Codes adopted by ordinance
  - 2014 NEC (Chapter 35)
  - **2015 Life Safety Code**
Jurisdiction Standards Adopted by Reference

- International Building Code
  - Chapter 9
    - NFPA 13-2013
    - NFPA 72-2013
  - Chapter 11
    - ICC A117.1-2009
  - Chapter 27
    - NFPA 70-2014

- International Energy Conservation Code
  - ASHRAE 90.1-2013
Other Laws

- Local Ordinances
  - Zoning laws
  - Other adopted codes

- Other Laws
  - Americans with Disabilities Act
  - Federal Energy Conservation Acts
Cx Standards

- ASHRAE 202-2018: Cx Process for Buildings and Systems
- ASHRAE Guideline 1.1-2007
- ASTM E 2813 Standard Practice for Building Enclosure Cx
- ICC G4-2012: Guideline For Commissioning
ASHRAE 202 Cx Process

- Standard 202-2018 describes how to plan, conduct, and document commissioning of a project.
- Informative appendices provide sample documentation, including checklists, systems manual, reports, training plan, and more.
- Provides specifics of the overall Cx process
- Provides details within each activity of the Cx process
## ASHRAE 202-2018

### Activities and Deliverables

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Owners Project Req. (OPR)

Documents the expectations and requirements:

1. Building use and operation
2. Project goals
3. Measurable performance criteria
4. Cost considerations
5. Benchmarks
6. Success criteria
7. Training
Basis of Design (BOD)

Documentation of

- Concepts
- Calculations
- Decisions and product selections used to meet the OPR and to satisfy code and standard requirements
- It includes a narrative and a list of items that support the design
2012 IECC Definition

BUILDING COMMISSIONING (C202)

“A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner’s project requirements and construction documents, and to minimum code requirements.”
2012 IECC Definition

BUILDING COMMISSIONING (C202)

“A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner’s project requirements and construction documents, and to minimum code requirements.”
2012 IECC Commissioning

• Mechanical
  • Commissioning Plan (C408.2.1)
    • Narrative
    • Equipment
    • Function to be tested
    • Conditions
2012 IECC / 202 Deliverables

C 408.2.1 Deliverables
Roles and Responsibilities

Owner Project Requirements

Cx Plan

Basis of Design

Cx Specification

Design Review Report

Submittal Review Report
2012 IECC Commissioning

- Mechanical
  - Threshold is 480 MBH cooling / 600 MBH heating
    - Excludes simple systems serving dwelling units
2012 IECC Commissioning

- Mechanical
  - Systems Adjusting and Balancing (C408.2.2)
    - Air
    - Hydronic
  - Functional Performance Testing (C408.2.3)
    - Equipment
    - Controls
    - Economizer
- Preliminary Commissioning Report (C408.2.4)
  - Acceptance of Report
  - Copy of Report
2012 IECC / 202 Deliverables

C 408.2.2 and C408.2.3 Deliverables

Construction checklist and reports

Issues and resolution logs
2012 IECC Commissioning

• Mechanical
  • Preliminary Commissioning Report (C408.2.4)
    • Acceptance of Report
    • Copy of Report
  • Documentation Requirements (C408.2.5)
    • Construction documents
    • Manuals
    • System balancing report
    • Final Commissioning Report
2012 IECC / 202 Deliverables

C 408.2.4 and C408.2.5 Deliverables

Construction checklist and reports

Issues and resolution logs
2012 IECC Commissioning

• Mechanical
  • Documentation Requirements (C408.2.5)
    • Construction documents
    • Manuals
    • System balancing report
    • Final Commissioning Report
2012 IECC / 202 Deliverables

C 408.2.5 Deliverables
Systems Manuals
2012 IECC Commissioning

• Lighting
  • Lighting System Functional Testing (C408.3)
    • Functional testing requirement
    • Construction document requirement
    • Report requirement is at the discretion of the code official
2015 IECC Commissioning

• Mechanical
  • Threshold is 480 MBH cooling / 600 MBH combined service water-heating and space-heating
2015 IECC Commissioning

• Lighting
  • Lighting System Functional Testing (C408.3)
    • Prescriptive functional testing requirements added
      • Occupant sensor controls
      • Time-switch controls
      • Daylight responsive controls
2018 IECC Commissioning

• General
  • Operations and maintenance manuals
2018 IECC Commissioning

• Lighting
  • Lighting System Functional Testing (C408.3)
    • Prescriptive functional testing for required automatic controls
    • Construction document requirements added
    • Operating manual requirements added
    • Report of functional testing requirement added
IECC “Commissioning”

- Air Leakage Test (Optional)
  - ASTM E 779 (C402.4.1.2.3)
- Service Water Heating
  - Recirculation Pumps
2010 90.1 Commissioning

- Mechanical
  - Completion requirements
    - Record drawings
    - Manuals
- System balancing
  - Commissioning (6.7.2.4)
    - Controls testing and calibration
    - Final Commissioning Report
2010 90.1 Commissioning

• Lighting
  • Lighting System Functional Testing (9.4.4)
    • Functional testing requirement
    • Construction document requirement
    • Report requirement is at the discretion of the code official
2013 90.1 Commissioning

• Lighting
  • Lighting System Functional Testing (9.4.3)
    • Prescriptive functional testing specific requirements added
      • Occupant sensor controls
      • Time-switch controls
      • Daylight responsive controls
      • Independent testing
2016 90.1 Commissioning

• Building Thermal Envelope
  • Air leakage verification (5.9.2.1)
    • Design review required
    • Nonconformity list generated
International Green Construction Code (IgCC) and ASHRAE 189.1
901.1 Scope.

The provisions of chapter 9 are intended to facilitate pre- and post-occupancy commissioning, operation and maintenance of buildings and structures.

902.1 Approved agency.

An approved agency shall provide all of the information necessary for the code official to determine that the agency meets the applicable requirements.

The code official shall be permitted to be the approved agency.
902.1.1 Independence.

- An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected.
- An approved agency shall have adequate equipment to perform the required commissioning.
- An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and commissioning.
903.1 General.

The registered design professional in responsible charge or approved agency shall perform commissioning during construction and after occupancy as required by Table 903.1.

The approved agency shall be qualified and shall demonstrate competence, to the satisfaction of the code official.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as the approved agency.
903.1.1 Preoccupancy report requirement.

- The approved agency shall keep records of the commissioning required by Table 903.1. The approved agency shall furnish commissioning reports to the owner and the registered design professional in responsible charge and, upon request, to the code official.
- Prior to the issuance of a Certificate of Occupancy, a final commissioning report shall be submitted to and accepted by the code official.

903.1.2 Post-occupancy report requirement.

- Post-occupancy commissioning shall occur as specified in the applicable sections of this code. A post-occupancy commissioning report shall be provided to the owner within 30 months after the Certificate of Occupancy is issued for the project and shall be made available to the code official upon request.
Commissioning IgCC

- Chapter 9 – Table 903.1
  - Site Development and Land Use
  - Material Resource and Efficiency
  - Energy (chapter 6)
  - Lighting
  - Water Resource Conservation, Quality, & Efficiency
  - Indoor Environmental Quality & Comfort

- Re-Commissioning (Post Occupancy)
  - Required within 30 months of occupancy
  - Report is provided to the owner with no action required by the code official
904.1 General.

- Building operations and maintenance documents in accordance with Section 904.3 shall be submitted to the owner prior to the issuance of the Certificate of Occupancy.
- The building owner shall file a letter with the code official certifying the receipt of record documents and building operations and maintenance documents.

904.2 Record documents. Record documents shall include all of the following:

1. Copies of the approved construction documents, including plans and specifications.
2. As-built plans and specifications indicating the actual locations of
904.2 Record documents.

3. For sites that have previously been copies of engineering and institutional control information shall be provided.


904.3 Building operations and maintenance documents.

The building O&M documents shall consist of:

The manufacturer’s specifications and recommendations,

Programming procedures illustrating to the owner how the building, site and systems are intended to be maintained and operated.

The information listed in items 1-6 of this section shall be included in the materials, as applicable to the specific project:
2012 IgCC Commissioning

CH. 6 ENERGY SYSTEMS COMMISSIONING AND COMPLETION

All of the following items are consistent with ‘15 IECC except post-occupancy recommissioning

- 611.1 Mechanical systems commissioning
- 611.1.1 Commissioning plan.
- 611.1.2 Systems adjusting and balancing.
- 611.1.3 Functional performance testing.
- 611.1.4 Preliminary commissioning report.
- 611.1.5 Completion requirements.
- 611.1.5.4 Final commissioning report.
- 611.1.5.5 Post-occupancy recommissioning.
2012 IgCC Commissioning

- Energy Systems Commissioning (611)
  - Mandatory
    - Mechanical
    - Lighting
    - Mandatory building thermal envelope air tightness test (605.1.2)
2015 IgCC Commissioning

- Energy Systems Commissioning (611)
  - Mandatory
    - Mechanical
    - Lighting
    - Mandatory building thermal envelope air tightness test
    - Domestic hot water equipment and systems
10.1 Scope.
- This section specifies requirements for construction and plans for operation, including the commissioning process.

10.3 Mandatory Provisions
10.3.1 Construction
10.3.1.1 Building Acceptance Testing.
- Acceptance testing shall be performed on all buildings using generally accepted engineering standards and handbooks acceptable to the AHJ.
- An acceptance testing process shall be incorporated into the design and construction of the building project.
2011 189.1 Commissioning

• Energy Systems Commissioning (10.3)
  • Mandatory
    • Acceptance testing (10.3.1.1)
      • Mechanical systems
      • Lighting systems
      • Fenestration control systems
      • Renewable energy systems
      • Water measuring devices
      • Energy measuring devices
    • Building Commissioning (10.3.1.2)
2011 189.1 Commissioning

• Energy Systems Commissioning (10.3)
  • Mandatory
    • Acceptance testing (10.3.1.1)
      • Mechanical systems
      • Lighting systems
      • Fenestration control systems
      • Renewable energy systems
      • Water measuring devices
      • Energy measuring devices
  • Building Commissioning (10.3.1.2)
    • OPR
    • BOD
2014 189.1 Commissioning

• Energy Systems Commissioning (10.3)
  • Mandatory
    • Acceptance testing (10.3.1.1)
      • Mechanical systems
      • Lighting systems
      • Fenestration control systems
      • Renewable energy systems
      • Water measuring devices
      • Energy measuring devices
  • Building Commissioning (10.3.1.2)
    • OPR
    • BOD
Commissioning
ASHRAE 2011 Standard 189.1
Building Project Commissioning – Section 10

- Buildings exceeding 5000 ft\(^2\) of gross floor area
  a. Mech systems: HVAC, IAQ, and refrigeration systems
  b. Lighting systems: daylighting controls, occupancy sensing devices, and, automatic shut-off controls
  d. Renewable energy systems.
  e. Water measurement devices
  f. Energy measurement devices

- Re-Commissioning (Post Occupancy)
10.3.1.2 Building Project Commissioning.

- Buildings that exceed 5000 ft² (500 m²), commissioning shall be performed using generally accepted engineering standards.
- Buildings complying with commissioning process will be deemed to comply with the requirements “Building Acceptance Testing.”
- A commissioning process shall be incorporated into the predesign, design, construction, and first year occupancy of the building project that verifies that the components, assemblies, and systems comply with the documented OPR.
- Procedures, documentation, tools, and training shall be provided to the building operating staff.
10.3.1.2.1 Activities Prior to Building Permit.

- Designate a project commissioning authority (CxA)
- The owner, in conjunction with the design team as necessary, shall develop the OPR during predesign.
- The design team shall develop the BOD.
- The CxA shall review both the OPR and BOD.
- Construction phase commissioning requirements shall be incorporated into project specifications and other construction documents developed by the design team.
- The CxA shall conduct two focused OPR reviews
- Develop and implement a commissioning plan containing
10.3.1.2.2 Activities Prior to Building Occupancy.

- Verify the installation and performance of the systems to be commissioned, including completion of the construction checklist and verification.
  - Exception to 10.3.1.2.2(a): Systems that, because their operation is seasonally dependent,
    - It shall be verified that the owner requirements for the training of operating personnel and building occupants is completed.
    - Complete preliminary commissioning report.
    - Verify a system manual has been prepared that includes O&M documentation.
10.3.1.2.3 Post-Occupancy Activities.
- Complete any commissioning activities called out in the commissioning plan.
- Verify the owner requirements for training operating personnel and building occupants are completed.
- Complete a final commissioning report.

10.3.1.2.4 Systems. The following systems, if included in the building project, shall be commissioned:
- Heating, ventilating, air-conditioning, IAQ, and refrigeration systems (mechanical and/or passive) and associated controls.
- Building envelope systems, components, and assemblies to verify the thermal and moisture integrity.
10.3.1.2.4 Systems cont’d

- Building envelope pressurization for air-tightness
- Lighting systems.
- Automatic controls for fenestration shading devices and dynamic glazing.
- Service water heating systems, Irrigation and plumbing
- Domestic and process water pumping and mixing systems.
- Renewable energy systems.
- Water measurement devices, as required in Section 6.3.3.
- Energy measurement devices, as required in Section 7.3.3.

10.3.1.2.5 Documentation. Owner shall retain the System Manual and Final Commissioning Report.
2018 IgCC Commissioning

• Functional Performance Testing
• Commissioning references ASHRAE 202
Summary

- Commissioning Process
  - IECC/90.1
    - Prescriptive
    - No referenced standards
  - IGCC/189.1
    - Prescriptive
    - Larger scope
    - No referenced standards
    - Prescriptive
    - References ASHRAE 202
Questions & Answers

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