

D R A F T

Ordinance No. \_\_\_\_ ORDINANCE: To Amend Chapter 5 of the Rockville City Code, entitled “Buildings and Building Regulations,” Article VIII, entitled “Energy Conservation Code” so as to adopt the ICC International Energy Conservation Code, 2006 Edition, with certain additions, deletions and amendments

BE IT ORDAINED BY THE MAYOR AND COUNCIL OF ROCKVILLE that Chapter 5 of the Rockville City Code entitled “Buildings and Building Regulations,” Article VIII, entitled “Energy Conservation Code,” be amended as follows:

SECTION 1. That Division 1, “Generally,” and Division 2, “Technical Standards” be amended to read as follows:

**ARTICLE VIII. ENERGY CONSERVATION CODE**

**DIVISION 1. GENERALLY**

**Sec. 5-156. Scope.**

This article regulates the design and construction of the exterior envelopes and selection of HVAC, service water heating, electrical distribution systems and equipment required for the purpose of effective use of energy and shall govern all buildings and structures, or portions thereof, hereafter erected that provide facilities or shelter for human occupancy.

**DIVISION 2. TECHNICAL STANDARDS**

**Sec. 5-161. International[BOCA National] Energy Conservation Code--Adopted.**

The [*BOCA National Energy Conservation Code*, 1996 Eighth Edition] ICC International Energy Conservation Code, 2006 Edition, issued by the [Building Officials and Code Administrators International, Inc.] International Code Council (ICC), is hereby adopted as the energy conservation code for the City. One (1) copy of same as adopted shall be maintained by the City Clerk in the office of the Council and made available for inspection by the public during regular office hours. Any amendment or change in such code promulgated by the [Building Officials and Code Administrators International, Inc.] ICC shall not become part of this article until the modifications have been duly adopted by ordinance.

SECTION 2. That a new Section 5-162 is added as follows:

**Sec. 5-162. Same--Amendments.**

The ICC International Energy Conservation Code, 2006 Edition (IECC), is amended in the following respects:

*Section 101.1* of the IECC is amended to read as follows:

**101.1 Title.** This code shall be known as the *International Energy Conservation Code of the City of Rockville*, and shall be cited as such. It is referred to herein as “this code”.

*Section 103.1.1* of the IECC is amended to read as follows:

**103.1.1 Above code programs.** The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code if the program provides a detailed written energy analysis study demonstrating that the requirements in the program exceed all requirements of this code and includes a requirement for inspections of each building by an accredited independent party to determine compliance. Buildings approved in writing by such an energy efficiency program and that meet all mandatory provisions of this chapter shall be considered in compliance with this code.

*Section 202 Definitions* of the IECC is amended by adding the following definitions:

**AIR BARRIER.** Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material, or a combination of materials.

**HIGH-EFFICACY LAMPS:** Compact florescent lamps, T-8 or smaller diameter linear florescent lamps, or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts,
2. 50 lumens per watt for lamps over 15 watts to 40 watts,
3. 40 lumens per watt for lamps 15 watts or less

*Section 301.1* of the IECC is amended to read as follows:

**301.1 General.** Climate zone 4 shall be used for the City of Rockville in determining the applicable requirements from Chapters 4 and 5.

*Section 301.2 and 301.3* of the IECC are deleted.

Section 401.2 of the IECC is amended to read as follows:

**401.2 Compliance.** Projects shall comply with Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 (referred to as the mandatory provisions) and either:

1. Sections 402.1 through 402.3 (prescriptive); or
2. Section 404 (performance).

Table 402.1.1 of the IECC is amended to read as follows:

**TABLE 402.1.1  
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT <sup>a</sup>**

| CLIMATE ZONE | FENESTRATION U-FACTOR | SKY-LIGHT U-FACTOR <sup>b</sup> | GLAZED FENESTRATION SHGC | CEILING R-VALUE | WOOD FRAME WALL R-VALUE | MASS WALL R-VALUE <sup>c</sup> | FLOOR R-VALUE | BASEMENT <sup>c</sup> WALL R-VALUE | SLAB <sup>d</sup> R-VALUE & DEPTH | CRAWL SPACE <sup>c</sup> WALL R-VALUE |
|--------------|-----------------------|---------------------------------|--------------------------|-----------------|-------------------------|--------------------------------|---------------|------------------------------------|-----------------------------------|---------------------------------------|
| 4            | 0.35                  | 0.60                            | 0.45                     | 49              | 19 or 13+5 <sup>e</sup> | 5/10                           | 19            | 10 / 13                            | 10, 2ft                           | 10 / 13                               |

For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 × 6 cavity.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- d. R-5 shall be added to the required slab edge R-values for heated slabs.
- e. Any combination of insulation shall be permitted to meet the requirements by summing the R-value of the cavity insulation and the R-value of the insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of the exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

Table 402.1.3 of the IECC is amended to read as follows:

**TABLE 402.1.3  
EQUIVALENT U-FACTORS <sup>a</sup>**

| CLIMATE ZONE | FENESTRATION U-FACTOR | SKY-LIGHT U-FACTOR | CEILING U-FACTOR | FRAME WALL U-FACTOR | MASS WALL U-FACTOR | FLOOR U-FACTOR | BASEMENT WALL U-FACTOR | CRAWL SPACE WALL U-FACTOR |
|--------------|-----------------------|--------------------|------------------|---------------------|--------------------|----------------|------------------------|---------------------------|
| 4            | 0.35                  | 0.60               | 0.020            | 0.056               | 0.141              | 0.047          | 0.059                  | 0.065                     |

- a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.

Section 402.1.5 of the IECC is added to read as follows:

**402.1.5 Envelope component descriptions and default values.** When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Tables 402.1.5.1 through 402.1.5.3 shall be used unless alternate values are approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation with the default framing fractions in Tables 402.1.5.1 through 402.1.5.3. Subject to approval by the code official, the frame fractions for the proposed design shall be permitted to be determined by the type of construction (Satisfactory, Intermediate or Advanced) as defined in Sections 402.1.5.1 through 402.1.5.3.

**402.1.5.1 Wood stud frame walls.** The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame walls are defined as follows:

*Satisfactory Insulation and Framing Fractions:*

Satisfactory wood stud frame walls include studs framed on 16-inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs.

Studs and plates: 21%

Insulated cavity: 75%

Headers: 4%

*Intermediate Insulation and Framing Fractions:*

Intermediate wood stud frame walls include studs framed on 16-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs.

Studs and plates: 18%

Insulated cavity: 78%

Headers: 4%

*Advanced Insulation and Framing Fractions:*

Advanced wood stud frame walls include studs framed on 24-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header.

Studs and plates: 13%

Insulated cavity: 83%

Headers: 4%

**TABLE 402.1.5.1  
FRAME WALL COMPONENT DEFAULT VALUES**

| <b>Component</b>   | <b>Default Value</b>     |                                  |
|--|--------------------------|----------------------------------|
| Interior Air Film R-Value                                  | 0.68                     |                                  |
| Drywall Layer R-Value                                      | 0.45                     |                                  |
| Cavity Layer R-Values                                      | Insulation: As Specified | Framing: R-1.25 per inch of wood |
| Standard Reference Design<br>Insulation / Framing Fraction | Insulation: 83 %         | Framing: 17 %                    |
| Proposed Design Default Insulation /<br>Framing Fraction   | Insulation: 78%          | Framing: 22%                     |
| Insulating Sheathing Layer R-Value                         | 0 or as installed        |                                  |
| Structural Sheathing Layer R-Value                         | 0.62                     |                                  |
| Siding Layer R-Value                                       | 0.61                     |                                  |
| Exterior Air Film R-Value                                  | 0.25                     |                                  |

**402.1.5.2 Wood frame floors.** The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood frame floors are defined as follows:

*Satisfactory Insulation and Framing Fractions:* Satisfactory wood floors include open joist systems framed 12-inch centers or solid joists framed 16-inch centers.

Framing: 12%

Insulated cavity: 88%

*Intermediate Insulation and Framing Fractions:* Intermediate wood floors include open joist systems framed 16-inch centers or solid joists framed 20-inch centers.

Framing: 10%

Insulated cavity: 90%

*Advanced Insulation and Framing Fractions:* Advanced wood floors include open joist systems framed 20-inch centers or joists framed 24-inch centers.

Framing: 8%

Insulated cavity: 92%

**TABLE 402.1.5.2  
FLOOR COMPONENT DEFAULT VALUES**

| <b>Component</b>   | <b>Default Value</b>     |                                  |
|--|--------------------------|----------------------------------|
| Interior Air Film R-Value                                  | 0.92                     |                                  |
| Floor Covering R-Value                                     | 1.23                     |                                  |
| Floor Subfloor R-Value                                     | 0.94                     |                                  |
| Cavity Layer R-Values                                      | Insulation: As Specified | Framing: R-1.25 per inch of wood |
| Standard Reference Design<br>Insulation / Framing Fraction | Insulation: 92%          | Framing: 8%                      |
| Proposed Design Default<br>Insulation / Framing Fraction   | Insulation: 90%          | Framing: 10%                     |
| Exterior Air Film R-Value                                  | 0.92                     |                                  |

**402.1.5.3 Wood frame ceilings.** The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood frame ceilings are defined as follows:

*Satisfactory Insulation and Framing Fractions:*

Satisfactory ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 11%

Insulated cavity: 89%

*Intermediate Insulation and Framing Fractions:*

Intermediate ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 9%

Insulated cavity: 91%

*Advanced Insulation and Framing Fractions:*

Advanced ceiling insulation and framing assumes full and even depth of insulation extending to the outside edge of exterior perimeter of the ceiling.

Framing: 7%

Insulated cavity: 93%

**TABLE 402.1.5.3  
CEILING COMPONENT DEFAULT VALUES**

| <b>Component</b>   | <b>Default Value</b>     |                                  |
|--|--------------------------|----------------------------------|
| Interior Air Film R-Value                                  | 0.61                     |                                  |
| Drywall Layer R-Value                                      | 0.45                     |                                  |
| Cavity Layer R-Values                                      | Insulation: As Specified | Framing: R-1.25 per inch of wood |
| Standard Reference Design<br>Insulation / Framing Fraction | Insulation: 93%          | Framing: 7%                      |
| Proposed Design Default<br>Insulation / Framing Fraction   | Insulation: 91%          | Framing: 9%                      |
| Exterior Air Film R-Value                                  | 0.61                     |                                  |

*Sections 402.2.1 and 402.2.2 of the IECC are deleted.*

*Section 402.4.1.1 of the IECC is added to read as follows:*

**402.4.1.1 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.1.1.1 and 402.4.1.1.2:

**402.4.1.1.1 Testing option.** Building envelope tightness shall be tested to have an air leakage less than 0.00036 SLA when tested with a blower door at a pressure of 50 Pascals (0.2 inch w.g.). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances and sealing thereof. Where required by the code official, an approved party independent from the builder shall conduct the building envelope tightness test. A written test report showing compliance shall be provided to the code official.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors connecting conditioned spaces shall be open; doors connecting to unconditioned spaces shall be closed but not sealed;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts systems shall be sealed, and supply and return registers shall not be sealed.

**402.4.1.1.2 Visual inspection option.** Building envelope tightness and insulation installation shall be field verified to meet the criteria in Table 402.4.1.1.2. Where required by the code official, an approved party independent from the builder and the installer of the insulation shall inspect the air barrier and insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the code official before interior finish materials are applied.

**TABLE 402.4.1.1.2  
AIR BARRIER AND INSULATION INSPECTION**

| <u>COMPONENT</u>  | <u>CRITERIA</u>   |
|---|---|
| Air barrier and thermal barrier                         | Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.<br>Breaks or joints in the air barrier are filled or repaired.<br>Air permeable insulation is not used as a sealing material.<br>Air permeable insulation is inside of an air barrier. |
| Ceiling / attic   | Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.   |
| Walls   | Corners and headers are sealed and insulated.<br>Junction of foundation and sill plate is sealed.   |
| Windows and doors                                       | Space between window/door jambs and framing is sealed.  |
| Rim joists  | Rim joists are insulated and include an air barrier.  |
| Floors (including above garage and cantilevered floors) | Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.   |
| Crawlspace walls  | Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with overlapping joints taped.  |
| Shafts, penetrations                                    | Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.   |
| Narrow cavities   | Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.   |
| Garage separation                                       | Air sealing is provided between the garage and conditioned spaces.  |
| Recessed lighting                                       | Recessed light fixtures are airtight, IC rated, and sealed to drywall.  |
| Plumbing and Wiring                                     | Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.   |
| Shower / tub on exterior wall                           | Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.   |
| Electrical / phone box on exterior walls                | Air barrier extends behind boxes or an air sealed type boxes are installed.   |
| Common wall   | Air barrier is installed in common wall between dwelling units.   |
| HVAC register boots                                     | HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.   |
| Fireplace   | Fireplace walls include an air barrier.   |

*Section 402.4.4* of the IECC is added to read as follows:

**402.4.4 Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

*Section 402.6* of the IECC is added to read as follows:

**402.6 Maximum fenestration U-factor and SHGC. (Mandatory).** The area weighted average maximum fenestration U-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zone 4 for vertical fenestration, and 0.75 in zone 4 for skylights.

Section 402.7 of the IECC is added to read as follows:

**402.7 Minimum opaque envelope requirements (Mandatory).** The thermal requirements for opaque envelope components shall not be less than the requirements in Table 402.7 when determining alternatives to the R-values in Table 402.1.1 under Sections 402.1.3, 402.1.4, or 404.

Table 402.7 of the IECC is added to read as follows:

**TABLE 402.7  
MINIMUM INSULATION REQUIREMENTS BY COMPONENT**

| CLIMATE ZONE | CEILING R-VALUE | WOOD FRAME WALL R-VALUE | MASS WALL R-VALUE | STEEL FRAME WALL R-VALUE <sup>a</sup> | FLOOR R-VALUE | BASEMENT WALL R-VALUE | SLAB R-VALUE AND DEPTH | CRAWL SPACE WALL R-VALUE |
|--------------|-----------------|-------------------------|-------------------|---------------------------------------|---------------|-----------------------|------------------------|--------------------------|
| 4            | 30              | 11                      | 4                 | R-11+3                                | 13            | 5/11 <sup>b</sup>     | 5, 2ft                 | 5/11 <sup>b</sup>        |

a. Cavity Insulation R-value is listed first, followed by continuous insulation R-value.

b. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation configuration meets the requirement.

Section 403.2.2 of the IECC is amended to read as follows:

**403.2.2 Sealing.** All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the International Residential Code. A written test report showing compliance with the duct tightness tests below shall be provided to the code official. The report shall include the test type and tested leakage in CFM per 100 ft<sup>2</sup> of conditioned floor area at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Where required by the code official, an approved party independent from the builder shall conduct the test. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 CFM per 100 ft<sup>2</sup> of conditioned floor area or a total leakage less than or equal to 12 CFM per 100 ft<sup>2</sup> of conditioned floor area. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 CFM per 100 ft<sup>2</sup> of conditioned floor area. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 CFM per 100 ft<sup>2</sup> of conditioned floor area.

**Exceptions:** Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

*Section 403.4* is deleted in its entirety and replaced to read as follows:

**403.4 Circulating hot water systems.** All circulating service hot water piping shall be insulated to at least R-2 for pipes sized 1” in diameter or less and R-4 for pipes larger than 1” in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

**403.4.1 Service water heating.** Service water heating systems and piping shall be installed in accordance with the applicable requirements of Sections 403.4.1.1 through 403.4.1.2.

**403.4.1.1 Insulation.** All Service Hot Water piping shall be insulated to at least R-2 for pipes sized 1” in diameter or less and R-4 for pipes larger than 1” in diameter for the distance between the service water heater to within 5 feet of each fixture connected to the hot water pipe.

**Exception:** Hot water distribution systems not located below ground or located in a mass floor or mass wall in contact with ground that supply hot water from condensing gas service water heating equipment, from instantaneous service electric or gas water heating equipment or from heat pump electric service water heating equipment.

**403.4.1.2 Stub-in for solar water.** All service water heating distribution systems shall have a stub-in connection point for future Solar Hot Water Systems in an accessible location within 5 feet of the roof with an access panel and identified. Installation of solar hot water heating systems shall comply with Section M2301 of the International Residential Code.

*Section 403.6* of the IECC is amended to read as follows:

**403.6 Equipment sizing.** Heating and cooling equipment shall be sized in accordance with this section and Table 403.6.

Table 403.6 is added to the IECC to read as follows:

**TABLE 403.6  
HEATING AND COOLING EQUIPMENT SIZING**

| UNIT  | MAXIMUM OVERSIZING<br>PERCENTAGE <sup>1,2</sup> | MINIMUM EFFICIENCY &<br>TESTING PROCEDURE |
|---|---|---|
| Air Conditioners  | 15%   | Table 503.2.3(1)                          |
| Multispeed <sup>3</sup> Air-Source<br>Heat Pumps and Ground-<br>Source Heat Pumps | 15%   | Table 503.2.3(2)                          |
| Single-speed Ground<br>Source Heat Pumps  | 25%   | Table 503.2.3(2) or<br>Table 503.2.3(3)   |
| All fuel-fired heating<br>appliances  | 40%   | Table 503.2.3(4) or<br>Table 503.2.3(5)   |

**Notes:**

1. Equipment shall be sized in accordance with ACCA Manual J:
  - a. Indoor and outdoor coils shall be matched for size;
  - b. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available;
  - c. Indoor temperatures shall be 75 F for cooling and 72 F for heating;
  - d. Infiltration rate shall be assumed as 0.00036 Specific Leakage Area (SLA).
2. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.
3. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

Section 403.7 is added to the IECC to read as follows;

**403.7 Electrical power and lighting systems.**

**403.7.1 Scope.** This section applies to lighting equipment, related controls and electric circuits serving the interior spaces and exterior building facades of all residential buildings including accessory structures and garages. Certification of fixture used shall be included on sticker per Section 401.3 and 506.5.

**403.7.2 Lighting Equipment.** A minimum of fifty percent (50%) of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

Table 404.2 of the IECC is amended to read as follows:

*Section 404.2 Mandatory requirements.* Compliance with this section requires that the criteria of Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 be met.

Table 404.5.2 (1) of the IECC is amended to read as follows:

**TABLE 404.5.2(1)**  
**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

| BUILDING COMPONENT            | STANDARD REFERENCE DESIGN   | PROPOSED DESIGN  |
|-------------------------------|---|--|
| Above-grade walls             | Type: mass wall if proposed wall is mass;<br>otherwise wood frame<br>Gross Area: same as proposed<br>U-Factor: from Table 402.1.3<br><br>Solar absorptions = 0.75<br>Remittance = 0.90  | As proposed<br><br>As proposed<br>As proposed, assuming<br>gaps/missing insulation equal to<br>5%, unless otherwise verified<br>As proposed<br>As proposed |
| Basement and crawlspace walls | Type: same as proposed<br>Gross Area: same as proposed<br>U-Factor: from Table 402.1.3, with insulation<br>layer on interior side of walls  | As proposed<br>As proposed<br>As proposed, assuming<br>gaps/missing insulation equal to<br>5%, unless otherwise verified                                   |
| Above-grade floors            | Type: wood frame<br>Gross Area: same as proposed<br>U-Factor: from Table 402.1.3  | As proposed<br>As proposed<br>As proposed, assuming<br>gaps/missing insulation equal to<br>5%, unless otherwise verified                                   |
| Ceilings                      | Type: wood frame<br>Gross Area: same as proposed<br>U-Factor: from Table 402.1.3  | As proposed<br>As proposed<br>As proposed, assuming<br>gaps/missing insulation equal to<br>5%, unless otherwise verified                                   |
| Roofs                         | Type: composition shingle on wood sheathing<br>Gross area: same as proposed<br>Solar absorptance = 0.75<br>Emittance = 0.90   | As proposed<br>As proposed<br>As proposed<br>As proposed   |
| Attics                        | Type: vented with aperture = 1 ft <sup>2</sup> per 300 ft <sup>2</sup><br>ceiling area  | As proposed  |
| Foundations                   | Type: same as proposed  | As proposed  |
| Doors                         | Area: 40 ft <sup>2</sup><br>Orientation: North<br>U-factor: same as fenestration from Table<br>402.1.3  | As proposed<br>As proposed<br>As proposed  |
| Glazing <sup>a</sup>          | Total area <sub>b</sub> =<br>(a) The proposed glazing area; where the<br>proposed glazing area is less than 18% of<br>the conditioned floor area<br>(b) 18% of the conditioned floor area; where<br>the proposed glazing area is 18% or more of | As proposed  |

|                             |  |   |
|-----------------------------|--|---|
|                             | <p>the conditioned floor area<br/> Orientation: equally distributed to four cardinal compass orientations (N, E, S, &amp; W)<br/> U-factor: from Table 402.1.2<br/> SHGC: From Table 402.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used<br/> Interior shade fraction:<br/> Summer (all hours when cooling is required) = 0.70<br/> Winter (all hours when heating is required) = 0.85<br/> External shading: none</p> | <p>As proposed<br/> As proposed<br/> As proposed<br/> Same as standard reference design<sup>c</sup><br/> As proposed</p>  |
| Skylights                   | None   | As proposed   |
| Thermally isolated sunrooms | None   | As proposed   |
| Air exchange rate           | Specific Leakage Area (SLA) <sup>d</sup> = 0.00036 assuming no energy recovery   | <p>For residences that are not tested, the same as the standard reference design<br/> For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate<sup>e</sup> but not less than 0.35 ACH<br/> For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate<sup>e</sup> combined with the mechanical ventilation rate,<sup>f</sup> which shall not be less than <math>0.01 \times CFA + 7.5 \times (N_{br} + 1)</math> where:<br/> CFA = conditioned floor area<br/> N<sub>br</sub> = number of bedrooms</p> |
| Mechanical ventilation      | <p>None, except where mechanical ventilation is specified by the proposed design, in which case:<br/> Annual vent fan energy use: kWh/yr = <math>0.03942 \times CFA + 29.565 \times (N_{br} + 1)</math><br/> where:<br/> CFA = conditioned floor area<br/> N<sub>br</sub> = number of bedrooms</p>   | As proposed   |
| Internal gains              | IGain = $17,900 + 23.8 \times CFA + 4104 \times N_{br}$ (Btu/day per dwelling unit)  | Same as standard reference design   |
| Internal mass               | An internal mass for furniture and contents of 8 pounds per square foot of floor area  | Same as standard reference design, plus any additional mass specifically designed as a thermal storage element <sup>g</sup> but not integral to the building envelope or  |

|                                      |   |  |
|--------------------------------------|---|--|
|                                      |   | structure  |
| Structural mass                      | For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air<br>For masonry basement walls, as proposed, but with insulation required by Table 402.1.3 located on the interior side of the walls<br>For other walls, for ceilings, floors, and interior walls, wood frame construction   | As proposed<br>As proposed<br>As proposed  |
| Heating systems <sup>h,i</sup>       | Fuel type: same as proposed design<br>Efficiencies:<br>Electric: air-source heat pump with prevailing federal minimum efficiency<br>Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency<br>Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency<br>Capacity: sized in accordance with Section M1401.3 of the <i>International Residential Code</i> | As proposed<br>As proposed<br>As proposed<br>As proposed<br>As proposed                |
| Cooling systems <sup>h,j</sup>       | Fuel type: Electric<br>Efficiency: in accordance with prevailing federal minimum standards<br>Capacity: sized in accordance with Section M1401.3 of the <i>International Residential Code</i>   | As proposed<br>As proposed<br>As proposed  |
| Service Water Heating <sup>h,k</sup> | Fuel type: same as proposed design<br>Efficiency: in accordance with prevailing Federal minimum standards<br>Use: gal/day = 30 + 10 × N <sub>br</sub><br>Tank temperature: 120°F  | As proposed<br>As proposed<br>Same as standard reference<br>Same as standard reference |
| Thermal distribution systems         | A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.  | As tested or as specified in Table 404.5.2(2) if not tested.                           |
| Thermostat                           | Type: Manual, cooling temperature setpoint = 75°F; Heating temperature set point = 70 °F  | Same as standard reference   |

For SI: 1 square foot = 0.93 m<sup>2</sup>; 1 British thermal unit = 1055 J; 1 pound per square foot = 4.88 kg/m<sup>2</sup>; 1 gallon (U.S.) = 3.785 L; °C = (°F-32)/1.8.

a. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than 50% of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.

b. For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine glazing area:

$$AF = A_s \_ FA \_ F$$

where:

$AF$  = Total glazing area.

$A_s$  = Standard reference design total glazing area.

$FA$  = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 x below-grade boundary wall area).

$F$  = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater. and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

c. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.

d. Where Leakage Area ( $L$ ) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

$SLA = L/CFA$

where  $L$  and  $CFA$  are in the same units.

e. Tested envelope leakage shall be determined and documented by an independent party approved by the code official. Hourly calculations as specified in the 2001 ASHRAE *Handbook of Fundamentals*, Chapter 26, page 26.21, Equation 40 (Sherman-Grimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.

f. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.

g. Thermal Storage Element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

h. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

i. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.

j. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

k. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum Energy Factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

Table 404.5.2 (2) of the IECC is amended to read as follows:

**TABLE 404.5.2(2)**  
**DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS<sup>a</sup>**

| DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION:                                   | FORCED AIR SYSTEMS | HYDRONIC SYSTEMS <sup>(b)</sup> |
|--|--------------------|---------------------------------|
| Distribution system components located in unconditioned space                      | --                 | 0.95                            |
| Untested distribution systems entirely located in conditioned space <sup>(c)</sup> | 0.88               | 1.00                            |
| "Ductless" systems <sup>(d)</sup>  | 1.00               | --                              |

For SI: 1 cubic foot per minute = 0.47 L/s; 1 square foot = 0.093 m<sup>2</sup>; 1 pound per square inch = 6895 Pa; 1 inch water gauge = 1250 Pa.

a. Default values given by this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

b. Hydronic Systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed loop piping and that do not depend on ducted, forced air flows to maintain space temperatures.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.

d. Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

*Section 501.1 and 501.2 of the IECC is amended to read as follows:*

**501.1 Scope.** The requirements contained in this chapter are applicable to all commercial buildings, or portions of commercial buildings. These commercial buildings shall meet the requirements of ASHRAE/IESNA Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings.

**Exception:** Low-rise residential buildings.

**501.2 Application.** Buildings less than 100,000 square feet shall have the alternative option to meet the requirements of the New Building Institute *Core Performance Guide*. Office buildings less than 20,000 square feet shall have the alternative option to meet the requirements of the *ASHRAE Advanced Energy Design Guide for Small Office Buildings*. Retail buildings less than 20,000 square feet shall have the alternative option to meet the requirements of the *ASHRAE Advanced Energy Design Guide for Small Retail Building*. K-12 Schools shall have the alternative option to meet the requirements of the *ASHRAE Advanced Energy Design Guide for K-12 School Building*. Warehouses and Self Storage buildings less than 50,000 square feet shall have the alternative option to meet the requirements of The ASHRAE 30% Advanced Energy Design Guide for Small Warehouses and Self Storage Buildings.

*Sections 502, 503, 504, 505 and 506 of the IECC are deleted in their entirety.*

*Chapter 6 of the IECC is amended to delete reference to ASHRAE Reference Standard 90.1-2004 and replace it ASHRAE Reference Standard 90.1-2007.*

NOTE: Underlining indicates language added in SECTION 1.  
[Brackets] indicate language deleted in SECTION 1.  
SECTION 2 is all new language.

I hereby certify that the foregoing is a true and correct copy of an ordinance adopted by the Mayor and Council at its meeting of

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Claire F. Funkhouser, City Clerk