

GEW142-14

611.1 611.1.1, 611.1.2, 611.1.2.1, 611.1.2.2, 611.1.3, 611.1.3.1, 611.1.3.2, 611.1.3.3, 611.1.4, 611.1.4.1, 611.1.4.2, 611.1.4.3, 611.1.5, 611.1.5.1, 611.1.5.2, 611.1.5.3, 611.1.5.4, 611.1.5.5, 611.2, 611.3, 611.3.1, 611.3.2, 611.3.3, 611.3.3.1, 611.3.3.2, 611.3.3.3, 611.3.3.4, 611.3.4, 611.3.5, 611.4, 611.4.1, 611.4.2, 611.4.3 (New), 611.4.5 (New), 611.5 (New), 611.6 (New), 611.7 (New), 611.7.1 (New), 611.7.2 (New), 611.7.3 (New), 611.8 (New), 611.8.1 (New), 611.9 (New), 611.9.1 (New), 611.9.2 (New), 611.9.2.1 (New), 611.9.2.2 (New), 611.9.2.3 (New), 611.9.2.4 (New), 611.9.2.5 (New), 611.10 (New), 611.10.1 (New), 611.10.2 (New), 611.10.3 (New)

THIS CODE CHANGE PROPOSAL IS ON THE AGENDA OF THE IgCC GENERAL CODE DEVELOPMENT COMMITTEE. SEE THE HEARING ORDER FOR THE IgCC GENERAL CODE DEVELOPMENT COMMITTEE.

Proponent: Brenda Thompson, Chair, representing Sustainability, Energy, High Performance Code Action Committee (SEHPCAC@iccsafe.org)

Revise as follows:

611.1 Mechanical Systems commissioning and completion requirements. ~~Within 60 days from approval conducting the final mechanical inspection, the registered design professional~~ Prior to passing the final inspection, the registered design professional or approved agency shall provide to the code official evidence of mechanical systems commissioning and completion of the mechanical system commissioned building systems installation to the code official, in accordance with the International Energy Conservation Code and provisions of this code. A Final Commissioning Report and Systems Manual shall be provided before project completion. Drawing notes Construction documents shall clearly indicate provisions for commissioning and completion requirements in accordance with this section and Section 903, and are permitted to refer to specifications for further requirements. Construction documents shall list equipment and systems to be commissioned and include the location of, and performance data pertaining to, each piece of equipment and system. The construction documents shall specify that the documents prescribed in this section and Section 903 be provided to the building owner before project completion. Copies of all the documentation shall be given to the owner and made available to the code official upon request.

611.1.1 Commissioning plan. ~~A commissioning plan shall be developed by a registered design professional or approved agency and include as a minimum all of the following items:~~

- ~~1. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed.~~
- ~~2. Equipment and systems to be tested including, but not limited to, the specific equipment, appliances or systems to be tested and the number and extent of tests.~~
- ~~3. Functions to be tested including, but not limited to, calibrations and economizer controls.~~
- ~~4. Conditions under which the test shall be performed including, but not limited to, affirmation of winter and summer design conditions and full outside air.~~
- ~~5. Measurable criteria for performance.~~

611.1.2 Systems adjusting and balancing. ~~HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include, at a minimum, the provisions of Sections 611.1.2.1 and 611.1.2.2.~~

~~**611.1.2.1 Air systems balancing.** Each supply air outlet and zone terminal device shall be equipped with a means for air balancing in accordance with the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors of 10 hp (7.35 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (735 W), fan speed shall be adjusted to meet design flow conditions.~~

~~**Exception:** Fans with fan motor horsepower of 1 hp (735 W) or less.~~

~~**611.1.2.2 Hydronic systems balancing.** Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or shall have test ports at each side of each pump.~~

~~**Exceptions:**~~

- ~~1. Pumps with pump motors of 5 hp (3677 W) or less.~~
- ~~2. Where throttling results in not greater than 5 percent of the nameplate horsepower draw above that required if the impeller were trimmed.~~

~~**611.1.3 Functional performance testing.** Functional performance testing shall be in accordance with the requirements of Sections 611.1.3.1, 611.1.3.2 and 611.1.3.3.~~

~~**611.1.3.1 Equipment.** Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications so that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all specified modes of control and sequence of operation, including under full load, part load and all of the following emergency conditions:~~

- ~~1. Each mode as described in the sequence of operation.~~
- ~~2. Redundant or automatic backup mode.~~
- ~~3. Performance of alarms.~~
- ~~4. Mode of operation upon a loss of power and restoration of power.~~

~~**611.1.3.2 Controls.** HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operated in accordance with the approved plans and specifications. Sequences of operation shall be functionally tested to document that they operate in accordance with the approved plans and specifications.~~

~~**611.1.3.3 Economizers.** Air economizers shall undergo a functional test to determine that they operate in accordance with the manufacturer's specifications.~~

~~**611.1.4 Preliminary commissioning report.** A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or approved agency and provided to the building owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify all of the following:~~

- ~~1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.~~
- ~~2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.~~
- ~~3. Climatic conditions required for performance of the deferred tests.~~

611.1.4.1 Acceptance. Buildings, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the building owner acknowledging that the building owner has received the Preliminary Commissioning Report.

611.1.4.2 Copy. At the request of the *code official*, a copy of the Preliminary Commissioning Report shall be made available for review.

611.1.4.3 Certification. A certification, signed and sealed by the *registered design professional*, documenting that the mechanical and service water heating systems comply with Sections C403 and C404 of the *International Energy Conservation Code*, shall be provided to the *code official*.

611.1.5 Completion requirements The construction documents shall specify that the requirements described in this section be provided to the building owner within 90 days of the date of receipt of the certificate of occupancy.

611.1.5.1 Drawings. Construction documents shall include the location of and performance data pertaining to each piece of equipment.

611.1.5.2 Manuals. An operating and maintenance manual in accordance with industry-accepted standards shall be provided and shall include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the building project. Required routine maintenance shall be clearly identified.
3. Names and addresses of not less than one service agency.

A systems manual shall be provided and shall include all of the following:

1. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
2. A complete narrative of how each system is intended to operate, including recommended setpoints, seasonal changeover information and emergency shutdown operation.
3. Control sequence descriptions for lighting, domestic hot water heating and all renewable energy systems complete with a description of how these systems connect to, and are controlled in conjunction with, the overall building system.

611.1.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 611.1.2 shall be provided.

611.1.5.4 Final commissioning report. A complete report of test procedures and results identified as "Final Commissioning Report" shall be completed and provided to the building owner. The report shall include all of the following:

1. Results of all functional performance tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests that were not performed at the time of report preparation because of climatic conditions.

~~**611.1.5.5 Post-occupancy recommissioning.** The commissioning activities specified in Sections 611.1.2 through 611.1.5 shall be repeated 18 to 24 months after certificate of occupancy. Systems and control devices that are not functioning properly shall be repaired or replaced. Adjustments to calibration settings shall be documented. This documentation shall be provided to the building owner.~~

~~**611.2 Sequence of operation Commissioning plan.** A sequence of operation shall be developed and finalized upon commissioning, when the operational details are initialized and validated. A sequence of operation shall be the final record of system operation, and shall be included on the control diagram "as" or as part of the education and operation and maintenance document that is provided to the owner.~~

A commissioning plan shall be developed for the systems specified in the construction documents to be commissioned by a registered design professional or approved agency and shall be assembled in accordance with Section 903.3.

~~**611.3 Lighting and electrical systems commissioning and completion requirements. Functional and performance testing.** Prior to issuance of a certificate of occupancy, the *registered design professional* shall provide evidence of lighting and electrical systems commissioning and completion in accordance with the *International Energy Conservation Code* and the provisions of this section.~~

~~Drawing notes shall specify the provisions for commissioning and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections 611.2.4 and 611.2.5~~

Functional and performance testing shall be performed in accordance with the requirements of Sections 611.3.1, 611.3.2 and 611.3.3.

~~**611.3.1 Preconstruction documentation, lighting. Equipment.** Construction and owner education documents shall include floor plans, diagrams and notations of sufficient clarity describing the types of, location and operational requirements of all lighting controls including a sequence of operation and preliminary intended setpoints for all dimming systems and automatic *daylight controls*, demonstrating conformance to the provisions of this code, relevant laws, ordinances, rules and regulations, as *approved by the code official*.~~

Equipment functional and performance testing shall demonstrate that the installation and operation of components, systems, and system-to-system interfacing relationships is in accordance with *approved plans and specifications* so that operation, function, performance and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all specified modes of control and sequence of operation, including under full-load, part-load and all of the following emergency conditions:

1. Each mode as described in the sequence of operation.
2. Redundant or automatic backup mode.
3. Performance of alarms.
4. Mode of operation upon a loss of power and restoration of power.

~~**611.3.2 Verification. Controls.** The approved agency conducting commissioning shall verify that controls have been installed in accordance with the *approved construction documents*. Any discrepancies shall be reviewed for compliance with Section 608 and the requirements of Section C405.2 of the *International Energy Conservation Code*.~~

Control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operated in accordance with the *approved plans and specifications*.

611.3.3 Commissioning—Sequence of operation. ~~Lighting controls shall be commissioned in accordance with this section. The sequence of operation shall be verified to document that the sequence operates in accordance with the approved plans and specifications. This verified sequence of operation shall be the final record of system operation, and shall be included on the control “record documents,” and as part of the education and Systems Manual operation and maintenance document that is provided to the owner.~~

611.3.3.1 Occupant sensors. ~~It shall be verified that the functional testing in accordance with Section C405.2 of the *International Energy Conservation Code* has been performed.~~

611.3.3.2 Automatic daylight controls. ~~Automatic daylight controls shall be commissioned in accordance with all of the following:~~

- ~~1. It shall be verified that the placement and orientation of each sensor is consistent with the manufacturer’s instructions. If not, the sensor shall be relocated or replaced.~~
- ~~2. Control systems shall be initially calibrated to meet settings and design intent established in the construction documents.~~
- ~~3. Prior to calibration of systems controlling dimmable luminaires, all lamps shall be seasoned in accordance with the recommendations of the lamp manufacturer.~~
- ~~4. Where located inside buildings, calibration of open-loop daylight controls, which receive illumination from natural light only, shall not occur until fenestration shading devices such as blinds or shades have been installed and commissioned.~~
- ~~5. Calibration of closed-loop daylight controls, that receive illumination from both natural and artificial light, shall not occur until furniture systems and interior finishes have been installed, and any fenestration shading devices such as blinds or shades have been installed and commissioned.~~
- ~~6. Calibration procedures shall be in accordance with the manufacturer’s instructions.~~

611.3.3.3 Time switch and programmable schedule controls. ~~Lighting controls installed in accordance with Section 608 shall be programmed. Scheduling shall incorporate weekday, weekend and holiday operating times, including leap year and daylight savings time corrections. It shall be verified that system overrides work and are located in compliance with Section C405.2 of the *International Energy Conservation Code*.~~

611.3.3.4 Dimming systems with preset scenes. ~~For programmable dimming systems, it shall be verified that automatic shutoff and manual overrides are working and that programming is complete. Prior to programming, the lamps shall be seasoned in accordance with NEMA LSD 23.~~

611.3.4 Post-commissioning documentation. ~~The following documentation shall be provided to the building owner in accordance with Section 903.~~

- ~~1. Settings determined during commissioning activities outlined in Section 611.3.3.~~
- ~~2. A narrative describing the intent and functionality of all controls including any capability for users to override a schedule or master command.~~
- ~~3. Specification sheets for all lighting equipment and controls.~~
- ~~4. Operation manuals for each lighting control device. Required maintenance and maintenance schedules shall be clearly identified. Documentation and instructions necessary for building maintenance personnel to maintain and recalibrate lighting systems and controls.~~
- ~~5. An annual inspection schedule for lighting controls.~~
- ~~6. Troubleshooting information for fluorescent dimming systems and the remediation of switching issues such as false-ons and false-offs.~~

611.3.5 Post-occupancy recommissioning. ~~The commissioning activities in Section 611.3.3 shall be repeated 18 to 24 months after issuance of the certificate of occupancy. Control devices that are not functioning properly shall be repaired or replaced. Adjustments to calibration settings shall be documented. This documentation shall be provided to the building owner.~~

611.4 Building envelope systems commissioning and completion requirements. Pre-certificate of occupancy commissioning report. ~~Prior to issuance of a certificate of occupancy, the registered design professional shall provide evidence of building thermal envelope systems commissioning and completion to the building owner in accordance with the International Energy Conservation Code and the provisions of this section.~~

~~Construction documents shall specify the provisions for commissioning and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the building owner and made available to the code official upon request in accordance with Sections 611.4.1 and 611.4.2.~~

A pre-certificate of occupancy report of commissioning test procedures and results shall be completed and certified by the registered design professional or approved agency and shall be provided to the building owner prior to final inspection. The report shall be identified as "Pre-Certificate of Occupancy Commissioning Report" and shall be assembled in accordance with Section 903.4.1

611.4.1 Preconstruction documentation, building thermal envelope. Acceptance. ~~Construction and owner education documents shall indicate the location, nature and extent of the work proposed and show the functional requirements and operation of all building thermal envelope systems demonstrating conformance to the provisions of this code, relevant laws, ordinances, rules and regulations, as approved by the code official.~~

Buildings, or portions thereof, shall not pass the final mechanical inspection until such time as the code official has received a letter of transmittal from the building owner acknowledging that the building owner has received the Pre-Certificate of Occupancy Commissioning Report.

611.4.2 Verification Copy available for review. ~~The approved agency conducting commissioning shall verify that building thermal envelope systems have been installed in accordance with the approved construction documents. Any discrepancies shall be reviewed for compliance with requirements of the International Energy Conservation Code and this code.~~

At the request of the code official, a copy of the Pre-Certificate of Occupancy Commissioning Report shall be made available for review.

611.4.3 Verification. The approved agency conducting commissioning shall verify that commissioned systems have been installed and perform in accordance with the approved construction documents. Any discrepancies shall be reviewed for compliance with requirements of the International Energy Conservation Code and this code.

611.4.5 Manuals A Systems Manual assembled in accordance with industry-accepted standards and Section 903.6.1 shall be provided to the owner before project completion.

611.5 Final Commissioning Report. A complete report of accomplishment of the commissioning plan including test procedures and results identified as "Final Commissioning Report" shall be completed in accordance with Section 903.5.1 before project completion and shall be provided to the building owner.

611.6 Commissioning completion. The commissioning activities specified in the commissioning plan including delayed testing shall be completed and documented before project completion. Equipment and systems repaired or replaced and adjustments to set-points and calibration settings shall be documented in the record sequence of operation and in Systems Manual updates. These documentations shall be provided to the building owner.

611.7 HVAC commissioning. HVAC equipment and systems shall be commissioned in accordance with the IECC and this section using recognized commissioning standards, as approved.

611.7.1 Mechanical systems adjusting and balancing. HVAC systems shall be tested, adjusted and balanced in accordance with generally accepted standards, as approved. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the construction documents. Test and balance activities shall include the provisions of Section C408.2.2 of the *International Energy Conservation Code* except that the exceptions to Section C408.2.2 shall not apply. A written report describing the test and balance activities and measurements completed shall be provided with the final Systems Manual.

611.7.2 HVAC system operations. HVAC equipment and systems commissioning shall include testing and balancing verification including adjustment of temperatures, flows, and sequence of operation.

611.7.3 HVAC economizers. Air and water economizers shall undergo a functional test to determine that they operate in accordance with the manufacturer's specifications and perform to project requirements.

611.8 Domestic hot water system commissioning. Domestic hot water equipment and systems shall be commissioned in accordance with this section and the construction documents.

611.8.1 Domestic hot water system operations. Domestic hot water equipment and systems commissioning shall include verification and adjustment of temperatures, flows, and sequence of operation.

611.9 Lighting and electrical systems commissioning. Lighting, lighting controls, plug load controls and electrical systems commissioning shall be completed in accordance with the *International Energy Conservation Code* and the provisions of this section.

611.9.1 Preconstruction documentation, lighting. Construction and owner education documents shall include floor plans, diagrams and notations of sufficient clarity describing the types of, and location and operational requirements of the lighting controls including a sequence of operation, schedules and preliminary intended set-points for area controls, dimming systems and automatic daylight controls, demonstrating conformance to the provisions of the construction documents and this code, as approved by the code official.

611.9.2 Lighting controls commissioning. Lighting controls shall be commissioned in accordance with this section.

611.9.2.1 Occupant sensors. It shall be verified that the functional testing in accordance with Section C405.2 of the *International Energy Conservation Code* has been performed.

611.9.2.2 Automatic daylight controls. Automatic daylight controls shall be commissioned in accordance with all of the following:

1. It shall be verified that the placement and orientation of each sensor is consistent with the manufacturer's and designer's instructions. If not, the sensor shall be relocated or replaced.
2. Control systems shall be initially calibrated to meet settings and design intent established in the construction documents.
3. Prior to calibration of systems controlling dimmable luminaires, the lamps shall be seasoned in accordance with the recommendations of the lamp manufacturer in accordance with NEMA LSD 23.
4. Where located inside buildings, calibration of open-loop daylight controls, that receive illumination from natural light only, shall not occur until fenestration shading devices such as blinds or shades have been installed and commissioned.

5. Calibration of closed-loop daylight controls, that receive illumination from both natural and artificial light, shall not occur until furniture systems and interior finishes have been installed, and any fenestration shading devices such as blinds or shades have been installed and commissioned.
6. Calibration procedures shall be in accordance with the manufacturer's instructions.

611.9.2.3 Time switch and programmable schedule controls. Lighting controls installed in accordance with Section 608 shall be programmed and commissioned. Scheduling shall incorporate weekday, weekend and holiday operating times, including leap year and daylight savings time corrections. It shall be verified that system overrides work and are located in compliance with Section C405.2 of the International Energy Conservation Code.

611.9.2.4 Dimming systems with preset scenes. For programmable dimming systems, it shall be verified that automatic shutoff and manual overrides are working and that programming is complete. Prior to programming, the lamps shall be seasoned in accordance with NEMA LSD 23.

611.9.2.5 Lighting documentation. The following documentation for lights, systems and control devices shall be provided to the building owner:

1. Settings determined during commissioning activities outlined in Section 611.9.2
2. A narrative describing the intent and functionality of all controls including any capability for users to override a schedule or master command.
3. Specification sheets for all lighting equipment and controls.
4. Operation manuals for each lighting control device. Required maintenance and maintenance schedules shall be clearly identified. Documentation and instructions necessary for building maintenance personnel to maintain and recalibrate lighting systems and controls.
5. An annual inspection schedule for lighting controls.
6. Troubleshooting information for dimming systems and the remediation of switching issues such as false-ons and false-offs.

611.10 Building envelope systems commissioning, Building thermal envelope, dynamic glazing and shading device systems shall be commissioned and completion documentation shall be provided to the building owner in accordance with the International Energy Conservation Code and the provisions of this section.

611.10.1 Preconstruction documentation, building thermal envelope. Construction and owner education documents shall indicate the location, nature and extent of the work proposed and show the functional requirements and operation of the building thermal envelope, dynamic glazing and shading device systems demonstrating conformance to the provisions of this code.

611.10.2 Continuous air barrier commissioning. Prior to final inspection, the registered design professional or approved agency shall provide evidence of continuous air barrier commissioning that shall include:

1. Clear identification of the continuous air barrier components specified for the project and identified on approved construction documents
2. Review of planned construction details to ensure continuity of the air barrier over the entire building thermal envelope.
3. A field inspection checklist clearly showing the requirements necessary for proper installation of the continuous air barrier.
4. Witnessing and reporting on any continuous air barrier testing specified by the owner.
5. Periodic field inspections over the course of project construction to ensure compliance with the continuous air barrier requirements including but not limited to proper material handling and storage, use of approved materials and approved substitutes, proper material and surface preparation, air barrier continuity at all building thermal envelope penetrations and other

requirements as necessary for achieving the performance objective of the continuous air barrier.

6. A final commissioning report provided to the building owner and code official demonstrating compliance with the continuous air barrier requirements.

611.10.3 Continuous air barrier commissioning report. A final commissioning report shall be delivered to the building owner, and shall include:

1. A field inspection checklist showing the requirements necessary for proper installation of the continuous air barrier.
2. The results of any building air leakage testing
3. Reports from field inspections during project construction showing compliance with continuous air barrier requirements including but not limited to proper material handling and storage, use of approved materials and approved substitutes, proper material and surface preparation and air barrier continuity at building thermal envelope penetrations.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. In 2012 and 2013, the SEHPCAC has held six two-day open meetings and 50 workgroup calls, which included members of the SEHPCAC as well as any interested parties, to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

This proposal is the first part of a two part proposal to separate the process of commissioning from the systems and building elements which must be observed, reviewed and found in compliance during the commissioning process. This change removes the process elements of commissioning, the second change – or Part II of this proposal will be to add a comprehensive process to Chapter 9 of this code. Thus, this proposal specifies the systems and building elements which need to be commissioned and the key things to be reviewed, the functions to be observed to verify that the installed systems are in compliance with the code. Chapter 9 will address the process of doing the commissioning including the specific reporting requirements.

Cost Impact: Will increase the cost of construction. While the vast majority of this proposal is editorial. New provisions for air barrier commissioning will add to the overall cost of the commissioning process.