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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By signing below, I hereby grant and assign to City and County of Denver all rights in copyright I may have in any authorship contributions I make to City and County of Denver in connection with this proposal. I understand that I will have no rights in any City and County of Denver publications that use such contributions in the form submitted by me or another similar form and certify that such contributions are not protected by the copyright of any other person or entity.

Signature: Charles Landherr

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:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Code Name</th>
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<tbody>
<tr>
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<td>(e.g., DBC-IBC, DBC-IEBC)</td>
<td>IGCC</td>
<td>International Green Construction Code</td>
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<td>IBC</td>
<td>International Building Code</td>
<td>IMC</td>
<td>International Mechanical Code</td>
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<tr>
<td>IEBG</td>
<td>International Existing Building Code</td>
<td>IPC</td>
<td>International Plumbing Code</td>
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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:
C403.5 New exception 7 for VRF Heat Recovery Systems

**C403.5 Economizers (Prescriptive)**
Economizers shall comply with Sections C403.5.1 through C403.5.5
....

**Exceptions:** Economizers are not required for the following systems.
1..
2..

**NEW EXCEPTION 7...**See below for proposed language.

Note: If the proposal is for a new section, indicate (new).
Proposal:
C403.5 New Exception 7

Variable refrigerant flow (VRF) systems, multiple-zone split-systems heat pumps, consisting of multiple, individually metered indoor units with multi-speed fan motors, served on a single common refrigeration circuit with an exterior reverse-cycle heat pump with variable speed compressor(s) and variable speed condenser fan(s). These systems shall also be capable of providing simultaneous heating and cooling operation, where in all rooms with VRF units recovered energy from the indoor units operating in one mode can be transferred to one or more perimeter zones (as determined by conditioned floor area) and the outdoor unit shall be at least 65,000 Btu/h in total capacity. For the purpose of this exception, dedicated server rooms, electronic equipment rooms or telecom switch rooms are not considered perimeter zones and shall not exceed 20 percent of the floor area served by the VRF system.

Note: Show the proposal using strikeout, underline format. At the start of each section, give one of the following instructions:

- Revise as follows:
- Add new text as follows:
- Delete and substitute as follows:
- Delete without substitution:

Supporting Information:

Purpose VRF heat recovery systems are heat pump systems with the capability to simultaneously heat and cool with a single outdoor heat pump unit. Heat recovery systems take the absorbed heat from the fan coils that are cooling and redirect it to indoor fan coils that are calling for heating which is acting as a refrigerant economizer. The purpose of the added exception would be to increase the efficiency of VRF Heat Recovery systems and reduce installation cost associated with having to add mixing boxes on fan coils. Adding economizers to heat recovery systems actually increase the energy use of the heat recovery systems since they can no longer provide heat recovery with the refrigeration. For larger systems, this exception would also increase flexibility of installations as current code requires economizers on systems over 270,000 BTUs which would limit heat recovery systems to ducted fan coils only to allow for mixing box integration.

Reasons Current code requires economizers on individual fan coils 54,000 BTUs or larger or for connected systems over 270,000 BTUs. The single most efficient feature and capability of VRF heat recovery systems is the ability to simultaneously heat and cool. If we add outdoor air mixing boxes to fan coils and allow for outside air to cool zones the systems will no longer be able to use refrigerant for heat recovery and this means the VRF outdoor unit would need to provide more compressor energy to provide heating for the fan coils calling for heat. The current code requires more installation and design cost and increase energy use by VRF systems.

Substantiation Several years ago ARI developed testing standards for VRF systems over 65,000 BTUs. The standard includes ratings of IEER, EER, High COP, Low COP, and SCHE. SCHE stands for simultaneous cooling and heating efficiency which test a VRF heat recovery system at a 50/50 cooling and heating scenario at 47 degrees outside. As an example, Mitsubishi’s PURY-P72TLMU ratings are as follows for all ducted fan coils: EER 13.5, IEER 23.1, High COP 3.65, Low COP 2.26, and SCHE 25.9. The SCHE rating is SCHE = (Heating Capacity (Btu/h) + Cooling Capacity (Btu/h)) / Total System Power Input (watts). This is not a direct correlation to COP, but if you convert it to COP you would get an approximate COP of about 8.633 for the above example. As you can see in a 50/50 simultaneous mode, VRF systems on average are about twice as efficient as 100% heating at 47 degrees outside. Anytime a heat recovery system is in simultaneous mode the compressor has to work less since the system is utilizing refrigerant economizer. Air side economizers on VRF systems basically move a system from a simultaneous efficiency condition to a 100% heating condition.

Bibliography AHRI 1230 standard:
ARI Directory for PURY-P72TLMU rating:
https://www.ahridirectory.org/NewSearch?programId=72&searchTypeId=3
Seattle Energy Code:

Note: This section MUST include these items:

- Purpose: State the purpose of the proposed amendment to physical, environmental and customary characteristics that are
specific to the City and County of Denver (e.g., clarify the code; revise outdated material; substitute new or revised material for physical, environmental and customary characteristics; add new requirements to the code; delete current requirements, etc. to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver)

- **Reasons**: Clearly justify the change to current code provisions, stating why the proposal is necessary to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver. Proposals that add or delete requirements shall be supported by a logical explanation that clearly shows why the current code does not reflect physical, environmental and customary characteristics that are specific to the City and County of Denver and explains how such proposal will improve the code.

- **Substantiation**: Substantiate the proposed amendment based on technical information and substantiation. Substantiation provided which is reviewed and determined as not germane to the technical issues addressed in the proposed amendment shall be identified as such.

- **Bibliography**: Include a bibliography when substantiating material is associated with the amendment proposal. The proponent shall make the substantiating materials available for review.

**Referenced Standards:**

Proposed new exception comes from Seattle’s Energy Code, C403.3 Exception 7


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

**Impact:**

This would **increase** VRF heat recovery system’s efficiency by allowing refrigerant economizer/heat recovery for much more efficient heating.

This would **decrease** installation cost as systems would not need to add outdoor air mixing boxes and controls to allow for air side economizer.

This would **decrease** design cost as engineers would not need to design addition of mixing boxes on VRF systems.

This proposal would be **less** restrictive as it would allow VRF systems to utilize the built in refrigerant economizer instead of needing to add air side economizer which is less effective.

**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