Code Amendment Proposal Form
For public amendments proposed to the 2021 editions of the International Codes

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

All proposals must be received by July 23, 2021.

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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

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

Acronym Code Name
DBC-xxxx Denver Building Code–xxxx (code) amendments (e.g., DBC-IBC, DBC-IEBC)
IBC International Building Code
IEBC International Existing Building Code
IECC International Energy Conservation Code

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.

Code Sections/Tables/ Figures Proposed for Revision:

- C403.2 System design (Modify the section)
- C403.2.4 Heat pump space heating (Add new section)
- C403.4.1.1 Heat pump supplementary heat (Modify the section)
- C503.3 Heating and cooling systems. (Modify the section)
Proposal:

Modify the section as follows:

**C403.2 System design.** Mechanical systems shall be designed to comply with Sections C403.2.1 through C403.2.3 C403.2.4. Where elements of a building's mechanical systems are addressed in Sections C403 through C403.14, such elements shall comply with the applicable provisions of those sections.

Add new section as follows:

**C403.2.4 Heat pump space heating.** Space heating shall be provided by electric heat pumps. The heat pump heating system shall be sized to satisfy 100 percent of peak heating load at an entering source dry bulb air temperature of 20°F (-7°C).

**Exceptions**

1. Buildings or areas of buildings, other than dwelling units or sleeping units, that meet the interior temperature requirements of IBC Chapter 12 with a total installed HVAC heating capacity no greater than 8.5 BTU/h (2.5 watts) per square foot of conditioned space.
2. Systems that provide less than 5 percent of the total building space heating capacity or serve less than 5 percent of the conditioned floor area.
3. Supplementary space heating systems in accordance with C403.4.1.1.
4. Make-up air for exhaust systems prohibited by the International Mechanical Code from having heat recovery systems.
5. Equipment replacements with an AHRI rated capacity of not more than 20 tons.
6. Other space heating systems as approved.

Modify the section as follows:

**C403.4.1.1 Heat pump supplementary heat.** Heat pumps having supplementary electric resistance heat systems, such as those provided by electric resistance or fossil fuels, shall have controls that limit supplementary heat operation to only those times when one of the following applies:

1. The heat pump is operating in defrost mode.
2. The vapor compression cycle malfunctions.
3. The thermostat malfunctions.
4. Outside air temperature is below 20°F (-7°C)

**Supporting Information:**

**Purpose:**

Move Denver towards its community-driven climate goals, health goals, and affordability goals through the use of clean, highly-efficient, cost-effective, and all-electric technologies.

**Reason and Substantiation:**

Electrification is a critical pillar of Net Zero Energy, and is required to meet Denver’s goal of Net Zero Energy in new buildings and homes by 2030. Denver’s existing building policy is likely to start requiring heat pumps ahead of the next 2024 code cycle, as recommended by the Energize Denver Task Force. New buildings should pave the way for electrification, and should be on a more ambitious track than existing buildings. Denver’s recently-released Renewable Heating and Cooling Implementation Plan and other local and regional studies have already demonstrated the cost-effectiveness of this approach.

New commercial buildings should require heat pumps for space and water heating in buildings with central HVAC and distributed systems in this code cycle, and should not delay until the next code cycle. Climate change cannot be stopped as long as natural gas is used to heat our buildings and water. In Denver, 20% of our greenhouse gas emissions come from burning natural gas, and 97% of this gas is used for space heating and hot water heating in our homes and buildings. Xcel Energy’s electrical grid in Colorado is getting dramatically cleaner and will be at least 80% renewable by 2030 – which is during the lifetime of any space heating equipment replaced now – making electric heat pumps the option with the lowest greenhouse gas emissions available today. Electric heat pumps are also three times more energy-efficient than their gas counterparts.
All-electric buildings are healthier, more comfortable, and lower-cost to build and operate. People living in the United States spend roughly 90% of their time indoors where pollution levels are largely unregulated and often worse than outdoor air quality (RMI 2020). Indoor air pollution caused by natural gas contributes significantly to exacerbating asthma and triggering asthma attacks, as well as other adverse health impacts. We can transition our homes and buildings to clean, highly efficient, all-electric heat powered by renewable electricity through the use of heat pump technology. Heat pumps use electricity to move heat from a cool space to a warm space, making the cool space cooler and the warm space warmer. “Cold climate” heat pumps work well in Denver’s winter climate (heat pump technology has improved significantly in recent years) and operate well down to -12 Fahrenheit. In addition, heat pumps work “in reverse” to provide cooling in the summertime.

In addition to the health, climate, and efficiency benefits outlined above, all-electric and renewably-powered buildings are affordable and can reduce construction costs. See more detail on cost impacts in the “Impact” section below.

Additional Notes:
- These requirements allow either air source or ground source heat pumps, as each have their own advantages for particular sites.
- These requirements include multiple exceptions. The intention is to make this only apply to general purpose space heating systems that are found in nearly all buildings and not to the specialty systems that are sometimes present for which heat pump water heaters may not be a good fit.
- Each list of exceptions includes “other systems as approved.” This allows the code official to respond to unique situations without a full “alternate means and methods” submission.
- We included an allowance for non-heat pump supplementary systems. It requires that they only operate at low temperatures where heat pump performance can be less optimal. The 20-degree cut-off is conservative and there are many heat pumps that can effectively and efficiently operate at much lower temperatures, but this maximizes heat pump equipment selection options.

Bibliography:
- Pragmatists for Clean Air, 2021, https://pragmatistsforcleanair.org/progress

Referenced Standards:
N/A

Impact:

In addition to the health, climate, and efficiency impacts outlined above, all-electric and renewably-powered buildings are affordable. All-electric new construction costs less than mixed-fuel new construction during the construction phase. A recent Community Energy study focused on the upfront and long-run cost estimates of electrification from data retrieved from a commercial building in Denver, and found that building all electric had 8% less upfront costs for all electric new construction commercial buildings, with rebates included. New construction commercial buildings cost around $18,100 less to build than mixed fuel new construction. Another study in a similar climate zone, through Pragmatists for Clean Air, followed an 80-unit multifamily building in Salt Lake City, Utah that was designed to be completely all electric with construction beginning in February 2020. The projected upfront costs for this build are estimated to be $133,434.32 cheaper than a mixed fuel build. Additional savings from rebates are expected to amount to $1,000 per unit, or an additional $80,000. Overall this project avoided $94,800 in costs from a lack of gas interconnection and interior gas infrastructure. Including rebates and lower upfront costs, this building was $213,434.32 cheaper to build than a gas building. Other projects by Pragmatists for Clean Air are saving $62,000-$450,000 in upfront costs before rebates, and they offer their plan designs online for free. Although the examples above are for specific buildings, all-electric construction is trending across the country for all the reasons noted above.

Xcel Energy is poised to increase its all-electric rebates as directed by a law passed this past 2021 legislative session (SB 246). Although the design cost for all-electric service hot water should be similar to that of a gas system, it’s worth noting that Xcel continues to offer free design assistance for construction and design teams, more than offsetting any increase in design for any project nuances.
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