



COMMUNITY DEVELOPMENT & NEIGHBORHOOD SERVICES  
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# **2018 IECC AMENDMENTS**

Adopted: January 12<sup>th</sup>, 2019

ORDINANCE NO. 150, 2018,  
OF THE COUNCIL OF THE CITY OF FORT COLLINS  
AMENDING CHAPTER 5, ARTICLE II, DIVISION 2, OF THE CODE  
OF THE CITY OF FORT COLLINS FOR THE PURPOSE OF REPEALING THE *2015  
INTERNATIONAL ENERGY CONSERVATION CODE* AND ADOPTING THE  
*2018 INTERNATIONALENERGY CONSERVATION CODE*, WITH AMENDMENTS

WHEREAS, since 1924, the City has reviewed, amended and adopted the latest nationally recognized building standards available for the times; and

WHEREAS, upon recommendation of City staff, the City Council has determined that it is in the best interests of the City to align seven interconnected basic construction codes under one publication year; and

WHEREAS, the seven interconnected basic construction codes are the *International Building Code*, *International Residential Code*, *International Mechanical Code*, *International Fuel Gas Code*, *International Energy Conservation Code*, and *International Property Maintenance Code*; and

WHEREAS, the City Council has determined that the 2018 publication year of the seven interconnected basic construction codes ought to be adopted and that any counterpart codes previously adopted should be repealed, both in order to align the publication years of the codes and also because the 2018 publications contain improvements in construction code regulation; and

WHEREAS, City staff has conducted a significant public outreach program, working with the regulated construction industry and building professionals; and

WHEREAS, the adoption of the seven interconnected basic construction codes has been presented to and recommended by the Board of Realtors, Water Board, Energy Board, Commission on Disability, Natural Resource Advisory Board, Poudre Fire Authority Board, Building Review Board, Affordable Housing Board, Air Quality Advisory Board, Northern Colorado Home Builder Association and the Chamber of Commerce; and

WHEREAS, the City Council has determined that it is in the best interest of the health, safety and welfare of the City and its citizens that the *2015 International Energy Conservation Code*, as previously adopted and amended by the City pursuant to Ordinance No. 072, 2017, be repealed and that in its place, the *2018 International Energy Conservation Code* be adopted, with local amendments as set forth in this Ordinance; and

WHEREAS, pursuant to the City Charter II, Section 7, City Council may enact any ordinance which adopts a code by reference in whole or in part provided that before adoption of such ordinance the Council hold a public hearing thereon and that notice of the hearing is published twice in a newspaper of general circulation published in the City, with one of such publications occurring at least eight (8) days preceding the hearing and the other publication occurring at least fifteen (15) days preceding the hearing; and

WHEREAS, in compliance with Article II, Section 7, the City Clerk published in the Fort Collins *Coloradoan* such notice of hearing concerning adoption of the 2018 International Building Code on November 18, 2018, and November 25, 2018; and

WHEREAS, attached as Exhibit “A” and incorporated herein by reference is the Notice of Public Hearing dated November 18, 2018, that was so published and which the Council hereby finds meets the requirements of Article II, Section 7 of the City Charter.

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FORT COLLINS as follows:

Section 1. That the City Council hereby makes and adopts the determinations and findings contained in the recitals set forth above.

Section 2. That Section 5-26(c) of the Code of the City of Fort Collins is hereby amended to read as follows:

(c) Pursuant to the power and authority conferred on the City Council by Section 31-16-202, C.R.S., and Article II, Section 7 of the Charter, the City Council hereby repeals the *2015 International Energy Conservation Code (2015 IECC)*, and adopts, as the energy conservation code of the City, the *2018 International Energy Conservation Code (2018 IECC)* published by the International Code Council, as amended by the City, which shall have the same force and effect as though set forth in full herein, except as amended pursuant to Section 5-31 of the City Code, and which shall apply exclusively to the design and construction of all buildings that are classified as residential buildings not more than three (3) stories above grade and their systems; new portions of such existing buildings and their systems; and new systems and equipment in such existing buildings, exclusive of detached one- and two-family dwellings, multiple single-family dwellings (townhouses), for the purpose of establishing minimum requirements for minimum energy efficiency. None of the *2018 International Energy Conservation Code* Appendices are hereby adopted.

Section 3. That Section 5-31 of the Code of the City of Fort Collins is hereby repealed in its entirety and reenacted to read as follows:

**Sec. 5-31. Amendments and deletions to the 2018 International Energy Conservation Code<sup>1</sup>**

The *2018 International Energy Conservation Code* adopted in § 5-26(c) is hereby amended in the following respects:

(1) ***Section C101.1 Title*** is hereby retained in its entirety with the following amendments:

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<sup>1</sup> Changes to the *2018 International Energy Conservation Code* are shown as follows: inserted language is highlighted in yellow and deleted language is shown as stricken.

**C101.1 Title.** This code shall be known as the *International Energy Conservation Code* of the *City of Fort Collins* and shall be cited as such. It is referred to herein as “this code.”

- (2) **Section C101.4 Applicability** is hereby retained in its entirety with the following amendments:

...

Information contained in the amended Commercial Sections: *C101.1 Title; C103.7 Permits; C104 Fees; C109 Board of Appeals; C110 Violations; C110.2 Work commencing before permit issuance; C202 Definitions; C301.5 Exterior and Interior design parameters; C402.2 Specific building thermal envelope insulation requirements*, shall be applicable to the corresponding Residential Sections and shall have the same meaning.

- (3) A new **Section C101.4.2 Energy assessment** is hereby added to read as follows:

**C101.4.2 Energy assessment.** Prior to any *alterations*, an energy assessment shall be completed and submitted to the *building official*.

**Exceptions:** Energy assessments are not required in the following cases.

1. *Buildings* for which the first Certificate of Occupancy was issued after October 2010.
2. First-time interior finishes.
3. A *building* that has undergone an energy assessment within the previous three years.
4. *Alterations* to the HVAC, lighting, power, and exterior walls systems, or replacement of such with a construction valuation of less than \$50,000.
5. *Residential buildings*.

- (4) A new **Section C103.7 Permits** is hereby added to read as follows:

**C103.7 Permits.** Procedures related to permits, required inspections, payment of fees and obtaining required approvals shall be as set forth in Section 105 of the adopted *International Building Code*, entitled ‘Permits’.

- (5) **Section C104 Fees** is hereby deleted and replaced in its entirety and the following is hereby added in lieu thereof:

#### **SECTION C104 FEES**

~~C104.1 Fees.~~ A permit shall not be issued until the fees prescribed in Section C104.2 have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

~~C104.2 Schedule of permit fees.~~ A fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

~~C104.3 Work commencing before permit issuance.~~ Any person who commences any work before obtaining the necessary permits shall be subject to an additional fee established by the *code official* that, which shall be in addition to the required permit fees.

~~C104.4 Related fees.~~ The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

~~C104.5 Refunds.~~ The *code official* is authorized to establish a refund policy.

**C104 Fees.** All items relating to fees shall be as specified in Section 109 of the adopted *International Building Code*, entitled "Fees."

- (6) *Section C109 Board of Appeals* is hereby deleted and replaced in its entirety and the following is hereby added in lieu thereof:

## **SECTION C109**

### **BOARD OF APPEALS**

~~C109.1 General.~~ In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The *code official* shall be an *ex officio* member of said board but shall not have a vote on any matter before the board. The board of appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

~~C109.2 Limitations on authority.~~ An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall have no authority to waive requirements of this code.

~~C109.3 Qualifications.~~ The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

**C109 Appeals.** Appeals of decisions, determinations and interpretations of this code shall be made pursuant to the applicable provisions of Section 113 of the adopted *International Building Code*, entitled "Board of Appeals."

- (7) A new *Section C110.1 Violations* is hereby added to read as follows:

**C110.1 Violations.** Any person who violates a provision of this code or fails to comply with any of the requirements thereof or who erects, constructs, alters or *repairs a building* or structure in violation of the *approved* construction documents or directive of the *building official*, or of a permit or certificate issued under the provisions of this code, shall be guilty



of a misdemeanor and shall be subject to the penalties and fines specified in Section 1-15 of the City Code.

- (8) A new **Section C110.2 Work commencing before permit issuance** is hereby added to read as follows:

**C110.2 Work commencing before permit issuance.** In addition to the penalties set forth in Section 110.1, any person or firm who, before obtaining the necessary permit(s), commences any construction of, or work on, a *building*, structure, electrical, gas, mechanical or plumbing system that is not otherwise exempted from obtaining a permit, shall be subject to a fine in addition to the standard prescribed permit fee. Said fine shall be equal in amount to the permit fee, except that it shall not be less than \$50 nor more than \$1,000 for the first such violation. A person or firm committing the same such violation repeatedly shall be subject to a fine equal to double the amount of the permit fee or double the amount of the fee imposed for the preceding violation, whichever is greater, for every such subsequent violation committed within 180 days of a previous violation. Said fines may be appealed to the City Manager pursuant to Chapter 2, Article VI of the City Code.

- (9) **Section C202 DEFINITIONS**, is hereby amended by adding, in alphabetical order, the following definitions:

**CONTINUOUS AIR BARRIER:** The combination of interconnected materials, assemblies, and flexible sealed joints and components of the *building thermal envelope* that provides air tightness to a specified permeability.

**ELECTRIC HEAT:** An indoor environmental primary heat source that is electric. A ground-source electric heat pump designed by a licensed professional engineer shall not be considered *electric heat*.

**NON-ELECTRIC HEAT:** An indoor environmental primary heat source that is gas or that is a ground-source electric heat pump designed by a licensed professional engineer to operate without the use of supplemental electric resistance heat.

- (10) A new **Section C301.5 Exterior and Interior Local Design Parameters** is hereby added to read as follows:

**Section C301.5 Exterior and Interior Local Design Parameters.** The following thermal design parameters shall be used for mechanical load calculations and designs.

**Exterior and Interior Local Design Parameters.**

Winter Outdoor, Design Dry-bulb (°F)	= 6
Winter Indoor, Design Dry-bulb (°F)	= 72
Summer, Outdoor Design Dry-bulb (°F)	= 90
Summer, Indoor Design Dry-bulb (°F)	= 75
Summer, Outdoor Design Wet-bulb (°F)	= 62
Summer, Indoor Design Wet-bulb (°F)	= 62

Degree Days heating = 5710

Degree days cooling = 694

**Fort Collins is in Climate Zone 5B.**

- (11) **Section C402.1.3 Insulation component R-value-based method** is hereby retained in its entirety with the following amendments:

...

**Exception:** For buildings using *electric heat* at the power density of 1.5 Watts per square foot or greater, the *building thermal envelope* values in Table C402.1.5 shall be mandatory.

- (12) **Section C402.1.4 Assembly U-factor, C-factor or F-factor-based method** is hereby retained in its entirety with the following amendments:

...

**Exception:** For buildings using *electric heat* at the power density of 1.5 Watts per square foot or greater, the *building thermal envelope* values in Table C402.1.5 shall be mandatory.

- (13) **Table C402.1.5 Building thermal envelope** is hereby added to read as follows:

Opaque elements R-value requirements shall be in accordance with Table C402.1.3 or otherwise specified in the table below. The U-factor requirements shall be in accordance with Table C402.1.4 or otherwise specified in the table below. Any cavities not shown below must use the normal prescriptive table.

**TABLE C402.1.5 (Mandatory)**  
**BUILDING THERMAL ENVELOPE REQUIREMENTS FOR ELECTRIC HEAT**

Building area to be insulated	All other	Group R	Assembly max U-value
Roofs - Insulation above deck	R-30ci	R-30ci	0.039
Roof - Metal bldg roof	R-19+R-11 LS	R-19+R-11 LS	0.035
Roof - Attic and other	R-49	R-49	0.021
Above grade wall - mass wall	R-15ci	R-15ci	0.08
Above grade wall - metal bldg wall	R-13+R-7.5 ext ci	R-13+R-7.5 ext ci	0.06
Above grade wall - metal framed wall	R-13+R-10ci	R-13+R-10ci	0.052
Above grade wall - wood framed wall	R-15+R7.5ci or R-19+5ci <sup>c</sup>	R-15+R7.5ci or R-19+5ci <sup>c</sup>	0.048

Below grade wall	R-10ci	R-10ci	0.092
Floor - mass	R-15ci	R-15ci	0.055
Floor - steel joist	R-30+7.5ci	R-30+7.5ci	0.029
Floor - wood joist/framing	R-38	R-38	0.026
Slab on grade - unheated	R-10ci for 2ft	R-10ci for 2ft	F-0.540
Slab on grade - heated	R15 for 3ft+R-5 full slab	R15 for 3ft+R-5 full slab	F-0.79 & 0.64
Opaque non-swinging doors	R-4.75	R-4.75	0.37

Fenestration	Assembly Max. U
Vertical Fenestration, (up to 40% of Wall maximum)	
Nonmetal framing: all <sup>a</sup>	U-0.25
Metal fr: curtainwall/storefront <sup>b</sup>	U-0.35
Metal framing: entrance door <sup>b</sup>	U-0.70
Metal framing: all other <sup>b</sup>	U-0.45
Skylight (up to 3% of Roof maximum)	U <sub>all</sub> -0.50
SHGC	U-0.40

The following definitions apply: ci = continuous insulation, Ls = liner system, NR = No (insulation) requirement.

<sup>a</sup> Nonmetal framing includes framing materials other than metal with or without metal reinforcing or cladding.

<sup>b</sup> Metal framing includes metal framing with or without thermal break. The "all other" subcategory includes operable windows, fixed windows, and non-entrance doors.

<sup>c</sup> Class I vapor retarders shall not be installed on the interior of framed walls where exterior ci value is less than R-7.5.

- (14) **Section C402.2 Specific building thermal envelope insulation requirements (Prescriptive)** is hereby retained in its entirety with the following amendments:

**C402.2 Specific building thermal envelope insulation requirements (Prescriptive)**

~~Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.7 and Table C402.1.3.~~ All insulation shall be installed to meet Residential Energy Services Network (RESNET) Grade I standard.

- (15) **Section C402.2.2 Above-grade walls** is hereby retained in its entirety with the following amendments:

**Section C402.2.2 Above-grade walls (Mandatory)**

...

- (16) **Section C402.2.4 Slab-on grade-perimeter insulation** is hereby retained in its entirety with the following amendments:

**Section C402.2.4 Slabs-on-grade perimeter insulation (Mandatory)**

...



- (17) **Section C402.2.5 Below-grade walls** is hereby deleted and replaced in their entirety and the following is hereby added in lieu thereof:

~~**C402.2.5 Below-grade walls.** The C factor for the below grade exterior walls shall be in accordance with Table C402.1.4. The R-value of the insulating material installed continuously within or on the below grade exterior walls of the building envelope shall be in accordance with Table C402.1.3. The C factor or R-value required shall extend to a depth of not less than 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor of the conditioned space enclosed by the below grade wall, whichever is less.~~

**C402.2.5 Thermal resistance of below-grade walls.** The minimum thermal resistance (*R-value*) of the insulating material installed in, or continuously on, the *below-grade walls* shall be R-10 and shall extend to a depth of 10 feet (3,048 mm) below the outside finish ground level, or to the level of the floor, whichever is less.

- (18) **Sections C402.5 Air leakage-thermal envelope (Mandatory)**, are hereby deleted and replaced in their entirety and the following is hereby added in lieu thereof:

~~**Section C402.5 Air leakage-thermal envelope (Mandatory).** The thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft<sup>2</sup> (0.2 L/s • m<sup>2</sup>). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.~~

~~**C402.5.1 Air barriers.** A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.~~

**Section C402.5 Air leakage-thermal envelope (Mandatory).** The *building thermal envelope* shall be designed and constructed with a *continuous air barrier* that complies with the following requirements to control air leakage into, or out of, the *conditioned space*. The boundary limits and size of the surface area (floor, wall, and ceiling or roof) of the *building air barrier*, and of the *zone* or *zones* to be tested for maximum *building* air infiltration and exfiltration, shall be clearly identified on the *approved* construction drawings. All *air barrier* components of each *building thermal envelope* assembly shall be clearly identified on construction documents and the joints, interconnections, and penetrations of the *air barrier* components shall be detailed and shall comply with Sections C402.5.1 through C402.5.8, and the *building thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.25 cfm/ft<sup>2</sup> (0.20 L/s • m<sup>2</sup>) under a pressure differential of 75 Pa) or in accordance with the most current version of the City of Fort Collins Building Air Leakage Test Protocol for commercial

buildings or City of Fort Collins Building Code Protocol for *New Multifamily Building Air Tightness Testing*. Documentation of the testing results shall be submitted to the *building official* prior to approval. If the building fails air leakage testing, the testing agency is required to perform a diagnostic evaluation in accordance with ASTM E1186-03. The testing agency can use additional methods to discover leaks. Repairs based on these diagnostics and retesting is required prior to submitting results to the building official. Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

- (19) **Section C405.2.1 Occupant sensor controls** is hereby retained in its entirety with the following amendments:

...

In new construction and *additions* that require a building permit, *occupant sensor controls* shall be provided to automatically reduce connected lighting power by not less than 50 percent during periods when no occupants are present in the following locations:

1. corridors and enclosed stairwells;
2. storage stack areas not open to the public;
3. library stack areas; and
4. parking garages.

Lighting in *means of egress* shall comply with the luminance or uniformity criteria required by the *International Building Code* when occupied.

**Exception:** *Automatic* power reduction shall not be used to control battery back-up emergency lighting and exit signage.

- (20) **Section C405.2.4 Specific application controls** is hereby retained in its entirety with the following amendments:

...

5. In hotels and motels the sleeping units shall have control devices or systems that are configured to automatically switch off all permanently installed luminaires, switched receptacles, televisions and the heating, ventilating and air conditioning system set point raised at least 5 degrees Fahrenheit (3 degrees centigrade) in the cooling mode and lowered at least 5 degrees Fahrenheit (3 degrees centigrade) in the heating mode whenever the guest room is unoccupied. All permanently wired luminaires located in bathrooms within sleeping units in hotels, motels, boarding houses or similar buildings shall be equipped with occupant sensors that require manual intervention to energize circuits.

...

- (21) **Section C405.2.6.1 Daylight shutoff** is hereby retained in its entirety with the following amendments:



**C405.2.6.1 Daylight shutoff.** Lights shall be automatically turned off when daylight is present and satisfies the lighting needs or within 30 minutes after sunrise.

(22) **Section 405.2.6.3 Lighting setback** is amended to read as follows:

**C405.2.6.3 Lighting setback** Exterior Lighting that is not controlled in accordance with Section C405.2.6.2 shall be controlled in accordance with Section C405.2.6.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 3050 percent by selectively switching off or dimming luminaires at one of the following times: from not later than one hour after business closing to not earlier than one hour before business opening.

1. From not later than midnight to not earlier than 6 a.m.
2. From not later than one hour after business closing to not earlier than one hour before business opening.
3. During any time where activity has not been detected for 15 minutes or more.

(23) A new **Section C405.10 Electricity distribution design** is hereby added to read as follows:

**C405.10 Electricity distribution design requirements and load type isolation.** Electric distribution systems within, on or adjacent to and serving a new *building* shall be designed in such fashion that each primary panel supplies only one electricity load type as defined in Sections C405.10.1 through C405.10.5. The energy load type served by each distribution panel shall be clearly designated on the panel with the use served, and adequate space shall be provided for installation of metering equipment or other data collection devices, temporary or permanent, to measure the energy use associated with each distribution panel.

**Exceptions:**

1. *Buildings* or spaces with less than 600 amp electric service are exempted from this requirement.
2. Electrical systems that are designed and constructed in such fashion that the total usage of each of the load types as described in Sections C405.10.1 through C405.10.5 shall be permitted to be measured through the use of installed *sub-meters* or other equivalent methods as *approved*.
3. Group U occupancies

**C405.10.1 Heating, ventilating, and air conditioning system electric load.** This category shall include all electricity used to heat, cool, and provide *ventilation* to the *building* including, but not limited to, fans, pumps, and cooling energy.

**C405.10.2 Lighting system electric load.** This category shall include all electricity for interior and exterior lighting used in occupant spaces and common areas.

**C405.10.3 Plug loads.** This category shall include all electricity use by devices, electric appliances and equipment connected to convenience receptacle *outlets*.

**C405.10.4 Process loads.** This category shall include all electricity used by any single load associated with activities within the *building*, such as, but not limited to, data centers, manufacturing equipment and commercial kitchens, that exceed 5% of the total energy use of the whole *building*.

**C405.10.5 Miscellaneous loads.** This category shall include all electricity use for all other *building* operations and other operational loads.

- (24) *Section C408 System commissioning* is hereby deleted and replaced in its entirety and the following is hereby added in lieu thereof:

## **SECTION C408**

### **MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING**

**C408.1 General.** This section covers the provision of maintenance information and the commissioning of, and the functional testing requirements for, building systems.

**C408.1.1 Building operations and maintenance information.** The building operations and maintenance documents shall be provided to the owner and shall consist of manufacturers' information, specifications and recommendations; programming procedures and data points; narratives; and other means of illustrating to the owner how the building, equipment and systems are intended to be installed, maintained and operated. Required regular maintenance actions for equipment and systems shall be clearly stated on a readily visible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

**C408.2 Mechanical systems and service water heating systems commissioning and completion requirements.** Prior to passing the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of mechanical and plumbing systems *commissioning* and completion in accordance with the provisions of this section.

*Construction document* notes shall clearly indicate 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 C408.2.4 and C408.2.5.

#### **Exception:**

The following systems are exempt:

1. Mechanical systems and service water heater systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water heating and space heating capacity.
2. Systems included in Section C403.5 that serve individual dwelling units and sleeping units.

**C408.2.1 Commissioning plan.** A *commissioning plan* shall be developed by a *registered design professional* or *approved agency* and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.



3. Functions to be tested, including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed. Testing shall affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

**~~C408.2.2 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 air system and hydronic system balancing.

**~~C408.2.2.1 Air systems balancing.~~** Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers used for air system balancing are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 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 (0.746 kW), fan speed shall be adjusted to meet design flow conditions.

**~~Exception:~~**

Fans with fan motors of 1 hp (0.74 kW) or less are not required to be provided with a means for air balancing.

**~~C408.2.2.2 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 test ports at each side of each pump.

**~~Exceptions:~~** The following equipment is not required to be equipped with a means for balancing or measuring flow:

1. Pumps with pump motors of 5 hp (3.7 kW) or less.
2. Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

**~~C408.2.3 Functional performance testing.~~** Functional performance testing specified in Sections C408.2.3.1 through C408.2.3.3 shall be conducted.

**~~C408.2.3.1 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 such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full load, part load and the following emergency conditions:

1. All modes as described in the *sequence of operation*;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

**~~Exception:~~**

Unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.3.2(3) that do not require supply air economizers.

**~~C408.2.3.2 Controls.~~** HVAC and service water heating control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of

operation shall be functionally tested to document they operate in accordance with ~~approved plans and specifications.~~

**~~C408.2.3.3 Economizers.~~** Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

**~~C408.2.4 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 or owner's authorized agent. The report shall be organized with mechanical and service hot water findings in separate sections to allow independent review. The report shall be identified as "Preliminary Commissioning Report" shall include the completed Commission Compliance Checklist, Figure C408.2.4, and shall identify:

- ~~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.~~
- ~~4. Results of functional performance tests.~~
- ~~5. Functional performance test procedures used during the commissioning process, including measurable criteria for test acceptance.~~

**~~C408.2.4.1 Acceptance of report.~~** ~~Buildings~~, or portions thereof, shall not be considered as an acceptable for a final inspection pursuant to Section C105.2.6 until the ~~code official~~ has received the Preliminary Commissioning Report from the building owner or owner's authorized agent.

**~~C408.2.4.2 Copy of report.~~** The ~~code official~~ shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the ~~code official~~.

**~~C408.3.2 Documentation requirements.~~** The ~~construction documents~~ shall specify that the ~~documents~~ described in this section be provided to the ~~building owner or owner's authorized agent~~ within 90 days of the date of receipt of the ~~certificate of occupancy~~.

**~~C408.3.2.1 Drawings.~~** Construction documents shall include the location and catalogue number on each piece of equipment.

**~~C408.3.2.2 Manuals.~~** An operating and maintenance manual shall be provided and include all of the following:

- ~~1. Name and address of not less than one service agency for installed equipment.~~
- ~~2. A narrative of how each system is intended to operate, including recommended setpoints.~~
- ~~3. Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.~~
- ~~4. Operation and maintenance manuals for each piece of lighting equipment. Required routine maintenance actions, cleaning and recommended relamping shall be clearly identified.~~
- ~~5. A schedule for inspecting and recalibrating all lighting controls.~~
- ~~6. \_\_\_\_\_~~

**~~C408.2.5.3 System balancing report.~~** A written report describing the activities and measurements completed in accordance with Section C408.2.2.

**~~C408.2.5.4 Final commissioning report.~~** A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

- ~~1. Results of functional performance tests.~~

2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.

3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

**Exception:**

Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

**C408.3 Lighting system functional testing.**

Controls for automatic lighting systems shall comply with this section.

**C408.3.1 Functional testing.**

Prior to passing final inspection, the registered design professional shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions. Functional testing shall be in accordance with Sections C408.3.1.1 and C408.3.1.2 for the applicable control type.

**C408.3.1.1 Occupant sensor controls.**

Where occupant sensor controls are provided, the following procedures shall be performed:

1. Certify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations.
2. For projects with seven or fewer occupant sensors, each sensor shall be tested.
3. For projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided, not less than 10 percent, but in no case less than one, of each combination shall be tested unless the code official or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.

For occupant sensor controls to be tested, verify the following:

- 3.1. Where occupant sensor controls include status indicators, verify correct operation.
- 3.2. The controlled lights turn off or down to the permitted level within the required time.
- 3.3. For auto on occupant sensor controls, the lights turn on to the permitted level when an occupant enters the space.
- 3.4. For manual on occupant sensor controls, the lights turn on only when manually activated.
- 3.5. The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

**C408.3.1.2 Time-switch controls.**

Where time switch controls are provided, the following procedures shall be performed:

1. Confirm that the time switch control is programmed with accurate weekday, weekend and holiday schedules.
2. Provide documentation to the owner of time switch controls programming including weekday, weekend, holiday schedules, and set up and preference program settings.
3. Verify the correct time and date in the time switch.
4. Verify that any battery back up is installed and energized.
5. Verify that the override time limit is set to not more than 2 hours.
6. Simulate occupied condition. Verify and document the following:

- 6.1. All lights can be turned on and off by their respective area control switch.
- 6.2. The switch only operates lighting in the enclosed space in which the switch is located.
7. Simulate unoccupied condition. Verify and document the following:
  - 7.1. Nonexempt lighting turns off.
  - 7.2. Manual override switch allows only the lights in the enclosed space where the override switch is located to turn on or remain on until the next scheduled shutoff occurs.
8. Additional testing as specified by the registered design professional.

#### **C408.3.1.3 Daylight responsive controls.**

Where daylight responsive controls are provided, the following shall be verified:

1. Control devices have been properly located, field calibrated and set for accurate setpoints and threshold light levels.
2. Daylight controlled lighting loads adjust to light level set points in response to available daylight.
3. The locations of calibration adjustment equipment are readily accessible only to authorized personnel.

#### **C408.3.2 Documentation requirements.**

The construction documents shall specify that documents certifying that the installed lighting controls meet documented performance criteria of Section C405 are to be provided to the building owner within 90 days from the date of receipt of the certificate of occupancy.

**C408 System Commissioning** shall be in conformance with Section 3604 of the adopted *International Building Code*, entitled "Commissioning, Operations and Maintenance."

- (25) **TABLE R402.1.2 Insulation and Fenestration Requirements by Component** is hereby deleted and replaced in its entirety and the following is hereby added in lieu thereof:

**TABLE R402.1.2  
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT**

HEATING SYSTEM TYPE	FENESTRATION U-FACTOR <sup>a</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE <sup>d</sup>	MASS WALL R-VALUE <sup>d</sup>	FLOOR R-VALUE <sup>c</sup>	BASEMENT WALL R-VALUE	SLAB <sup>a</sup> R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
<i>Non-Electric heat</i>	0.30	0.55	NR	49	20 or 13 + 5 <sup>hl</sup>	13/17	30	10/13/ 15/19 <sup>k</sup>	10.2 ft	10/13/ 15/19 <sup>k</sup>
<i>Electric heat</i>	0.30	0.55	NR	49	20+5 <sup>hl</sup>	15/19	30	15/19	10.3 ft	15/19

For SI: 1 foot = 304.8 mm.

NR = Not Required.

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the

insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

**Exception:** In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC

for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means

R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall. Alternatively, compliance

with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs as indicated in the



- table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation shall not be required in warm-humid locations as defined by Figure N1101.10 and Table N1101.10.
- g. Alternatively, insulation sufficient to fill the framing cavity providing not less than an R-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section N1102.2.5. The second R-value applies where more than half of the insulation is on the interior of the masswall.
- j. All rim joists and adjoining plates shall be air-sealed and insulated using spray foam insulation to R-15 minimum.
- k. All rim joists and adjoining plates shall be air-sealed.
- l. Class I vapor retarders shall not be installed on the interior of framed walls where exterior ci value is less than R-7.5.

- (26) **TABLE R402.1.4 Equivalent U-Factors** is hereby deleted and replaced in its entirety and the following is hereby added in lieu thereof:

**TABLE R402.1.4  
EQUIVALENT U-FACTORS<sup>a</sup>**

HEATING SYSTEM TYPE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING R-VALUE	FRAME WALL U-FACTOR	MASS WALL U-FACTOR <sup>b</sup>	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
Nonelectric heat	0.30	0.55	0.026	0.057	0.082	0.033	0.050	0.055
Electric heat	0.30	0.55	0.026	0.048	0.060	0.033	0.050	0.055

- a. Non-fenestration U-factors shall be obtained from measurement, calculation or an approved source.
- b. When more than half the insulation is on the interior, the mass wall U-factor shall be the same as the frame wall U-factor.

- (27) **Section R402.2.3 Eave baffle** is hereby retained in its entirety with the following amendments:

**R402.2.3 Eave baffle and blocks (Mandatory).** For air permeable insulations in vented attics with ventilation from open or box soffits, a baffle shall be installed to provide ventilation from the soffit to the attic adjacent to each soffit or eave vent. In the case of continuous soffit vents, enough baffles shall be installed to maintain the required attic ventilation from the soffit. Baffles shall maintain an opening equal or greater than the size of the vent. The ventilation baffle shall extend over the top of the attic insulation between rafters or trusses, maintaining a minimum 1 inch clear opening below the roof deck and sufficient space for the minimum depth of attic insulation. The baffle shall be permitted to be any solid material. All other spaces between rafters or trusses shall be blocked at the outside edge of the exterior wall top plate, with air impermeable materials so as to contain the attic insulation to a minimum R-19 over the exterior wall top plate..

- (28) **Section R402.2.10 Slab-on-grade floors** is hereby retained in its entirety with the following amendments:

**Section R402.2.10 Slab-on-grade floors (Mandatory)**

...

- (29) A new **Section R402.2.14 Rim insulation requirements** is hereby added to read as follows:

**R402.2.14 Rim insulation requirements.** All rim plates and rim joist which are part of the thermal envelope shall be air-sealed. All rim plates and rim joist which are part of the thermal envelope shall be insulated using spray foam materials to R-15 minimum when the *basement* walls are insulated to 10/13 in accordance with Table R402.1.2.

- (30) **Section R402.4.1.2 Testing**, is hereby retained in its entirety with the following amendments:

**R402.4.1.2 Testing.** The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with Section 802 of the RESNET Mortgage Industry National Home Energy Rating Standards and RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*. Testing shall comply with the City of Fort Collins Building Code Protocol for New Multifamily Building Air Tightness Testing.

~~Testing shall occur after rough-in and after installation of penetrations of the *building thermal envelope*, including but not limited to penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

~~General requirements during testing:~~

- ~~1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the intended weather stripping or other *infiltration* control measures.~~
- ~~2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended *infiltration* control measures.~~
- ~~3. Interior doors, if installed at the time of the test, shall be open.~~
- ~~4. Exterior doors for continuous *ventilation systems* and heat recovery ventilators shall be closed and sealed.~~
- ~~5. Heating and cooling systems, if installed at the time of the test, shall be turned off.~~
- ~~6. Supply and return registers, if installed at the time of the test, shall be fully open.~~
- ~~7. *Combustion air* inlets shall not be closed or otherwise obstructed.~~
- ~~8. Garage doors to the exterior shall be closed.~~

~~In additions or *alterations* to existing *buildings*, air sealing compliance shall be considered acceptable when the items listed in Table R402.4.1.1, applicable to the method of construction, are field verified.~~

- (31) **Section R402.5 Maximum fenestration U-factor and SHGC (Mandatory)** is hereby retained in its entirety with the following amendments:

The area-weighted average maximum fenestration U-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.480.40 for *vertical fenestration* and 0.75 for skylights in Climate Zones 4 and 5 and 0.40 in Climate Zones 6 through 8 for vertical fenestration, and 0.75 in ~~Climate Zones 4 through 8~~ for skylights. The area-weighted average maximum



~~fenestration SHGC permitted using tradeoffs from Section R405 in Climate Zones 1 through 3 shall be 0.50.~~

- (32) *Section R403.3.1 Insulation (Prescriptive)* is hereby retained in its entirety with the following amendments:

**R403.3.1 Insulation (Prescriptive)(Mandatory).**

...

- (33) A new *Section R403.3.7 Ducts located in conditioned space* is hereby deleted in its entirety, and replaced with the following in lieu thereof:

**R403.3.7 Ducts located in conditioned space.** For ducts to be considered as inside a conditioned space, such ducts shall comply with either of the following:

- ~~1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.~~
- ~~2. The ducts shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:~~
  - ~~2.1. The air handler is located completely within the continuous air barrier and within the building thermal envelope.~~
  - ~~2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m<sup>2</sup>) of conditioned floor area served by the duct system.~~
  - ~~2.3. The ceiling insulation R-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation R-value, less the R-value of the insulation on the duct.~~

**R403.3.7 Ducts located in conditioned space.** For ducts to be considered as inside conditioned space, the duct system shall be located completely within the continuous air barrier and within the building thermal envelope.

- (34) *Section R403.7 Equipment sizing and efficiency rating (Mandatory)* is hereby retained in its entirety with the following amendments:

**R403.7 Equipment sizing and efficiency rating (Mandatory).** Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed. designed in accordance with *International Residential Code* Section M1401.3 and performance will be verified in accordance with *International Residential Code* Section M1309.

- (35) A new **Section R404.2 Occupant sensor controls** is hereby added to read as follows:

**R404.2 Occupant sensor controls.** In multifamily buildings, occupant sensor controls shall be provided to automatically reduce connected lighting power by not less than 50 percent during periods when no occupants are present in common corridors and common enclosed stairwells.

Lighting in means of egress shall comply with the luminance or uniformity criteria required by the *International Building Code* when occupied.

**Exception:** Automatic power reduction shall not be used to control battery back-up emergency lighting and exit signage.

- (36) A new **Section R405.1 Scope** is hereby retained in its entirety with the following amendments:

**R405.1 Scope.** This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water heating energy only. In addition, requirements for the Simulated Performance Alternative are detailed within The City of Fort Collins Residential New Construction Simulated Performance Alternative (SPA) Guide.

**Exception:** In addition to all mandatory sections, new buildings, additions, or alterations where the primary heat source is electrical shall comply with prescriptive portions of the code.

- (37) **Chapter 6 REFERENCED STANDARDS** is hereby amended by adding, in alphabetical order, the following additional referenced standard:

RESNET® Mortgage Industry National Home Energy Rating Systems Standards  
Residential Energy Services Network, Inc.

P.O. Box 4561

Oceanside, CA 92052-4561


<http://resnet.us>

RESNET® reference standard Grade I and Grade II Insulation  
Referenced in Amended 2012 IECC Section C402.2.

Section 4. The City Attorney and the City Clerk are authorized to modify the formatting and to make such other amendments to this Ordinance as necessary to facilitate publication in the Fort Collins Municipal Code; provided, however, that such modifications and amendments shall not change the substance of the Code provisions.



Introduced, considered favorably on first reading, and ordered published this 18th day of December, A.D. 2018, and to be presented for final passage on the 2nd day of January, A.D. 2019.

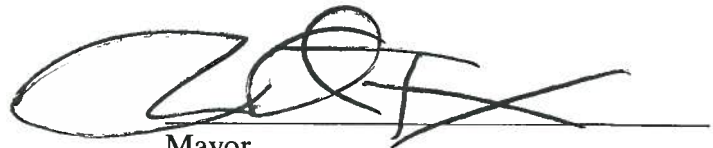
  
Mayor

ATTEST:

  
City Clerk



Passed and adopted on final reading on the 2nd day of January, A.D. 2019.

  
Mayor

ATTEST:

  
City Clerk



## NOTICE OF PUBLIC HEARING

NOTICE is hereby given of a public hearing to be held before the City Council of the City of Fort Collins, Colorado, on the 4th day of December, A.D., 2018 at 6:00 p.m., or as soon thereafter as the matter may come on for hearing, in the Council Chambers at the City Hall, 300 LaPorte Avenue, Fort Collins, Colorado for the purpose of considering the adoption of ordinances adopting by reference the *2018 International Building Code*, *2018 International Residential Code*, *2018 International Energy Conservation Code*, *2018 International Mechanical Code*, and the *2018 International Fuel Gas Code*, *2018 International Existing Building Code*, and the *2018 International Pool and Spa Code*, together with local amendments, promulgated by the International Code Council.

Not less than one (1) copy of said Codes has been, and now is on file in the Office of the City Clerk of the City of Fort Collins and is available for public inspection.

The purpose of the International Building Code, International Residential Code, International Energy Conservation Code, International Mechanical Code, the International Fuel Gas Code, 2018 International Existing Building Code, and the 2018 International Pool and Spa Code adopted by said ordinance is to provide for protection of public health and safety and general welfare.

The City of Fort Collins will make reasonable accommodations for access to City services, programs and activities and will make special communication arrangements for persons with disabilities. Please call 221-6515 (V/TDD: Dial 711 for Relay Colorado) for assistance.

This notice is given and published by order of the City of Fort Collins, Colorado.

Dated at Fort Collins, Colorado this 18th day of November, A.D. 2018.

Delynn Coldiron  
City Clerk