State Commercial Energy Code; (What’s going on with adoption)

2012 to 2018
International Energy Conservation Code Update
Introduction

David Ruffcorn, AIA
Construction/Design Engineer Senior
Iowa State Fire Marshal’s Office
Building Code Bureau
Iowa Code Status

• State has adopted Building Codes since 1978
• Iowa is a Hybrid Home Rule State
  – IBC, IRC, IEBC, are Home Rule and have various adopted years depending on jurisdiction
  – Creates Implementation Issues with years
State Building Code -IAC 661-
Chapter 301 consists of the following adopted codes

- 2015 International Building Code
- 2015 International Residential Building Code
- 2015 International Existing Building Code
- 2012 International Energy Conservation Code – Statewide
- 2017 National Electrical Code - Statewide
- 2015 International Mechanical Code – Statewide under the Iowa Department of Public Health
- ADA 2010
- 2018 International Energy Conservation Code – Commercial only spring 2020?
Home Rule Codes

Dates vary by Jurisdiction

- 2015 International Building Code – *By Jurisdiction*
- 2015 International Residential Building Code - *By Jurisdiction*
- 2015 International Existing Building Code - *By Jurisdiction*
Adoption of Statewide Codes

- Staff does not adopt, vote or ask for codes to change – you do!

- Staff writes administrative code and handles the meetings.
  - Work groups – work through possible changes
  - Governors Office - Politics
  - Codes Council – Have a yes or no vote
  - Hearings – Everyone has their say!
  - Legislative Committee – Did staff do their due-diligence?
Phone Conferences (**Positive Result**)

- What is your opinion about moving to the 2018 IECC?
- Where do you get your information about the Energy Code?
- Has the Energy Code had an impact on construction, positive or negative?
- Has there been a drop in your business because of the Energy Code?
- Do you use equipment that is fuel burning, natural draft?

Meetings at Oran Pape Building (**Positive Result**)
Construction of Statute.

Legal opinion from DPS Attorneys:

- Local jurisdictions can not adopt an Energy Code, more strict or less strict than what is adopted by the State.
What’s Changed!
<table>
<thead>
<tr>
<th>IECC 2018</th>
<th>IECC 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1 – Scope and Administration</td>
<td>Chapter 1 – Scope and Application/Administration and Enforcement</td>
</tr>
<tr>
<td>Chapter 2 – Definitions</td>
<td>Chapter 2 – Definitions</td>
</tr>
<tr>
<td>Chapter 3 – General Requirements</td>
<td>Chapter 3 – General Requirements</td>
</tr>
<tr>
<td>Chapter 4 – Commercial Energy Efficiency</td>
<td>Chapter 4 – Commercial Energy Efficiency</td>
</tr>
<tr>
<td>Chapter 5 – Existing Buildings</td>
<td>Chapter 5 – Referenced Standards</td>
</tr>
<tr>
<td>Chapter 6 – Referenced Standards</td>
<td>Chapter 5 – Referenced Standards</td>
</tr>
</tbody>
</table>
Review required by an Architect or Engineer

*Review required.* The plans and specifications for all buildings to be constructed which exceed a total volume of 100,000 cubic feet of enclosed space that is heated or cooled shall be reviewed by a registered architect or licensed professional engineer for compliance with applicable energy efficiency standards. **Buildings that have a total volume of 100,000 cubic feet or less may be reviewed by any designated owner’s representative for compliance with applicable energy efficiency standards.**
IECC Compliance - Two Climate Zones

- Iowa Has Two Climate Zones
  - Zone 5
  - Zone 6
Climate Zones

2018 IECC

ASHRAE 90.1 2016
Commercial Envelope Efficiency

Chapter 4 (CE)
Building Envelope consists of:

- Fenestration
- Roof
- Ceilings
- Walls
  - Above grade
  - Below grade
  - Mass walls
- Floors
- Slab
- Crawl space
There are four options for Compliance

- Prescriptive
- Trade-off
- Component Performance – New in the 2015
- Performance
Mandatory Requirements –

No Matter What Path of Compliance

- Air Leakage
- Air barriers
- Fenestration air leakage
- Rooms Containing Fuel-burning Appliances
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weatherseals
- Vestibules
- Recessed lighting
Paths of Compliance and their Limitations

Prescriptive - C402.1.3 – Insulation component R-value based method

Trade-off - C402.1.4 – Assembly U-factor, C-factor or F-factor based method

Performance - C402.1.5 – Component Performance Alternative

Total Building Performance – C407
### Commercial Roof Insulation by Climate Zone - Prescriptive

#### 2012 IECC

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 EXCEPT MARINE</th>
<th>5 AND MARINE</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
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<td>All Other</td>
<td>Group R</td>
<td>All Other</td>
<td>Group R</td>
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<tr>
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<td>All other</td>
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<td>Group R</td>
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<tr>
<td>Wood framed and</td>
<td>R-13+ R-3.8ci or R-20</td>
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<td>R-13+ R-3.8ci or R-20</td>
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### 2018 IECC

**TABLE C402.1.3**

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<tbody>
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**No Change**
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<td>Group R</td>
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<td></td>
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</tr>
<tr>
<td>Below-grade wall</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>R-7.5ci</td>
<td>R-7.5ci</td>
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<tr>
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<td>R-8.3ci</td>
<td>R-10ci</td>
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<td>R-10ci</td>
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</tr>
</thead>
<tbody>
<tr>
<td>All Other</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>R-10 for 24 below</td>
<td>R-10 for 24 below</td>
<td>R-10 for 24 below</td>
<td>R-15 for 24 below</td>
<td>R-20 for 24 below</td>
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<tr>
<td>Group R</td>
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</tr>
</tbody>
</table>

#### Slab-on-Grade Floors

- Unheated slabs: R-7.5 for 12 below
- Heated slabs: R-7.5 for 12 below

#### Opaque Doors

- Swinging: U-0.61
- Roll-up or sliding: R-4.75

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<td>R-15 for 24 below</td>
<td>R-20 for 24 below</td>
</tr>
</tbody>
</table>

#### Slab-on-Grade Floors

- Unheated slabs: R-7.5 for 12 below + R-5 full slab
- Heated slabs: R-7.5 for 12 below + R-5 full slab

#### Opaque Doors

- Nonswinging: R-4.75
### TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 EXCEPT MARINE</th>
<th>5 AND MARINE 4</th>
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<th>7</th>
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</thead>
<tbody>
<tr>
<td><strong>U-factor</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed fenestration</td>
<td>0.50</td>
<td>0.50</td>
<td>0.46</td>
<td>0.38</td>
<td>0.38</td>
<td>0.36</td>
<td>0.29</td>
<td>0.29</td>
</tr>
<tr>
<td>Operable fenestration</td>
<td>0.65</td>
<td>0.65</td>
<td>0.60</td>
<td>0.45</td>
<td>0.45</td>
<td>0.43</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Entrance doors</td>
<td>1.10</td>
<td>0.83</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>SHGC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHGC</td>
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<td>0.25</td>
<td>0.25</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.45</td>
<td>0.45</td>
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<tr>
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<td>0.50</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td><strong>SHGC</strong></td>
<td></td>
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<td>0.40</td>
<td>NR</td>
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<td></td>
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</tbody>
</table>

NR = No requirement.
### Table C402.4

**Building Envelope Fenestration Maximum U-Factor and SHGC Requirements**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 Except Marine</th>
<th>5 and Marine 4</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td><strong>U-factor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.46</td>
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<td>0.29</td>
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<td>0.60</td>
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<td>0.45</td>
<td>0.43</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Entrance doors</td>
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<td>0.83</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>SHGC</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>SEW</td>
<td>N</td>
<td>SEW</td>
<td>N</td>
<td>SEW</td>
<td>N</td>
<td>SEW</td>
<td>N</td>
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<tr>
<td>PF &lt; 0.2</td>
<td>0.25</td>
<td>0.33</td>
<td>0.25</td>
<td>0.33</td>
<td>0.25</td>
<td>0.33</td>
<td>0.36</td>
<td>0.48</td>
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<tr>
<td>0.2 ≤ PF &lt; 0.5</td>
<td>0.30</td>
<td>0.37</td>
<td>0.30</td>
<td>0.37</td>
<td>0.30</td>
<td>0.37</td>
<td>0.43</td>
<td>0.58</td>
</tr>
<tr>
<td>PF ≥ 0.5</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>Skylights</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U-factor</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
</tbody>
</table>

NR = No Requirement, PF = Projection Factor.

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<sup>a</sup> “N” indicates vertical fenestration oriented within 45 degrees of true north. “SEW” indicates orientations other than “N.” For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.
Use when the envelope assemblies don’t fit in the prescriptive table

- Works for 95% of all projects
- Trades off over insulated areas for under-insulated areas
- Free and simple program
- Tied to table C402.1.4

<table>
<thead>
<tr>
<th>Component</th>
<th>Assembly</th>
<th>Gross Area</th>
<th>Cavity Insulation R-Value</th>
<th>Conduits Insulation R-Value</th>
<th>U-Factor</th>
<th>SHGC</th>
<th>Projection Percent</th>
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<tbody>
<tr>
<td>Roof 1</td>
<td>Non-Wood Deck/ Rafters, etc.</td>
<td>6112</td>
<td>0.0</td>
<td>26.1</td>
<td>0.057</td>
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<td></td>
</tr>
<tr>
<td>Skylight 1</td>
<td>Metal Frame, Double Pane</td>
<td>112</td>
<td>0.0</td>
<td>0.500</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior Wall 1</td>
<td>Solid Concrete or Masonry</td>
<td>6000</td>
<td>22.0</td>
<td>0.0</td>
<td>0.114</td>
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<tr>
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<td>Glass</td>
<td>42</td>
<td>0.0</td>
<td>0.700</td>
<td>0.58</td>
<td>0.00</td>
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<tr>
<td>Window 1</td>
<td>Metal Frame, Double Pane</td>
<td>1500</td>
<td>0.600</td>
<td>0.65</td>
<td>0.00</td>
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<td></td>
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<tr>
<td>Window 2</td>
<td>Metal Frame, Double Pane</td>
<td>56</td>
<td>0.700</td>
<td>0.72</td>
<td>0.00</td>
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<tr>
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<td>Overhead</td>
<td>238</td>
<td>0.140</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door 3</td>
<td>Solid</td>
<td>40</td>
<td>0.200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Wall 2</td>
<td>Metal Frame, 16&quot; o.c.</td>
<td>812</td>
<td>22.0</td>
<td>0.0</td>
<td>0.156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement Wall 1</td>
<td>Solid Concrete or Masonry</td>
<td>2000</td>
<td>10.8</td>
<td>0.082</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor 1</td>
<td>Sub-Grades, Unheated</td>
<td>150</td>
<td>10.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2015/2018 Commercial Compliance Component Performance Alternative

\[ A + B + C + D + E = \text{Zero} \quad \text{(Equation 4-2)} \]

where:

\[ A = \text{Sum of the (UA Diff) values for each distinct assembly type of the building thermal envelope, other than slabs on grade and below-grade walls.} \]
\[ \text{UA Diff} = \text{UA Proposed} - \text{UA Table}. \]
\[ \text{UA Proposed} = \text{Proposed } U\text{-value} \cdot \text{Area}. \]
\[ \text{UA Table} = (U\text{-factor from Table C402.1.3 or Table C402.1.4}) \cdot \text{Area}. \]

\[ B = \text{Sum of the (FL Diff) values for each distinct slab-on-grade perimeter condition of the building thermal envelope.} \]
\[ \text{FL Diff} = \text{FL Proposed} - \text{FL Table}. \]
\[ \text{FL Proposed} = \text{Proposed } F\text{-value} \cdot \text{Perimeter length}. \]
\[ \text{FL Table} = (F\text{-factor specified in Table C402.1.4}) \cdot \text{Perimeter length}. \]

\[ C = \text{Sum of the (CA Diff) values for each distinct below-grade wall assembly type of the building thermal envelope.} \]
\[ \text{CA Diff} = \text{CA Proposed} - \text{CA Table}. \]
\[ \text{CA Proposed} = \text{Proposed } C\text{-value} \cdot \text{Area}. \]
\[ \text{CA Table} = (\text{Maximum allowable } C\text{-factor specified in Table C402.1.4}) \cdot \text{Area}. \]

Where the proposed vertical glazing area is less than or equal to the maximum vertical glazing area allowed by Section C402.4.1, the value of \( D \) (Excess Vertical Glazing Value) shall be zero. Otherwise:

\[ D = (DA \cdot UV) \cdot (DA \cdot U \text{ Wall}), \text{ but not less than zero.} \]
\[ DA = (\text{Proposed Vertical Glazing Area}) \cdot (\text{Vertical Glazing Area allowed by Section C402.4.1}). \]
\[ \text{UA Wall} = \text{Sum of the (UA Proposed) values for each opaque assembly of the exterior wall.} \]
\[ \text{U Wall} = \text{Area-weighted average } U\text{-value of all above-grade wall assemblies.} \]
\[ \text{UAV} = \text{Sum of the (UA Proposed) values for each vertical glazing assembly.} \]
\[ UV = \text{UAV total vertical glazing area.} \]

Where the proposed skylight area is less than or equal to the skylight area allowed by Section C402.4.1, the value of \( E \) (Excess Skylight Value) shall be zero. Otherwise:

\[ E = (EA \cdot US) \cdot (EA \cdot U \text{ Roof}), \text{ but not less than zero.} \]
\[ EA = (\text{Proposed Skylight Area}) \cdot (\text{Allowable Skylight Area as specified in Section C402.4.1}). \]
\[ \text{U Roof} = \text{Area-weighted average } U\text{-value of all roof assemblies.} \]
\[ \text{UAS} = \text{Sum of the (UA Proposed) values for each skylight assembly.} \]
\[ US = \text{UAS total skylight area.} \]
State Requirements for Performance Energy Modeling

- Department of Energy DOEII – Energy Modeling Engine Software

NEW

- The allowed performance method, ASHRAE 90.1 2016, Section 11.1 outlines the Energy Cost Budget Method.
Structure of the 2018 IECC

Envelope Changes
When the thermal properties of airspaces are calculated as part of the thermal wall assembly, these airspaces must be enclosed in an unvented cavity designed to minimize airflow into and out of the cavity.
Vertical Fenestration Requirement
Section C402.4.1 – Prescriptive (Max area)

Percentage of Vertical Fenestration Area to Gross Wall Area

✓ Allowed up to 30% maximum of above grade wall
✓ In Climate Zones 1-6, up to 40% maximum of above grade wall with daylighting controls
Based on above-grade wall area (*gross*)

- Includes walls between conditioned space and unconditioned space or the great outdoors
  - Includes walls that are > 15% above grade

**Total fenestration area (includes frame and glazing)**

- Does not include opaque door area
✓ Limited to ≤ 3% of Roof Area
✓ Up to 6% allowed if automatic daylighting controls installed in toplit zones
In certain types of enclosed spaces > 2,500 ft\(^2\) in floor area directly under a roof with > 75% of ceiling area with ceiling height > 15 ft.

- Total toplit daylight zone to not be < ½ the floor area and provide one of the following:
  - Minimum of 3% of skylight area to toplit daylight zone where all skylights have a VT not less than 0.40 OR
  - Provide a minimum skylight effective aperture of not less than 1%

**Exceptions:**
- Climate Zones 6-8
- Spaces with LPDs < 0.5 W/ft\(^2\)
- Documented shaded spaces
- Daylight area under rooftop monitors is > 50% of floor area
- Spaces where total area minus area of daylight zones adjacent to vertical fenestration is < 2,500 ft\(^2\) and lighting is controlled per C405.2.5 (Exterior Lighting Controls)
Continuous air barrier required except in:
- Climate Zone 2B

Air barrier placement allowed:
- Inside of building envelope
- Outside of building envelope
- Located within assemblies composing envelope OR
- Any combination thereof

Continuous for all assemblies part of the thermal envelope and across joints and assemblies

Joints and seams sealed including sealing transitions in places and changes in materials, securely installed in or on the joint for its entire length to not dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation
Penetrations of air barrier and air leakage paths to be caulked, gasketed or otherwise sealed in a manner compatible with construction materials and location (sealing to allow for expansion, contraction and mechanical vibration)

- Joints and seals
  - Sealed in same manner or taped
- Sealing of concealed fire sprinklers where required in a manner recommended by manufacturer
  - Caulking or other adhesive sealants should not be used to fill voids between fire sprinkler cover plates and walls, or ceilings
- Recessed lighting to comply with C402.5.8
- Where similar objects are installed that penetrate the air barrier, make provisions to maintain the air barrier’s integrity
Appliances and combustion air openings to be located outside the building thermal envelope or enclosed in a room isolated from inside the thermal envelope in Climate Zones 3-8, one of the following to comply:

- Rooms to be sealed and insulated per envelope requirements
- Doors into the rooms fully gasketed
- Water lines and ducts insulated
- Combustion air ducts that pass through conditioned space, insulated to $\geq R-8$

**Exceptions:**
- Fireplaces and stoves complying with 901-905 IMC and Section 2111.14 IBC
What’s Changed!
Heating, Ventilating, and Air Conditioning
Changes
C403
Applies to all equipment used in heating and cooling of buildings
✓ Where components from different manufacturers are used
  ▪ calculations and supporting data demonstrating combined efficiency meets requirements

Must comply with all listed efficiencies
## IECC 2018
### Table C403.3.2(2) Efficiency Requirements (Mandatory)

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SIZE CATEGORY</th>
<th>HEATING SECTION TYPE</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>MINIMUM EFFICIENCY</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air cooled (cooling mode)</td>
<td>&lt; 65,000 Btu/h</td>
<td>All</td>
<td>Split system</td>
<td>14.0 SEER</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single packaged</td>
<td>14.0 SEER</td>
<td></td>
</tr>
<tr>
<td>Through-the-wall air cooled</td>
<td>≤ 30,000 Btu/h</td>
<td>All</td>
<td>Split system</td>
<td>12.0 SEER</td>
<td>AHRI 210/240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single packaged</td>
<td>12.0 SEER</td>
<td></td>
</tr>
<tr>
<td>Single-duct high-velocity air cooled</td>
<td>&lt; 65,000 Btu/h</td>
<td>All</td>
<td>Split system</td>
<td>11.0 SEER</td>
<td></td>
</tr>
</tbody>
</table>

(partial table; similar to other efficiency tables not shown)
Heating system for heated vestibules and air curtains with integral heating
  - Controls configured to shut off heat when outdoor air temperature is > 45°F

Heating and cooling systems controlled by thermostat in vestibule configured to limit heating to < 60°F and cooling to > 85°F

**Exception:** control of heating or cooling provided by
  - site-recovered energy or
  - transfer air that would otherwise be exhausted
In Group R-1 buildings with > 50 guestrooms, each guestroom to be provided with controls complying with C403.7.6.1 and C403.7.6.2.

- For these systems room occupancy sensing can be either:
  - Occupant sensors, or
  - Card key controls

- For these systems unrented rooms can be determined either:
  - With a signal from a networked reservation, or
  - After 16 hours of continuous vacancy
Capable of and configured to

- Automatically raise cooling setpoint and lower heating setpoint by not less than 4°F from occupant setpoint within 30 minutes after occupants leave (vacant)
- Automatically raise cooling setpoint to not lower than 80°F and lower heating setpoint to not higher than 60°F when guestroom is unrented and is unoccupied more than 30 minutes (unrented)

Not precluded

- Networked control systems capable of returning thermostat setpoints to default occupied setpoints 60 minutes prior to time a guestroom is scheduled to be occupied
- Cooling capable of limiting relative humidity with a setpoint not lower than 65% relative humidity during unoccupied periods
Capable of and configured to
- Automatically turn off ventilation and exhaust fans within 30 minutes of occupants leaving OR
- Isolation devices provided to each guestroom capable of automatically shutting off supply of outdoor air to and exhaust air from guestroom

**Exception:** Guestroom ventilation systems not precluded from having an automatic daily pre-occupancy purge cycle that provides daily outdoor air ventilation during unrented periods at design ventilation rate for 60 minutes, or at a rate and duration equivalent to one air change
What’s Changed!
Service Water Heating
C404
### Service Water Heating (Mandatory)

**Section C404**

#### Table C404.2 Minimum Performance of Water-Heating Equipment

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Size Category</th>
<th>Subcategory or Rating Condition</th>
<th>Performance Required*</th>
<th>Test Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water heaters, electric</td>
<td>≤ 12 kW</td>
<td>Tabletop&lt;sup&gt;1&lt;/sup&gt;, ≥ 20 gallons and ≤ 120 gallons</td>
<td>0.93 - 0.00132V, EF</td>
<td>DOE 10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resistance ≥ 20 gallons and ≤ 55 gallons</td>
<td>0.960 - 0.0003V, EF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grid-enabled &gt; 75 gallons and ≤ 120 gallons</td>
<td>1.061 - 0.00168V, EF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 12 kW</td>
<td>Resistance ≥ 24 inches and ≤ 55 gallons and ≤ 120 gallons</td>
<td>3.057 - 0.00113V, EF</td>
<td>DOE 10 CFR Part 430</td>
</tr>
<tr>
<td>Storage water heaters, gas</td>
<td>≤ 75,000 Btu/h and ≤ 155,000 Btu/h</td>
<td>&lt; 4,000 Btu/gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt; (Q&lt;sub&gt;800 + 110, V&lt;sub&gt;i&lt;/sub&gt;&lt;/sub&gt; / Btu / h)</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td></td>
<td>&gt; 155,000 Btu/h</td>
<td>&lt; 4,000 Btu/gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt; (Q&lt;sub&gt;800 + 110, V&lt;sub&gt;i&lt;/sub&gt;&lt;/sub&gt; / Btu / h)</td>
<td></td>
</tr>
<tr>
<td>Instantaneous water heaters, gas</td>
<td>&gt; 50,000 Btu/h and &lt; 200,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 2 gal</td>
<td>0.82 - 0.00192V, EF</td>
<td>DOE 10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td>≥ 200,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 10 gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td></td>
<td>≥ 200,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and ≥ 10 gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Storage water heaters, oil</td>
<td>≤ 105,000 Btu/h</td>
<td>≥ 20 gal and ≤ 50 gallons</td>
<td>0.88 - 0.00192V, EF</td>
<td>DOE 10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td>≥ 105,000 Btu/h</td>
<td>&lt; 4,000 Btu/h/gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td>Instantaneous water heaters, oil</td>
<td>≤ 210,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 2 gal</td>
<td>0.59 - 0.00192V, EF</td>
<td>DOE 10 CFR Part 430</td>
</tr>
<tr>
<td></td>
<td>≥ 210,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 10 gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 210,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and ≥ 10 gal</td>
<td>78% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td>Hot water supply boilers, gas and oil</td>
<td>≥ 300,000 Btu/h and &lt; 12,500,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 10 gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td>Hot water supply boilers, gas and oil</td>
<td>≥ 300,000 Btu/h and &lt; 12,500,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and ≥ 10 gal</td>
<td>80% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Hot water supply boilers, oil</td>
<td>≥ 300,000 Btu/h and &lt; 12,500,000 Btu/h</td>
<td>≥ 4,000 Btu/h/gal and &lt; 10 gal</td>
<td>78% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ANSI Z21.10.3</td>
</tr>
<tr>
<td>Pool heaters, gas and oil</td>
<td>All</td>
<td>—</td>
<td>82% E&lt;sub&gt;i&lt;/sub&gt;</td>
<td>ASHRAE 146</td>
</tr>
</tbody>
</table>

*Continued...*
Piping from water heater to termination of heated water fixture supply pipe (all recirculation piping) to be insulated per Table C403.11.3

- Both inlet and outlet piping of storage water heater or heated water storage tank
  - Piping to a heat trap or first 8 ft. of piping, whichever is less
  - Piping that is heat traced per Table C403.11.3 or heat trace manufacturer instructions
- Tubular piping insulation installed in accordance with insulation manufacturer’s instructions
- Insulation to be continuous
  - Except where piping passes through a framing member
- Minimum insulation thickness not to supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temps. or personnel against external surface temps. on the insulation
Exceptions to SHW piping insulation:

- Tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance
- Valves, pumps, strainers and threaded unions in piping that is ≤1” in nominal diameter
- Piping from user-controlled shower and bath mixing valves to the water outlets
- Cold-water piping of demand recirculation water system
- Tubing form hot drinking-water heating unit to the water outlet
- Piping at locations where a vertical support of the piping is installed
- Piping surrounded by building insulation with a thermal resistance ≥ R-3
New Mandatory Code Requirement:
For the first time ever, the flow rate of shower heads shall not exceed 2.0 gpm at 80 psi in all buildings.
What’s Changed!
Electrical Power and Lighting Systems
C405
Two methods to determine allowance:

✓ Building Area Method
  - Floor area for each building area type x value for the area
  - “area” defined as all contiguous spaces that accommodate or are associated with a single building area type as per the table
  - When used for an entire building, each building area type to be treated as a separate area

✓ Space-by-Space Method
  - Floor area of each space x value for the area
  - Then sum the allowances for all the spaces
  - Tradeoffs among spaces are allowed
## Building Area Method

*Table C405.3.2(1)*

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>LPD (w/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive facility</td>
<td>0.71</td>
</tr>
<tr>
<td>Convention center</td>
<td>0.76</td>
</tr>
<tr>
<td>Courthouse</td>
<td>0.90</td>
</tr>
<tr>
<td>Dining: bar lounge/leisure</td>
<td>0.90</td>
</tr>
<tr>
<td>Dining: cafeteria/fast food</td>
<td>0.79</td>
</tr>
<tr>
<td>Dining: family</td>
<td>0.78</td>
</tr>
<tr>
<td>Dormitory</td>
<td>0.61</td>
</tr>
<tr>
<td>Exercise center</td>
<td>0.65</td>
</tr>
<tr>
<td>Fire station</td>
<td>0.53</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>0.68</td>
</tr>
</tbody>
</table>

*(partial table)*
## Space-By-Space Method

*Table C405.3.2(2)*

<table>
<thead>
<tr>
<th>Common Space Types</th>
<th>LPD (w/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locker room</td>
<td>0.48</td>
</tr>
<tr>
<td>Lounge/breakroom</td>
<td></td>
</tr>
<tr>
<td>In a healthcare facility</td>
<td>0.78</td>
</tr>
<tr>
<td>Otherwise</td>
<td>0.62</td>
</tr>
<tr>
<td>Office</td>
<td></td>
</tr>
<tr>
<td>Enclosed</td>
<td>0.93</td>
</tr>
<tr>
<td>Open plan</td>
<td>0.81</td>
</tr>
<tr>
<td>Parking area, interior</td>
<td>0.14</td>
</tr>
<tr>
<td>Pharmacy area</td>
<td>1.34</td>
</tr>
</tbody>
</table>

*(partial table)*
Occupancy sensors are required in:

- Classrooms/lecture/training rooms
- Conference/meeting/multipurpose rooms
- Copy/print rooms
- Lounges/breakrooms
- Enclosed offices
- Open plan office areas
- Restrooms
- Storage rooms
- Locker rooms
- Other spaces < 300 ft² enclosed by floor-to-ceiling height partitions
- Warehouse storage areas

**Occupancy sensor function (other than for warehouses):**

- Automatically turn lights off within 20 minutes after occupants have left space
- Either manual-on or controlled to automatically turn on lighting to not more than 50% power
- Incorporate a manual control to allow occupants to turn off lights
Exemptions:
Full auto-on controls allowed in

- Public corridors
- Stairways
- Restrooms
- Primary building entrance areas and lobbies
- Areas where manual-on operation would endanger safety or security of room or occupants
Spaces less than 300 ft² to comply with C405.2.1.1
All other spaces to comply with:

- General lighting controlled separately in zones with floor areas not greater than 600 ft²
- Automatically turn off general lighting in all control zones within 20 minutes after occupants have left
- General lighting power in each control zone reduced by not less than 80% of full zone general lighting power, in reasonable uniform illumination pattern within 20 minutes of all occupants leaving
  - Control functions that switch control zone lights completely off when zone is vacant meet this requirement
- Any daylight responsive control to active general lighting or control zone general lighting only when occupancy for the same area is detected
What’s Changed!
Additional Efficiency Packages
C406
One additional efficiency feature must be selected to comply with the IECC

- More efficient HVAC performance, OR
- Reduced lighting power density system, OR
- Enhanced lighting controls, OR
- On-site supply of renewable energy
- Dedicated outdoor air system, OR
- More efficient SWH
Reduced energy use in SWH per C406.7
Buildings with the following types allowed to use this compliance method:
- Group R-1: Boarding houses, hotels, or motels
- Group I-2: Hospitals, psychiatric hospitals, and nursing homes
- Group A-2: Restaurants and banquet halls or buildings containing food preparation areas
- Group F: Laundries
- Group R-2: Buildings with residential occupancies
- Group A-3: Health clubs and spas
- Buildings showing a service hot water load of ≥10% of total building energy loads as shown with an energy analysis per C407
Reduced energy use in SWH (cont’d)

Load fraction:

Building SWH system has ≥1 of the following sized to provide > 60% of hot water requirements or sized to provide 100% of hot water requirements if building complies with C403.4.7

- Waste heat recovery from service hot water, heat recover chillers, building equipment, process, equipment, or combined heat and power system
- Solar water-heating systems

Enhanced Envelope Performance

- Total UA of building thermal envelope as designed to be not less than 15% below total UA of building thermal envelope per Section C402.1.5
Reduced Air Infiltration

- Air infiltration verified by whole-building pressurization test
  - Per ASTM E779 or ASTM E1827
  - By independent third party
- Measured air-leakage rate not to exceed 0.25 cfm/ft\(^2\) under pressure differential of 0.3 inches w.c. (75 Pa), with calculated surface area the sum of above- and below-grade building envelope
- Submit report to code official and building owner
  - Including: tested surface area, floor area, air by volume, stories above grade, and leakage rates

Exception: Buildings over 250,000 ft\(^2\) of conditioned floor area don’t need testing on whole building, can test representative above-grade sections. Tested areas to total not less than 25% of conditioned floor area and tested per C406.9
What’s Changed!
Total Building Performance
C407
A maximum on-site renewable energy code reduction of 5% is now a component of C407.3 the Performance based compliance approach. In addition to limiting the amount of renewable energy offset, this section also requires documentation which demonstrates the reduction in energy use associated with on-site renewable energy.
New administrative code language 661-303.3(103A)

- Commercial buildings shall comply with ASHRAE 90.1 Chapter 11 requirements.
IECC 2018

What’s Changed!

Existing Buildings

71 Ways to Make Your Building MORE ENERGY EFFICIENT
Existing Buildings Chapter 5

Section C501 - General

✓ Additions, alterations, or repairs
✓ Existing buildings
✓ Maintenance
✓ Compliance
✓ New and replacement materials
✓ Buildings designated as historic
2018 Commercial Compliance
Approach Methods

Renovations: Chapter 5 – Existing Buildings

- Prescriptive path will have to meet table C402.1.3
  - Will not make you replace materials that are not part of the project.
- COMcheck works with renovations as well
  - Will trade off materials replaced in the renovation
Building Science Corp’s Perfect Commercial Wall

Figure 8: "The Commercial Wall"—The almost best wall we know how to construct. Affordable. Works everywhere in all climate zones.
www.energycodes.gov

ICCSAFE.ORG

buildingscience.org
Questions