Code Amendment Proposal Form
For public amendments proposed to the 2018 editions of the International Codes

Instructions: Upload this form and all accompanying documentation at www.denvergov.org/BuildingCode. If you are submitting your proposal on a separate sheet, make sure it includes all information requested below.

All proposals must be received by April 26, 2019.

CONTACT INFORMATION

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Signature:

AMENDMENT PROPOSAL

Please use a separate form for each proposal.

1) Code(s) associated with this proposal. Please use acronym: IECC (and ASHRAE 90.1)

If you submitted a separate coordination change to another code, please indicate which code:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Code Name</th>
<th>Acronym</th>
<th>Code Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBC-xxxx</td>
<td>Denver Building Code–xxxx (code) amendments (e.g., DBC-IBC, DBC-IEBC)</td>
<td>IFGC</td>
<td>International Fuel Gas Code</td>
</tr>
<tr>
<td>IEBC</td>
<td>International Existing Building Code</td>
<td>IMC</td>
<td>International Mechanical Code</td>
</tr>
<tr>
<td>IECC</td>
<td>International Energy Conservation Code</td>
<td>IPC</td>
<td>International Plumbing Code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRC</td>
<td>International Residential Code</td>
</tr>
</tbody>
</table>

2) Please check here if a separate graphic file is provided: ☐

Graphics may also be embedded within your proposal below.

3) Use this template to submit your proposal or attach a separate file, but please include all items requested below in your proposal. The only formatting needed is BOLDING, STRIKEOUT, AND UNDERLINING. Please do not provide additional formatting such as tabs, columns, etc., as this will be done by CPD.
Proposed for Revision:
C401.2  
C407

Note: If the proposal is for a new section, indicate (new).

Proposal:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of compliance options a or c of Section 4.2.11 of ANSI/ASHRAE/IESNA 90.1 and IECC sections C402.5 and C408:
   a. For buildings complying with ASHRAE/IESNA 90.1, Section 4.2.1.1.a, the proposed envelope performance factor is equal to or less than 90 percent of the proposed envelope performance factor of the base design, the interior lighting power allowance is equal to or less than 70 percent of the lighting power allowance of the base design, and the HVAC minimum efficiency requirements of the proposed design is equal to or less than 90 percent of the HVAC minimum efficiency requirements of the base design.
   b. ASHRAE/IESNA 90.1, Section 11, Energy Cost Budget Method is not an acceptable compliance path.
   c. For buildings complying with ASHRAE/IESNA 90.1 Appendix G, Performance Rating Method, use one of the following methods and include the site energy, in kbtu/sf/yr, of the proposed design and baseline building design in the compliance documentation:

   1) When using the Energy Cost approach for Appendix G, the Performance Cost Index (PCI) shall be less than or equal to the Performance Cost Index Target (PCI) when calculated in accordance with the following:
      \[ \text{PCI} = 0.82 \times \frac{\text{BBUEC} + (\text{BPF} \times \text{BBREC})}{\text{BBP}} \]
      Where
      - PCI = Performance Cost Index calculated in accordance with Section G1.2.
      - BBUEC = Baseline Building Unregulated Energy Cost, the portion of the annual energy cost of a Baseline building design that is due to unregulated energy use.
      - BBREC = Baseline Building Regulated Energy Cost, the portion of the annual energy cost of a Baseline building design that is due to regulated energy use.
      - BPF = Building Performance Factor from the PCI column of Table 4.2.1.1. For building area types not listed in Table 4.2.1.1 use “All others.” Where a building has multiple building area types, the required BPF shall be equal to the area-weighted average of the building area types.
      - BBP = Baseline Building Performance.
      Regulated energy cost shall be calculated by multiplying the total energy cost by the ratio of regulated energy use to total energy use for each fuel type. Unregulated energy cost shall be calculated by subtracting regulated energy cost from total energy cost.

   2) When using the Energy Source approach for Appendix G, the Source Energy Index (SEI) shall be less than or equal to the Source Energy Index Target (SEIT) when calculated in accordance with the following:
      \[ \text{SEI} = 0.82 \times \frac{\text{BBUSE} + (\text{BPF} \times \text{BBRSE})}{\text{BBP}} \]
      Where
      - SEI = Source Energy Index calculated in accordance with Section G1.2.
      - BBUSE = Baseline Building Unregulated Source Energy, the portion of the annual source energy of a Baseline building design that is due to unregulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.
      - BBRSE = Baseline Building Regulated Source Energy, the portion of the annual source energy of a Baseline building design that is due to regulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.
      - BPF = Building Performance Factor from the SEI column of Table 4.2.1.1. For building area types not listed in Table 4.2.1.1 use “All others.” Where a building has multiple building area types, the required BPF shall be equal to the area-weighted average of the building area types.
      - BBP = Baseline Building Performance.
Regulated source energy shall be calculated by multiplying the total source energy by the ratio of regulated energy use to total energy use for each fuel type. Unregulated source energy shall be calculated by subtracting regulated source energy from total source energy.

### Building Performance Factor (BPF)

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>Climate Zone</th>
<th>Performance Rating Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AA and BB</td>
<td>SEI</td>
</tr>
<tr>
<td>Multifamily</td>
<td>0.71</td>
<td>0.75</td>
</tr>
<tr>
<td>Healthcare/hospital</td>
<td>0.64</td>
<td>0.56</td>
</tr>
<tr>
<td>Hotel/motel</td>
<td>0.64</td>
<td>0.62</td>
</tr>
<tr>
<td>Office</td>
<td>0.62</td>
<td>0.65</td>
</tr>
<tr>
<td>Restaurant</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>School</td>
<td>0.46</td>
<td>0.52</td>
</tr>
<tr>
<td>Warehouse</td>
<td>0.51</td>
<td>0.64</td>
</tr>
<tr>
<td>All others</td>
<td>0.62</td>
<td>0.61</td>
</tr>
</tbody>
</table>

### Table 4.2.1.2 Source Energy Conversion Factors

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity (Grid Purchase)</td>
<td>2.80</td>
</tr>
<tr>
<td>Electricity (On-site Renewable Energy Installation)</td>
<td>1.00</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>1.05</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>1.01</td>
</tr>
<tr>
<td>Propane &amp; Liquid Propane</td>
<td>1.01</td>
</tr>
<tr>
<td>Steam</td>
<td>1.20</td>
</tr>
<tr>
<td>Hot Water</td>
<td>1.20</td>
</tr>
<tr>
<td>Chilled Water, Coal, Wood, Other</td>
<td>1.00</td>
</tr>
</tbody>
</table>

2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

3. The requirements of Sections C403.3 through C403.8.1 through C403.10.1, C404, C405, C407 and C408. The building energy cost or site EUI shall be equal to or less than 85 percent of the standard reference design building.

**Modify Section C407.2 as follows:**

C407.2 Mandatory requirements. Compliance with this section requires compliance with Sections C402.5, C403.2, C403.3 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. Minimum mandatory requirements shall be modeled in the Standard Reference Design and mandatory requirements shall be modeled as designed in the Proposed Design.

**Modify Section C407.4.1 as follows:**

**C407.4.1 Compliance report.** Permit submittals shall include a report documenting that the proposed design has annual energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include the following information:

1. Address of the building.

An inspection checklist documenting the building component characteristics of the proposed design as specified in Table C407.5.1(1). The inspection checklist shall show the estimated annual energy cost and site Energy Use Intensity in kBtu/sf/yr for both the standard reference design and the proposed design.
**Supporting Information:**

**Purpose:**
The proposed amendment reconciles the differences in the energy performance compliance methods allowed under 2018 IECC. The proposed amendment requires that buildings complying per sections C401.2.1 (ASHRAE 90.1) or C401.2.2 achieve better performance to achieve a comparable level of energy performance with buildings complying with 2018 IECC, C401.2.3.

**Reasons:**
Currently, buildings minimally complying with ASHRAE 90.1 (2018 IECC, C401.2.1), whether using a prescriptive/trade-off method or a performance method, would not comply with 2018 IECC (C401.2.2 or C401.2.3) and therefore, are not as energy efficient as buildings complying with C401.2.2 or C401.2.3. In addition, buildings complying with C401.2.2 (Prescriptive) are not as efficient as those complying with C401.2.3 (Total Building Performance).

The proposed amendment intends to rectify the energy performance differences by increasing the required energy performance by 18% for 2018 IECC C401.2.1 (compliance per ASHRAE 90.1) and requiring projects complying with 2018 IECC C401.2.2 to comply with two of the packages in section C406.

The proposed changes to 2018 IECC C401.2.1 and C401.2.2 would result in increased energy savings in the City and County of Denver by closing some of the loopholes in 2018 IECC.

**Substantiation:**
In comparing compliance using ASHRAE 90.1-2013 Energy Cost Budget method with the 2015 IECC Total Building Performance method, Group14’s experience has been that design teams prefer to follow IECC to stay within the I-Codes; however, design teams switch to ASHRAE 90.1 if they are having trouble demonstrating compliance with 2015 IECC Total Building Performance. This is also the case with compliance with the Green Buildings Ordinance; in general, complying with ASHRAE 90.1 energy cost budget method is less costly than the IECC Total Building Performance method because the ASHRAE 90.1 baseline is easier to meet.

In addition, minimally complying with 2018 IECC, section C401.2.3 (prescriptive method in IECC) does not result in a building as efficient as one complying with section C401.2.3 (Total Building Performance). PNNL analyzed the energy savings of the C406 Option Packages in 2018 IECC and found significant savings differences, as shown in Figure 1. The intent of the packages is to achieve an additional 4% energy savings over the prescriptive requirements of the IECC (C401.2.2).

![Variation in Building Cost Savings for Options](image)

*Figure 1*

In effect, IECC C401.2.2 (prescriptive) with a package is intended to be 4% more efficient than the minimum prescriptive requirements. Under IECC C401.2.3 (performance), the building must demonstrate that it is 15 percent more efficient than the minimum prescriptive requirements.

A project that follows C401.2.2 with this proposed amendment would select two of the packages now. If the packages remained as is, the savings would be 6-8 percent. By increasing the performance requirements for the HVAC (C406.2) and Lighting (C406.3) packages, the estimated energy savings could exceed 10% depending on the two packages that are selected.
Bibliography:


**Referenced Standards:**

**Note:** List any new referenced standards that are proposed to be referenced in the code.

**Impact:**

The proposed changes will result in more consistency in the implementation of the 2018 IECC and the desired energy performance. The proposed changes may result in higher costs for projects following C401.2.1 (ASHRAE 90.1) or C401.2.2 (IECC prescriptive); however, the costs will remain the same for projects following C401.2.3 (Total Building Performance).

As with costs, the proposed changes are more restrictive for compliance per C401.2.1 and C401.2.2; however, there are no changes proposed to compliance per C401.2.3

**Note:** Discuss the impact of this proposal in this section AND indicate the impact of this amendment proposal for each of the following:

- The effect of the proposal on the cost of construction: ☒ Increase ☐ Reduce ☐ No Effect
- The effect of the proposal on the cost of design: ☒ Increase ☐ Reduce ☐ No Effect
- Is the proposal more or less restrictive than the I-codes: ☒ More ☐ Less ☐ Same

**Departmental Impact:** (To be filled out by CPD staff)

**Note:** CITY STAFF ONLY. Discuss the impact of this proposal in this section AND indicate the impact of this amendment proposal for each of the following:

- The effect of the proposal on the cost of review: ☐ Increase ☐ Reduce ☐ No Effect
- The effect of the proposal on the cost of enforcement/inspection: ☐ Increase ☐ Reduce ☐ No Effect