

CHAPTER 9

COMMISSIONING, OPERATION AND MAINTENANCE

*THIS CHAPTER IS PROVIDED FOR REFERENCE ONLY.
IT IS NOT ADOPTED AS A REQUIREMENT OF THE CODE.*

SECTION 901 GENERAL

901.1 Scope. The provisions of this chapter are intended to facilitate the acceptance testing, pre- and post-occupancy *commissioning*, operation and maintenance of *buildings* constructed in accordance with this code in a manner that is consistent with the intent of other provisions of this code, and to further that goal through the education of *building* owners and maintenance personnel with regard to related best operating and management practices.

SECTION 902 APPROVED AGENCY

902.1 Approved entity. An *approved entity* 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 entity*.

902.1.1 Independence. An *approved entity* shall be objective, competent and independent from the contractor responsible for the work being inspected. The entity shall also disclose possible conflicts of interest so that objectivity can be confirmed.

902.1.2 Equipment. An *approved entity* shall have adequate equipment to perform the required *commissioning*. The equipment shall be periodically calibrated.

902.1.3 Personnel. An *approved entity* shall employ experienced personnel educated in conducting, supervising and evaluating functional tests and *commissioning*.

SECTION 903 COMMISSIONING

903.1 General. Where application is made for construction as described in this section, the *registered design professional in responsible charge* or *approved entity* shall perform *commissioning* during construction and after occupancy as required by Table 903.1. Where Table 903.1 specifies that *commissioning* is to be done on a periodic basis, the *registered design professional in responsible charge* shall provide a schedule of periodic *commissioning* with the submittal documents that shall be reviewed and *approved* by the *code official*.

The *approved entity* shall be qualified and shall demonstrate competence, to the satisfaction of the *code official*, for the *commissioning* of the particular type of construction or operation. 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 entity* provided those personnel meet the qualification requirements of this section to the satisfaction of the *code official*. The *approved entity* shall pro-

vide written documentation to the *code official* demonstrating competence and relevant experience or training. Experience or training shall be considered relevant where the documented experience or training is related in complexity to the same type of *commissioning* activities for projects of similar complexity and material qualities.

903.1.1 Pre-occupancy report requirement. The *approved entity* shall keep records of the *commissioning* required by Table 903.1. The *approved entity* shall furnish *commissioning* reports to the owner and the *registered design professional in responsible charge* and, upon request, to the *code official*. Reports shall indicate that work was or was not completed in conformance to *approved construction documents*. Discrepancies shall be brought to the immediate attention of the contractor for correction. Where discrepancies are not corrected, they shall be brought to the attention of the owner, *code official* and to the *registered design professional in responsible charge* prior to the completion of that phase of the work. 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.

SECTION 904 BUILDING OPERATIONS, MAINTENANCE AND OWNER EDUCATION

904.1 General. The operations and maintenance and *building* owner education documents shall be in accordance with Sections 904.3 and 904.4 and submitted to the owner prior to the issuance of the certificate of occupancy. Record documents shall be in accordance with Section 904.2. The *building* owner shall file a letter with the *code official* certifying the receipt of record documents and *building* owner education, operations and maintenance documents. At least one copy of these materials shall be in the possession of the owner and at least one additional copy shall remain with the *building* throughout the life of the *structure*.

904.1.1 Owner responsibility. *Buildings* built under this code shall be maintained and operated at the level of performance required by the *approved* documents.

904.1.1.1 Periodic reporting. Where required by Table 303.1, a report confirming that the *building* is maintained and operated at the level of performance required by the *approved* documents shall be submitted to the *code official* at approved intervals.

**TABLE 903.1
COMMISSIONING PLAN**

| CONSTRUCTION OR SYSTEM REQUIRING VERIFICATION | PRE-OCC. | POST-OCC. | METHOD | OCCURRENCE | | SECTION/ REF. STD. |
|---|----------|-----------|---|---|------------------------|---|
| | | | | Pre-Occ. | Post-Occ. | |
| Chapter 4: Site development and land use | | | | | | |
| Natural resources and base line conditions of <i>building site</i> | X | None | Report | With <i>permit</i> submittal | None | 402.3.1 |
| Landscape irrigation systems | X | None | Field inspection | Installation | None | 402.3.3 406.6 |
| <i>Topsoil</i> and vegetation protection measures; setbacks from protected areas | X | None | Field inspection and report | Installation of measures, prior to other site disturbance | None | 402.3 |
| Imported soils | X | None | Field inspection and report | With <i>permit</i> submittal; After all fill operations complete. | None | 402.3.5.5 |
| Soil restoration and reuse | X | None | Field inspection and report | Preparation and replacement of soils | None | 402.3.5.4 |
| Soil percolation test | X | None | Field inspection and report | Prior to installation of <i>gray water</i> irrigation system | None | 406.2.2 |
| Storm water management system operation | None | X | Field inspection | Installation | 24 months | 402.3.2 |
| Erosion and sediment control | X | X | Field inspection | During construction activities | Periodic for 24 months | 402.3.6 |
| Hardscape and shading provided by structures and vegetation | X | X | Field inspection and report | During construction and installation | 24 months | 404.2 |
| Vegetative roofs and terraces | X | X | Field inspection and report | Installation of protective membranes, base materials, soils and vegetation | 24 months | 404.3.2 |
| Site lighting | X | None | Testing and report | Installation | None | 405 |
| Chapter 5: Materials | | | | | | |
| Moisture control (Section 506.3) | | | | | | |
| a. Foundation sub-soil drainage system. | X | None | Field inspection and verification | Periodic inspection for entire sub-soil drainage system. | None | 506.3 and IBC Ch 18 |
| b. Foundation damp-proofing and water-proofing. | X | None | Field inspection and verification | Periodic inspection for the entire foundation. | None | 506.3 and IBC Ch 18 |
| c. Flashing at: Windows, exterior doors, skylights, wall flashing and drainage systems. | X | None | Field inspection and verification | Periodic inspection for not less than a percentage determined by design professional in responsible charge of all flashing locations. | None | 506.3 and IBC Ch 14 |
| d. Exterior wall coverings. | X | None | Field inspection and verification | Periodic inspection for not less than 25% of exterior wall cladding systems. | None | 506.3 and IBC Ch 14 |
| Chapter 6: Energy | | | | | | |
| Energy consumption, monitoring, targeting and reporting | | | | | | |
| a. Monitoring system | X | None | Inspection and verification | During construction and prior to occupancy | None | 604 |
| b. Calibration | X | X | Testing and review and evaluation or test reports | During commissioning | Annually | 604, 611 |
| Mechanical system completion— all buildings | | | | | | |
| a. Air system balancing—provide the means for system balancing | X | None | Inspection and verification | During construction and prior to occupancy | None | 612.1.2.1 and through reference to IECC |
| b. Hydronic system balancing—provide means for system balancing | X | None | Inspection and verification | During construction and prior to occupancy | None | 612.1.2.2 and through reference to IECC |
| c. Duct system testing | X | None | Testing, testing report and verification of results | During construction and/or at final inspection. | None | 613.5.3 and through reference to the IECC |
| d. Mechanical system manuals – construction documents to require O&M manual | X | None | Verification of construction documents | Plan review | None | 612.1.5.2 |

continued

TABLE 903.1—continued
COMMISSIONING PLAN

| CONSTRUCTION OR SYSTEM REQUIRING VERIFICATION | PRE-OCC. | POST-OCC. | METHOD | OCCURRENCE | | SECTION/ REF. STD. |
|--|----------|-----------|---|---|--|--------------------|
| | | | | Pre-Occ. | Post-Occ. | |
| Chapter 6: Energy—continued | | | | | | |
| Mechanical systems—buildings over 5,000 square feet total building floor area | | | | | | |
| a. Commissioning required and noted in plans and specifications | X | None | Verification of construction documents | Plan review | None | 612.1 |
| b. Documentation of required commissioning outcomes | X | None | Verification with the building owner | Subsequent to completion of all commissioning activities | None | 612.1 |
| c. Preparation and availability of a commissioning plan | X | None | Verification with the RDP or commissioning agent | Between plan review and commissioning initiation | None | 612.1.1 |
| d. Balance HVAC systems (both air and hydronic) | X | X | HVAC system installer/contractor or commissioning agent | After installation of HVAC systems and prior to occupancy | TBD | 612.1.2 |
| e. Functional performance testing of HVAC equipment | X | X | HVAC system installer/contractor or commissioning agent | After installation of HVAC systems and prior to occupancy | TBD | 612.1.3 |
| f. Functional performance testing of HVAC controls and control systems | X | X | HVAC system installer/contractor or commissioning agent | After installation of HVAC systems and prior to occupancy | TBD | 612.1.3.2 |
| g. Preparation of preliminary commissioning report | None | X | HVAC system installer/contractor or commissioning agent | None | Subsequent to commissioning | 612.1.4 |
| h. Acceptance of HVAC systems and equipment/system verification report | None | X | Building owner | None | Letter verifying receipt of the commissioning report | 612.1.4.1 |
| i. Preparation and distribution of final HVAC system completion— Documentation that construction documents, required drawings, manuals, balancing reports and commissioning report have been provided to the owner | None | X | RDP, contractor or commissioning authority | None | 90 days after final certificate of occupancy | 612.1.5 |
| Ch 6: Lighting | | | | | | |
| Auto demand reduction control system functionality | X | X | Functional testing | Final inspection | 18-24 months | 605.4 |
| Plug load controls | X | None | Functional testing | Final inspection | None | 609.6 |
| Connection of appliances to switched receptacles | | X | Field inspection | None | 18-24 months | 609.6 |
| Specified transformer nameplate efficiency rating | X | None | Field inspection | Final inspection | None | 609.8.1.1 |
| Verification of lamp | X | X | Field inspection | Final inspection | 18-24 months | 609.10 |
| Verification of ballast | X | None | Field inspection | Final inspection | None | 609.10 |
| Lighting controls | | | | | | |
| a. Installation | X | None | Field inspection | Post-installation | None | 609.11 |
| b. Calibration | X | X | System installer/contractor or commissioning agent | Post-installation | 18-24 months | 612.2 |

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TABLE 903.1—continued
COMMISSIONING PLAN

| CONSTRUCTION OR SYSTEM REQUIRING VERIFICATION | PRE-OCC. | POST-OCC. | METHOD | OCCURRENCE | | SECTION/ REF. STD. |
|--|----------|-----------|-----------------------------------|--|----------------|--------------------|
| | | | | Pre-Occ. | Post-Occ. | |
| Chapter 7: Water | | | | | | |
| Water Quality Tests | | | | | | |
| Rainwater system | | X | Field testing and verification | None | 707.16.1 | 707.16.1 |
| Graywater system | | X | Field testing and verification | None | 708.13.8 | 708.13.8 |
| Chapter 8: IEQ | | | | | | |
| Building construction, features, operations and maintenance facilitation | | | | | | |
| Air handling system access | X | X | Field inspection and verification | During construction and prior to occupancy | 18 - 24 months | 802.2 |
| Air handling system filters | X | X | Field inspection and verification | During construction and prior to occupancy | 18 - 24 months | 802.4 |
| HVAC systems | | | | | | |
| Temperature and humidity in occupied spaces | | X | Field inspection and verification | | 18 - 24 months | 803.2 |
| Specific indoor air quality & pollutant control measures | | | | | | |
| Listing, installation and venting of fireplaces and combustion appliances | X | | Field inspection and verification | During construction and prior to occupancy | | 804.1 |
| Radon mitigation | X | | Field inspection and verification | During construction and prior to occupancy | | 804.2 |
| Sound Transmission | | | | | | |
| Mechanical and emergency generator equipment located outside buildings or located where exposed to exterior environment. | X | None | Field testing and verification | See Section 807.5.1 | None | 807.5.1 |
| HVAC background sound | X | None | Field testing and verification | See Section 807.5.2 | None | 807.5.2 |

904.2 Record documents. The cover sheet of the record documents for the project shall clearly indicate that at least one copy of the materials shall be in the possession of the owner and at least one additional copy shall remain with the *building* throughout the life of the *structure*. 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 piping, ductwork, valves, controls, equipment, access panels, lighting and other similar components where they are concealed or are installed in locations other than those indicated on the *approved construction documents*.
3. A copy of the certificate of occupancy.

904.3 Building operations and maintenance documents. The *building* operations and maintenance documents shall consist of manufacturer’s specifications and recommendations, programming procedures and data points, narratives and other means of illustrating to the owner how the *building*, site and systems are intended to be maintained and operated. The following information shall be included in the materials, as applicable to the specific project:

1. Directions to the owner or occupant on the manual cover sheet indicating that at least one copy of the materials

shall be in the possession of the owner or occupant and at least one additional copy shall remain with the *building*.

2. Operations and maintenance manuals for equipment, products and systems installed under or related to the provisions of Chapter 4 including, but not limited to, the following, as applicable:
 - 2.1. Vegetative shading, vegetative roofs and natural resource protections and setbacks.
 - 2.2. Water-conserving landscape and irrigation systems.
 - a. Storm water management systems.
 - b. Permanent erosion control measures.
 - c. Landscape or tree management plans.
3. Operations and maintenance documents for materials, products, assemblies and systems installed under or related to the provisions of this code for material resource conservation in accordance with Chapter 5 including, but not limited to, the following, as applicable:
 - 3.1. Care and maintenance instructions and recommended replacement schedule for flooring including, but not limited to, carpeting, walk-off mats and tile.

- 3.2. Care and maintenance instructions for natural materials including, but not limited to, wood, *bio-based materials* and stone.
 - 3.3. Available manufacturers' instructions on maintenance for:
 - 3.3.1. Exterior wall finishes.
 - 3.3.2. *Roof coverings*.
 - 3.3.3. Exterior doors, windows and *skylights*.
 - 3.4. Information and recommended schedule for required routine maintenance measures including, but not limited to, painting and refinishing.
 - 3.5. A copy of the service life plan required by Chapter 5.
4. Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for energy conservation in accordance with Chapter 6 including, but not limited to, the following:
- 4.1. Heating, ventilating and air conditioning systems, including:
 - 4.1.1. Recommended equipment maintenance schedule.
 - 4.1.2. Air filters and fluid filters, including recommended replacement schedule and materials.
 - 4.1.3. Time clocks, including settings determined during *commissioning*.
 - 4.1.4. Programmable controls and thermostats, including settings determined during *commissioning*.
 - 4.2. Domestic hot water systems, including performance criteria and controls.
 - 4.3. *Building thermal envelope* systems, including:
 - 4.3.1. Glazing systems inspection schedule.
 - 4.3.2. Performance criteria for replacements and *repairs*.
 - 4.3.3. Information and recommended schedule on required routine maintenance measures including, but not limited to, sealants, mortar joints and screens.
 - 4.4. Electrical and lighting systems, including:
 - 4.4.1. Technical specifications and operating instructions for installed lighting equipment.
 - 4.4.2. Luminaire maintenance and cleaning plan.
 - 4.4.3. Lamp schedule, recommended relamping plan and lamp disposal information.
 - 4.4.4. Programmable and automatic controls documentation, including settings determined during *commissioning*.
 - 4.4.5. Occupant sensor and daylight sensors documentation, including settings determined during *commissioning*.
 - 4.5. Automatic demand reduction systems.
5. Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for water conservation in accordance with Chapter 7 including, but not limited to, the following:
- 5.1. Domestic fixtures.
 - 5.2. Water regulating devices, including faucets and valves.
 - 5.3. Irrigation and *rainwater* and *gray water* catchment.
6. Operations *and* maintenance *documents* for equipment products and systems under or related to the provisions of this code for indoor environmental quality in accordance with Chapter 8 including, but not limited to, the following:
- 6.1. Humidification/dehumidification.
 - 6.2. Green cleaning products, procedures and techniques.
 - 6.3. Recommended window cleaning schedule.
 - 6.4. *Ventilation* controls.
 - a. Floor finishes.
 - b. Fireplaces and combustion appliances.
 - c. Radon mitigation system.
 - d. Indoor plants.
- 904.4 Building owner education manual.** The owner shall cause to be assembled an informational document on the *building*, site or *structure* and systems and sustainable features that are covered by this code and included in the *building*. Such information shall be educational in nature and sufficient for future tenants, owners and operators of the *building*, *building site*, *structure* and systems to understand the basic purpose and basis for these systems and features and how they are to be maintained for continued performance. The education documents shall consist of a statement of performance goals or requirements and a narrative illustrating the reasoning behind the *building's* site, features and systems design. One copy of the owner education manual shall be in the possession of the owner and one additional copy shall remain with the *building* throughout the life of the *structure*.

