PART 3

3 Amendments to 2018 International Energy Conservation Construction Code Residential Provisions

3.1 Amendments to Section 401.2

R401.2 Compliance. Projects shall comply with one of the following:

1. The provisions of Sections R401 through R404.
2. The provisions of Sections R401 through R404 and the provisions of Section R408 (passive house).
3. The provisions of Section R406 (ERI).
4. For *Group* R-2, *Group* R-3 *and Group* R-4 *buildings*, the provisions of Section R405 (simulated performance) and the provisions of Sections R401 through R404 labeled "Mandatory." The building energy cost shall be equal to or less than 80 percent of the standard reference design building.

3.2 Amendments to Table R402.1.2 Insulation and fenestration requirements by component

Table R402.1.2
Insulation and Fenestration Requirements by Component[a]

Climate Zone	Fenestration U-factor[h]	Skylight U-factor[h]	Glazed fenestration SHGC[h]	Ceiling R-Value	Wood Frame Wall[b,c] R-Value	Mass Wall[d] R-Value	Floor R-Value	Basement Wall[e] R-Value	Slab[f] R-Value and Depth	Crawl Space Wall[e] R-Value
4	0.27	0.50	0.4	49	21 int. or 20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19
5	0.27	0.50	NR	49	21 int. or 20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19
6	0.27	0.50	NR	49	20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19

NR = Not Required
For SI: 1 foot = 304.8 mm.

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. Int. (intermediate framings) denotes standard framing 16 inches on center. Headers shall be insulated with a minimum of R-10 insulation.
c. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+10" means R-13 cavity insulation plus R-10 continuous insulation.
d. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies when more than half the insulation is on the interior of the mass wall.
e. 15/19 means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall.
f. R-10 continuous 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.
g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
h. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

3.3 Amendments to Table R402.1.4 Equivalent U-factors

Table R402.1.4
Equivalent U-factors[a]

Climate Zone	Fenestration U-factor	Skylight U-factor	Ceiling U-factor	Frame Wall U-factor	Mass Wall U-factor[b]	Floor U-factor	Basement Wall U-factor	Crawl Space Wall U-factor
4	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
5	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
6	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. Mass wall shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall U-factor shall not exceed 0.056.

3.4 Amendments to Section R402.2.2 Ceilings without attic spaces

R402.2.2 Ceiling without attic spaces. Where Section R402.1.2 requires insulation R-values greater than R-38 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m^2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

3.5 Amendments to Section R402.4.1.1 Installation

R402.4.1.1 Installation. The components of the *building thermal envelope* as indicated in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instruction and the criteria indicated in Table R402.4.1.1 as applicable to the method of construction. An approved agency shall inspect all components and verify compliance. The inspection shall include an open wall visual inspection of all components included in Table R402.4.1.1 and shall be installed so that the insulation material uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions, and is split, installed, or fitted tightly around wiring and other penetrations in the cavity. No more than 2 percent of the total insulated area shall be compressed below the thickness required to attain the labeled R-value or contain gaps or voids in the insulation.

3.6 Amendments to Section R403.3 Ducts

R403.3 Ducts. All ducts and air handlers shall be installed in accordance with Section R403.3.1 through R403.3.8, where applicable. The duct system in new buildings and additions shall be located in a conditioned space in accordance with Sections R403.3.7 (1) and R403.3.7 (2).

3.7 Addition of New Section R403.3.8 Duct system sizing (Mandatory)

R403.3.8 Duct system sizing (Mandatory). Ducts shall be sized in accordance with ACCA Manual D based on calculations made in accordance with Sections R403.7 and R403.8.

3.8 Amendments to Section R403.5 Service hot water systems

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5

3.9 Amendments to Section R403.5.4 Drain water heat recovery units

R403.5.4 Drain water heat recovery units. Drain water heat recovery units shall have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO PS 92 and be tested and labeled in accordance with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

3.10 Addition of New Section R403.5.5 Supply of heated water

R403.5.5 Supply of heated water. In new *buildings*, heated water supply piping shall be in accordance with one of the following:

> **R403.5.5.1 Maximum allowable pipe length method.** The maximum allowable pipe length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the maximum pipe length in Table R403.5.5.1. Where the length contains more than one size of pipe, the largest size shall be used for determining the maximum allowable length of the piping in Table R403.5.5.1.

R403.5.5.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1. The maximum volume of hot or tempered water in the piping to public lavatory faucets shall be 2 ounces. For fixtures other than public lavatory faucets, the maximum volume shall be 64 ounces for hot or tempered water from a water heater or boiler; and 24 ounces for hot or tempered water from a circulation loop pipe or an electrically heat-traced pipe. The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1.

R403.5.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the source of hot water and the termination of the fixture supply pipe. The volume shall be determined from the "Volume" column of Table R403.5.5.1. The volume contained within fixture shutoff valves, flexible water supply connectors to a fixture fitting, or within a fixture fitting shall not be included in the water volume determination. Where hot or tempered water is supplied by a circulation loop pipe or a heat-traced pipe, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Table R403.5.5.1
Pipe Volume and Maximum Piping Lengths

Nominal Pipe or Tube Size (inch)	VOLUME (Liquid Ounces Per Foot Length)	Maximum Pipe or Tube Length		
		System without a circulation loop or heat-traced line (feet)	System with a circulation loop or heat-traced line (feet)	Lavatory faucets – public (metering and nonmetering (feet)
1/4[a]	0.33	50	16	6
5/16[a]	0.5	50	16	4
3/8[a]	0.75	50	16	3
1/2	1.5	43	16	2
5/8	2	32	12	1
3/4	3	21	8	0.5
7/8	4	16	6	0.5
1	5	13	5	0.5
1 1/4	8	8	3	0.5
1 1/2	11	6	2	0.5
2 or larger	18	4	1	0.5

a. The flow rate for ¼-inch size pipe or tube is limited to 0.5 gallons per minute; for 5/16-inch size, it is limited to 1 gpm; for 3/8-inch size, it is limited to 1.5 gpm.

R403.5.5.3 Drain water heat recovery units. New buildings shall include a drain water heat recovery unit that captures heat from at least one shower, and such drain water heat recovery unit must have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO PS 92 and be tested and labeled in accordance with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers.

Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

R403.5.5.4 Recirculation Systems. Projects shall include a recirculation system with no more than 0.5-gallon (1.9 liter) storage. The storage limit shall be measured from the point where the branch feeding the fixture branches off the recirculation loop to the fixture. Recirculation systems must be based on an occupant-controlled switch or an occupancy sensor, installed in each bathroom, which is located beyond a 0.5-gallon stored-volume range from the water heater.

3.11 Addition of New Section R403.6.2 Balanced and HRV/ERV systems (Mandatory)

R403.6.2 Balanced and HRV/ERV systems (Mandatory). In new buildings, every dwelling unit shall be served by a heat recovery ventilator (HRV) or energy recovery ventilator (ERV) installed per manufacturer's instructions. The HRV/ERV must be sized adequately for the specific application, which will include the building's conditioned area, and number of occupants.

Exception: In Climate Zone 4, a balanced *ventilation* system designed and installed according to the requirements of Section M1507.3 of the 2015 International Residential Code (IRC) that uses the return side of the building's heating and/or cooling system air handler to supply outdoor air, shall be permitted to comply with this section. When the outdoor air supply is ducted to the heating and/or cooling system air handler, the mixed air temperature shall not be less than that permitted by the heating equipment manufacturer's installation instructions. Heating and/or cooling system air handlers used to distribute outdoor air shall be field-verified to not exceed an efficacy of 45 W/CFM if using furnaces for heating and 58 W/CFM if using other forms of heating. In the balanced system design, an equivalent exhaust air flow rate shall be provided simultaneously by one or more exhaust fans, located remotely from the source of supply air. The balanced system's exhaust and supply fans shall be interlocked for operation, sized to provide equivalent air flow at a rate greater than or equal to that determined by IRC Table M1507.3.3(1) and shall have their fan capacities adjusted for intermittent run time per Table M1507.3.3(2). Continuous operation of the balanced *ventilation* system shall not be permitted.

3.12 Addition of New Section R403.6.3 Verification

R403.6.3 Verification. Installed performance of the mechanical *ventilation* system shall be tested and verified by an *approved agency* and measured using a flow hood, flow grid, or other airflow measuring device in accordance with Air Conditioning Contractors of America (ACCA) HVAC Quality Installation Verification Protocols – ANSI/ACCA 9QIvp-2016.

3.13 Amendments to Section R404.1 Lighting equipment (Mandatory)

R404.1 Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall use lamps with an efficacy of at least 65 lumens per watt or have a total luminaire efficacy of at least 45 lumens per watt.

R404.1.1 Lighting equipment (Mandatory). Fuel gas lighting systems shall not have continuously burning pilot lights.

3.14 Addition of New Section R404.2 Electrical power packages (Mandatory)

R404.2 Electrical power packages (Mandatory). New buildings shall comply with the following:

1. Solar-ready zone. Detached one and two-family dwellings and townhouses where the conditioned space is greater than 1,400 square feet shall comply with the requirements of Appendix RA.
2. Electrical Vehicle Service Equipment Capable. Detached one or two-family dwellings and townhouses with parking area provided on the *building site* shall provide a 208/240V 40-amp outlet for each dwelling unit or panel capacity and conduit for the future installation of such an outlet. Outlet or conduit termination shall be adjacent to the parking area. For residential occupancies where there is a common parking area, provide either:
   a. Panel capacity and conduit for the future installation of 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet, or
   b. 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet.

3.15 Amendments to Table R406.4 Maximum Energy Rating Index

Table R406.4
Maximum Energy Rating Index

Climate Zone	Energy Rating Index[a]
4	50
5	50
6	50

a. Where *on-site renewable energy* is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.4 of the 2015 *International Energy Conservation Code.*

3.16 Addition of New Section R408 Passive House

Section R408
Passive House

R408.1 General. *Buildings* shall comply with either Section R408.1.1 or R408.1.2 and shall comply with Section R408.2.

R408.1.1. Passive House Institute US (PHIUS) Approved Software. PHIUS+. Passive Building Standard - North America, where Specific Space Heat Demand and (sensible only) Cooling Demand, as modeled and field-verified by a Certified Passive House Consultant, is less than or equal to 9kBTU/ft2/year. The *dwelling unit* shall also be tested with a blower door and found to exhibit no more than 0.05 CFM50/ft² or 0.08 CFM75/ft² of air leakage.

R408.1.2 Passive House Institute (PHI) Approved Software. Passive House Institute: Low Energy Building Standard, where Specific Space Heating and (sensible only) Cooling Demand is less than or equal to 9.5 kBTU/ft²/year, as modeled and field-verified by a Certified Passive House Consultant. The *dwelling unit* shall also be tested with a blower door and found to exhibit an *infiltration* rate of no more than 1.0 air changes per hour under a pressure of 50 Pascals.

R408.2 Documentation

1. If using the PHIUS software:
    a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:
        i. A list of compliance features; and
        ii. A statement that the estimated Specific Space Heat Demand is "based on plans."
    b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:
        i. A copy of the final report submitted on a form that is approved to document compliance with PHIUS+ standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heat Demand of less than or equal to 9 kBTU/ft2/year.

2. If using the PHI software:

   a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:

      i. A list of compliance features; and

      ii. A statement that the estimated Specific Space Heating and Cooling Demand is "based on plans."

   b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:

      i. A copy of the final report submitted on a form that is approved to document compliance with PHI standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heating or Cooling Demand is less than or equal to 9.5 kBTU/ft^2/year.

3.17 Amendments to "ACCA" in Chapter 6 Referenced Standards

Manual D—16: Residential Duct Systems

R403.3.8

Manual J—16: Residential Load Calculation Eighth Edition

R403.7

Manual S—14: Residential Equipment Selection

R403.7

3.18 Addition of a new entry for "IAPMO" to Chapter 6 Referenced Standards

IAPMO **International Association of Plumbing and Mechanical Officials**
4755 E. Philadelphia St.
Ontario, CA 91761

IAPMO IGC 346:2017 Test Method for Measuring the Performance of Drain Water Heat Recovery Units

R403.5.4.3

IAPMO PS 92-2013: Heat Exchangers and Indirect Water Heaters

R403.5.4.3

3.19 Addition of a new entry for "PHI" to Chapter 6 Referenced Standards

PHI **Passive House Institute**
Rheistrasse 44/46
64283 Darmstadt, Germany

PHI 2016: Low Energy Building Standard, Version 9f
R408.1

3.20 Addition of a New Entry for "PHIUS" to Chapter 6 Referenced Standards

PHIUS **Passive House Institute US**
116 West Illinois Street, Suite 5E
Chicago, IL 60654, USA

PHIUS+ 2015: Passive Building Standard – North America
R408.1