



Development Services Public Notification

Directive Type: Code Adoption Notification

Effective Date: June 1, 2021

From: Office of the Building Official

Pertinence: 2018 ICC International Energy Conservation Code (IECC) Adoption

Directive:

In compliance with ARM 24.301.202, the City of Missoula has adopted the 2018 International Energy Conservation Code (IECC) and the associated amendments contained in the ARM. Effective June 1, 2021, all permit submittals will be required to meet the 2018 IECC requirements. Permits submitted prior to this date will be reviewed in accordance with the 2012 IECC requirements.

Appendices:

- A – Commercial related Energy Code changes as provided by Brian Cook
- B – Residential related Energy Code changes as provided by Brian Cook
- C – Residential Mechanical related Energy Code changes as provided By Walter Dunlap
- D – Plumbing relate Energy Code changes as provided by Tony Sauro
- E – Plumbing relate Energy Code changes as provided by Tony Sauro

Should you have any questions regarding this directive, please contact Aaron Bowman, City Building Official at BowmanA@ci.missoula.mt.us for assistance.

End of Directive

Appendix A

2018 International Energy Conservation Code (IECC) – Commercial Summary of Significant Changes

Building Envelope

- Heated slabs require R-5 full slab insulation in addition to perimeter insulation. Perimeter insulation requirements remain unchanged from 2012. **TABLE C402.1.3**
- An exception has been added to vestibules requirements. Doors with air curtains meeting specific requirements may now be excepted. **C402.5.7**
- Loading dock weather seal requirements have been clarified to note that direct contact with vehicles is required. **C402.5.6**
- Requirements have been added for the thermal isolation of rooms or spaces that contain fuel burning appliances where combustion air is supplied through openings in an exterior wall. **C402.5.3**
- An exception to the required insulation of radiant heating systems has been added for heated slabs that are insulated to code. **C402.2.6**
- Requirements have been added to address enclosing airspaces when used as part of the envelope design. **C402.2.7**
- Previous section “Floors over outdoor air or unconditioned spaces” has been renamed “Floors” in C402.2.3. Exceptions have been added for the configuration of insulation in these areas. **C402.2.3**

Mechanical

- Minimum efficiency tables have been updated to reflect increased requirements for most equipment. **Tables C403.3.2 (1-9)**
- HVAC Systems serving areas over 25,000 sqft in area or than span more than one floor and are designed to operate or be occupied non-simultaneously are required to be divided into isolation zones. Exceptions are noted. **C403.2.1**
- A section has been added regarding minimum turndown ratio for boilers. **C403.3.4**
- Heating and cooling system controls have been relocated and consolidated. **C403.4**
- Economizer language has been expanded on what systems require them. Simple and Complex systems are consolidated to this section New requirements are added for air and water-side economizers. Tables for water chilled and DX economizers have been expanded. **C403.5**
- Economizers need mandatory fault detection and diagnostics. **C403.5.5**
- New mandatory requirements for demand control ventilation, enclosed parking garage ventilation controls, ventilation air heating control, and energy recovery ventilation systems. **C403.7**
- New requirements for multizone VAV systems and controls. **C403.6**
- Kitchen exhaust systems have new requirements for supply and replacement air **C403.7.5**
- Group R-1 buildings with more than 50 guestrooms have new control requirements. **C403.7.6**
- Added a new requirement for fans to have a fan efficiency grade (FEG) of not less than 67. **C403.8.3**
- Added a section for fractional fan motors. Code now requires motors from 1/12 horsepower (hp) to under 1 hp to be EC motors or have a minimum efficiency of 70%. **C403.8.4**

- Added control requirements for walk-in coolers and freezers, and refrigerated warehouse coolers and freezers. The requirements are for cover doors, insulation, evaporator fan motor, lighting, anti-sweat heater, condenser fan motor, and their controls. **C403.10**

Electrical

- Lighting controls has been expanded and adds Luminaire level lighting controls (LLLC) option for compliance with lighting controls requirements. **C405.2 – 405.2.6**
- Extends occupancy sensor control requirements to copy rooms, lounges, locker rooms, open plan office areas, and warehouses. Reduced time-to-off from 30 to 20 minutes. **C405.2.1**
- Daylight-responsive controls and settings have been expanded. Hotel and motel sleeping units and guest suites, the requirement changed from manual control to automatically switching off all installed luminaires and switched receptacles within 20 minutes after all occupants leave the room. **C405.2.3 and C405.2.3.1**
- Exterior lighting controls require exterior façade and landscape lighting to be automatically turned off as a function of dawn/dusk and a set business opening and closing time. Power reduction and time constraints are noted. **C405.2.6**
- Added additional equipment that is excluded when calculating total connected lighting power. **C405.3.1**. Exterior total connected power has similar expansions per **C405.4.1**.
- **Table C405.3.2(1)** Building Area Method and **Table C405.3.2(2)** Space-by-Space Method have been updated.
- **Table C405.3.2(2)** reflects decreased interior lighting power allowances.
- **Table C405.4.2(2)** reflects decreased exterior lighting power allowances.
- Electric motors have minimum efficiency requirements. **C405.7**
- Escalators, moving walks, and elevators have new requirements. **C405.8**

Total Building Performance and Efficiency Packages

- Clarification of sections which require compliance. **C406.1**
- Requirement/clarification that reduction in energy cost of the proposed design associated with on-site renewable energy shall not be more than 5% of the total energy cost when using the performance-based compliance method. **C407.3**
- On-site renewable energy reduction must be documented and provided to AHJ. **C407.4.2**
- Introduces option to use an exceptional calculation method whenever the simulation program does not model a design, material, or device of the proposed design. **C407.6.3**

Commissioning

- Occupant sensor controls, time-switch controls, and daylight responsive controls require functional testing. **C408.3**
- Added two items to be identified in the preliminary commissioning report - results of functional performances tests and test procedures. **C408.2.4**

Appendix B

2018 International Energy Conservation Code (IECC) – Residential Summary of Significant Changes and Review

Building Envelope

- Walls, crawl and basement walls, floors, and ceiling insulation requirements remain unchanged.
- Air change rate is still 4 ACH per hour.
- Doors and window minimum U-factor is now 0.30. **Table R402.1.2**
- The air sealing table has been updated to split up air barrier and insulation requirements. 3 items added - recessed lighting, shower/tubs on exterior walls, and HVAC register boots through the thermal envelope. **Table R402.4.1.1**
- Crawl access doors and hatches do not need to be insulated to match surrounding assemblies, but must meet 0.30 minimum U-factor. (Vertical doors only) **R402.2.4**
- 90% of lighting must have high efficiency bulbs (LED or CFL). **R404.1**
- An alternative compliance path has been added in **Section R406** – Energy Rating Index (ERI). See [Spring 2018: Proposed Energy Codes #12](#) for more information.
- Chapter 5 has been added to address existing buildings.

Mechanical

- Building framing cavities may be used for return ducts if there is no atmospherically vented furnace, boiler, or water heater located in the house outside of a sealed and insulated room that is isolated from inside the thermal envelope and if the duct system has been tested as having a maximum total leakage not greater than 4 cfm/SF. The room walls, floor, and ceilings shall be insulated in accordance with the basement wall requirements of **Table R402.1.2**.
- Where ducts provide combustion air to open combustion fuel burning appliances, the appliance and combustion air opening shall be located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope at the insulation level for basement walls and sealed with the door gasketed. **R402.4.4**
- Language added to clarify how ducts buried in attic insulation should be insulated **403.3.6.1**
- Ducts buried in insulation may be considered to be in conditioned space when using the ERI compliance path provided certain requirements are met. **R403.3.7**
- HRV and ERV units have minimum fan efficiency values added to **Table R403.6.1**.
- An exception was added for duct leakage testing on HRV and ERV units not connected to heating and cooling systems. **R403.3.3**
- The duct leakage to the outside Montana amendment has been removed. Duct testing requirements and criteria are per **R403.3.3 and R403.3.4**.

Electrical

- 90% of lighting must have high efficiency bulbs (LED or CFL). **R404.1**

Appendix C

2018 IECC Significant Changes - Mechanical RESIDENTIAL PROVISIONS

R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.5, Building Cavities, is deleted in its entirety and replaced with:

"Building framing cavities shall not be used as supply ducts."

Exception: Building framing cavities may be used for return ducts if there is no atmospherically vented furnace, boiler, or water heater located in the house outside of a sealed and insulated room that is isolated from inside the thermal envelope and if the duct system has been tested as having a maximum total leakage not greater than 4 cfm/SF. The room walls, floor, and ceilings shall be insulated in accordance with the basement wall requirements of Table R402.1.2. Climate zone 6 (R-15/19)

R403.3.6 Ducts buried within ceiling insulation. Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation *R*-value not less than R-8.
2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the *R*-value of the duct insulation.

Exception: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

R403.3.6.1 Effective *R*-value of deeply buried ducts.

Where using a simulated energy performance analysis, sections of ducts that are: installed in accordance with Section R403.3.6; located directly on, or within 5.5 inches (140 mm) of the ceiling; surrounded with blown-in attic insulation having an *R*-value of R-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of R-25.

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 m²) 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.

R403.6.1 Whole-house mechanical ventilation system fan efficacy.

Fans used to provide whole-house mechanical ventilation shall meet the efficacy requirements of Table R403.6.1.

Exception: Where an air handler that is integral to tested and *listed* HVAC equipment is used to provide whole-house mechanical ventilation, the air handler shall be powered by an electronically commutated motor.

Appendix D

2018 IECC Significant Changes – Plumbing Residential Provisions

R403.5.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

R403.5.2 Demand recirculation water systems. *Demand recirculation water systems* shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

R403.5.3 Hot water pipe insulation (Prescriptive). Insulation for hot water piping with a thermal resistance, *R*value, of not less than R-3 shall be applied to the following:

1. Piping 3/4 inch (19.1 mm) and larger in nominal diameter.
2. Piping serving more than one dwelling unit.
3. Piping located outside the *conditioned space*.
4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried piping.
7. Supply and return piping in recirculation systems other than demand recirculation systems.

Author note: Pay attention to 1 and 2 from above as this is a change from the previous code cycle.

Appendix E

2018 IECC Significant Changes – Plumbing Commercial Provisions

C404.3 Heat traps for hot water storage tanks. Storage tank-type water heaters and hot water storage tanks that have vertical water pipes connecting to the inlet and outlet of the tank shall be provided with integral heat traps at those inlets and outlets or shall have pipe-configured heat traps in the piping connected to those inlets and outlets. Tank inlets and outlets associated with solar water heating system circulation loops shall not be required to have heat traps.

C403.11.3 Piping insulation (Mandatory). Piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.11.3.

**TABLE C403.11.3
MINIMUM PIPE INSULATION THICKNESS (in inches)a, c**

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu • in./h • ft ² • °F) ^b	Mean Rating Temperature, °F	< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

a. For piping smaller than 1½ inches and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted (before thickness adjustment required in footnote b) but not to a thickness less than 1 inch.

b. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:

$$T = r [(1 + t/r)K/k - 1]$$

where:

T = minimum insulation thickness,

r = actual outside radius of pipe,

t = insulation thickness listed in the table for applicable fluid temperature and pipe size,

K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu • in/h • ft² • °F) and

k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

c. For direct-buried heating and hot water system piping, reduction of these thicknesses by 1½ inches (38 mm) shall be permitted (before thickness adjustment required in footnote b) but not to thicknesses less than 1 inch.

C404.4 Insulation of piping. Piping from a water heater to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table C403.11.3. On both the inlet and outlet piping of a storage water heater or heated water storage tank, the piping to a heat trap or the first 8 feet (2438

mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table C403.11.3 or the heat trace manufacturer's instructions. Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation.

Exception: Tubular pipe insulation shall not be required on the following:

1. The tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance.
2. Valves, pumps, strainers and threaded unions in piping that is 1 inch (25 mm) or less in nominal diameter.
3. Piping from user-controlled shower and bath mixing valves to the water outlets.
4. Cold-water piping of a demand recirculation water system.
5. Tubing from a hot drinking-water heating unit to the water outlet.
6. Piping at locations where a vertical support of the piping is installed.
7. Piping surrounded by building insulation with a thermal resistance (*R*-value) of not less than R-3.

C404.5 Heated water supply piping. Heated water supply piping shall be in accordance with Section C404.5.1 or C404.5.2. The flow rate through 1/4-inch (6.4 mm) piping shall be not greater than 0.5 gpm (1.9 L/m). The flow rate through 5/16-inch (7.9 mm) piping shall be not greater than 1 gpm (3.8 L/m). The flow rate through 3/8-inch (9.5 mm) piping shall be not greater than 1.5 gpm (5.7 L/m).

C404.5.1 Maximum allowable pipe length method. The maximum allowable piping length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the following. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

1. For a public lavatory faucet, use the "Public lavatory faucets" column in Table C404.5.1.
2. For all other plumbing fixtures and plumbing appliances, use the "Other fixtures and appliances" column in Table C404.5.1.

**TABLE C404.5.1
PIPING VOLUME AND MAXIMUM
PIPING LENGTHS**

NOMINAL PIPE SIZE (inches)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)	
		Public lavatory faucets	Other fixtures and appliances
$\frac{1}{4}$	0.33	6	50
$\frac{5}{16}$	0.5	4	50
$\frac{3}{8}$	0.75	3	50
$\frac{1}{2}$	1.5	2	43
$\frac{5}{8}$	2	1	32
$\frac{3}{4}$	3	0.5	21
$\frac{7}{8}$	4	0.5	16
1	5	0.5	13
$1\frac{1}{4}$	8	0.5	8
$1\frac{1}{2}$	11	0.5	6
2 or larger	18	0.5	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L, 1 gallon = 128 ounces.

C404.6 Heated-water circulating and temperature maintenance systems. Heated-water circulation systems shall be in accordance with Section C404.6.1. Heat trace temperature maintenance systems shall be in accordance with Section C404.6.2. Controls for hot water storage shall be in accordance with Section C404.6.3. Automatic controls, temperature sensors and pumps shall be in a location with *access*. Manual controls shall be in a location with *ready access*.

Author's Note: Pay special attention to the location of manual controls as the ready access is provision is new to the 2018 code.

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water.

C404.6.3 Controls for hot water storage. The controls on pumps that circulate water between a water heater and a heated-water storage tank shall limit operation of the pump from heating cycle startup to not greater than 5 minutes after the end of the cycle.

C404.7 Demand recirculation controls. Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).

Author's Note: Please pay close attention to the requirements as C404.7 is a new provision of the 2018 code.