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.**

CONTACT INFORMATION

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Organization or Representing Self: Self

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:

AMENDMENT PROPOSAL

Please use a separate form for each proposal.

1) Code(s) associated with this proposal. Please use acronym: _____

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

Acronym	Code Name
DBC-AP	Denver Building Code–Administrative Provisions
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
IFC	International Fire Code
IFGC	International Fuel Gas Code
IRC	International Residential Code
IMC	International Mechanical Code
IPC	International Plumbing Code
DGC	Denver Green 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:

M1601.1.1 Above-ground duct systems

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

Proposal:

Add new definition as follows:
AIR, TRANSFER: Air moved from one indoor space to another.

SECTION M1601 DUCT CONSTRUCTION
Revise as follows:

M1601.1.1 Above-ground duct systems. Above-ground *duct systems* shall conform to the following:

1. *Equipment* connected to *duct systems* shall be designed to limit discharge air temperature to not greater than 250°F (121°C).
2. Factory-made ducts shall be *listed* and *labeled* in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Fibrous glass duct construction shall conform to the SMACNA Fibrous Glass Duct Construction Standardsor *NAIMA Fibrous Glass Duct Construction Standards.*
4. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the SMACNA HVAC Duct Construction Standards—Metal and Flexible except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A653.
5. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. *Duct systems* shall be constructed of materials having a flame spread index of not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists shall be permitted ~~to be used~~ for *transfer air* between two rooms or spaces on the same level. ~~as air plenums shall comply with the following conditions:~~
   ~~7.1. These cavities or spaces shall not be used as a plenum for supply air.~~
   ~~7.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.~~
   ~~7.3. Stud wall cavities shall not convey air from more than one floor level.~~
   ~~7.4. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by tight-fitting Fire blocking in accordance with Section R302.11. Fire blocking materials used for isolation shall comply with Section R302.11.1.~~
   ~~7.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.~~
   ~~7.6. Building cavities used as plenums shall be sealed.~~
8. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

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:

Today home buyers are looking for and expect reasonable indoor air quality. Building cavities do not help with this expectation. Think of all the rough edges and surfaces where years of dust and dirt can collect. Cleaning of building cavities is difficult at best if not impossible.

From ACCA Manual D, "The following components pertain to potential space pressure problems, air quality problems, duct system efficiency and air delivery problems caused by panned construction. If the practitioner chooses to use this type of construction, the practitioner assumes full responsibility for all unintended consequences" Manual D continues and lists nine different issues with panned joist and stud spaces duct systems.

The code has many items that are not great choices and certainly not best practice. With this proposal we can eliminate one code item that will surely be a path to failure and which currently creates a possible loophole that it is in conflict with the 2021 IECC. The IECC does not allow building cavities to be used as ductwork that is seeing pressure from the air handling unit. (R403.3.5 Building Cavities (Mandatory. Building framing cavities shall not be used as ducts or plenums) The 2021 IECC (residential) also requires duct leakage testing regardless of duct location. By deleting this method of ducting we give the contactor a better chance for success. In addition, for several code cycles the residential energy code has not allowed building cavities to be used as supply or return air ducts. Which has been and currently remains a conflict between the codes.

Consistency between code is critical for the enforcement and administration of codes in the City of Denver. Contradiction between the IRC and the IECC sends a confusing message to the public and makes inspection and enforcement more difficult. This proposal aligns the codes creating consistent performance and enforcement.

It is impossible to control the air that is being pushed and pulled through building cavities that are used as ducts. When you pan a floor system for example, the air that is returning to the furnace comes from many more places than the intended room. Air, being a transport mechanism for moisture, energy, and pollutants, needs to be better controlled than is possible by using building cavities as duct work, and therefore HVAC systems need to be fully ducted. The IECC recognizes the building durability, efficiency, and safety concerns associated with allowing building cavities to be used as pressurized duct systems and that we gain better control and predictability of air flow that is being pushed and pulled by the air handling equipment by prohibiting such practices. Moisture control, energy control, pollutant control, house and room pressure control are all gained by fully ducting HVAC systems and not allowing building cavities to be used as duct Work. The Department of Energy (D.O.E.) has published statistics indicating that the average duct system leaks between 20% and 40%. This leakage is often connected directly to the outdoors through building cavities. When the building cavity is positively or negatively pressurized by air handling equipment the connections to outside are heightened causing pressure differentials in buildings that create building safety, durability, health, and efficiency issues.

When you google “Building Cavities as Ductwork” you find several articles from nationally recognized building scientist as well as trade groups, DOE, EnergyStar, code groups and others that all point out that utilizing building cavities to carry pressurize air from the supply or the return side of the furnace is a bad idea.

I have summarized these concerns and provided links to resources for the information below to support and provide evidence that duct leakage through building cavities is a problem. I urge you to do your own research for I am sure you will conclude, as I have, that using a building cavity as the duct system in a building is more detrimental that beneficial. By simply installing a true duct in the cavity or plenum the issue is solved, thus improving buildings within the City of Denver.

Bibliography: From the Building America Solution Center
Building Cavities Not Used as Supply or Return Ducts
“Cavities (or interstitial spaces) within walls are also sometimes used as supply or return air pathways. These cavities often connect inside air with outside air from an attic or crawlspace. It is very difficult to make such cavity spaces airtight. When cavity spaces are used as return air pathways or supply air ducts, a few issues will arise. Because cavity spaces are leaky, building pressure imbalances across the building envelope will occur, driving building infiltration. A cavity space used as a return air pathway will pull pollutants into the building from unknown sources. Another issue (less talked about) with using cavity spaces as return air pathways is fire safety. Building materials such as wood products do not meet the flame and smoke spread criteria as do approved duct materials. Using cavities as return or supply ducts is not a fire hazard in itself but will encourage a fire to spread throughout the building. In humid climates, a cavity space used as a return air pathway will pull humid air into the cavity space, possibly encouraging mold or rotting of building materials.”
https://basc.pnnl.gov/resource-guides/building-cavities-not-used-supply-or-return-ducts

Perhaps the Worst HVAC Duct Idea Ever — The Panned Joist Return,. Allison Bailes on August 18, 2011
“Panned joist return ducts are almost always terribly leaky. Those junctions between wood and metal are difficult to seal, and the thermal expansion and contraction of the wood will often cause sealing materials to fail.”
https://www.energyvanguard.com/blog/43723/Perhapsthe-Worst-HVAC-Duct-Idea-Ever-The-Panned-Joist-Return

From Building Science Corporation:
Inof-801: What’s Wrong With this Practice? Using unsealed wall cavitied or panned floor joists as return plenum
“The negatively pressurized cavities will draw air through any cracks to try to alleviate the pressure difference. This means that the return system will suck on the walls—and any contaminants that might be in the walls—and redistribute them to the living space. By negatively pressuring the walls in a hot-humid climate, warm humid air could be drawn into the walls from the exterior, and condensation is likely to occur on the cooler air-conditioned surfaces.”
https://buildingscience.com/documents/information-sheets/information-sheet-wrong-using-unsealed-wall-cavities-orpanned-floor-joists-as-return-plenum
Info-603 Duct sealing
“The only place air should be able to leave the supply duct system and the furnace or air handling unit is at the supply registers. The only place air should be able to enter the return duct system and the furnace or air handling unit is at the return grilles. A forced air system should be able to be pressure tested the way a plumber pressure tests a plumbing system for leaks. Builders don’t accept leaky plumbing systems, so they should not accept leaky duct systems.”
https://buildingscience.com/documents/information-sheets/information-sheet-duct-sealing

DOE Building Technologies Program Study Measure Guideline: Sealing and Insulating of Ducts in Existing Homes
One reason is that building cavities are very prone to air leakage: gaps in framing and/or drywall are very common, and many building cavities have electrical and plumbing penetrations. Using building cavities as ductwork on the return air side can also result in pollutants entering the air stream and being distributed throughout the home.

Building Cavities are difficult to impossible to seal to the standards called for by the IECC.
“Duct leakage can also lead to pressure imbalances within homes. Such imbalances not only can affect comfort and efficiency but can also impact health and durability. In homes with some types of combustion equipment, for example, large return duct leaks in a basement system can cause negative pressures which, in turn, can interfere with proper draft. Under these conditions, exhaust gases can be sucked into the home. Other risks of pressure imbalances include buildup of moisture (and associated problems like mold) in parts of buildings.”
https://www.nrel.gov/docs/fy12osti/53494.pdf

Washington State University, “Improving Forced Air Heating Systems”
https://docplayer.net/30025411-Supplement-a-improving-forced-air-heating-systems.html

According to Energy Star: “Supply-side leakage to the outside can cause a negative pressure difference in the building with reference to outside. Return-side leakage, on the other hand, can cause a positive pressure difference in the building with reference to the outside. On average, such leakage can cause a 10% to 20% increase in heating and cooling energy use, along with a 20% to 50% decrease in heating and cooling equipment efficiency.”

In houses with forced-air heating and cooling systems, ducts are used to distribute conditioned air throughout the house. In a typical house, however, about 20 to 30 percent of the air that moves through the duct system is lost due to leaks,

holes, and poorly connected ducts. The result is higher utility bills and difficulty keeping the house comfortable, no matter how the thermostat is set.
https://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts
http://www.norbord.com/na/blog/supply-or-return-ducting-in-building-cavities/

Building Code Assistant Project
https://bcapcodes.org/tools/code-builder/residential/ducts/
U.S. Threatened by Leaky Ducks
https://www.energy.gov/energysaver/articles/us-threatened-leaky-ducks

DOE: Leaky Ducts are Top Energy Waster

https://www.achrnews.com/articles/124595-doe-leaky-ducts-are-top-energy-waster
Minimizing Energy Lo sses in Duct s
Ducts that leak heated air into unheated spaces can add hundreds of dollars a year to your heating and cooling bills, but you can reduce that loss by sealing and insulating your ducts.
https://www.energy.gov/energysaver/minimizing-energy-losses-ducts
Duct Leakage Can Create 3 Big Problems in Your Home
3 major effect s that duct leakage can have on your ho me
1. Makes your ho me less efficient . When your home has duct leaks, conditioned air escapes before it gets to your living spaces. This decreases your home's efficiency levels in two ways. First, your furnace and air conditioner waste energy on conditioning air that is never actually used. Second, your heating and cooling system has to work harder and longer to maintain your desired home temperature levels, which can severely increase operating costs.
2. Makes your home less comfortable. Duct leakage makes it difficult for your home to heat and cool properly. Depending on where the leakage is located, some rooms might never receive enough conditioned air, which can create uneven temperature levels in your home. In addition, unconditioned air can leak into your ducts and alter your home's temperature levels.
3. Worsens your home's air quality. Another side effect of unconditioned air leaking into your ducts is that it can worsen your home's air quality. That's because the air that leaks inside is unfiltered, and it can contain all sorts of contaminants. This is especially problematic when duct leaks occur in parts of your home that are commonly dusty (such as your attic).
https://www.hydesac.com/duct-leakage-can-create-3-big-problems-in-your-home/

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:

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

Impact:

The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase the cost of construction because section R403.3.5 Building Cavities, of the IECC, already prohibits the uses of building cavities as pressurized duct work in a dwelling. Other sections of the code state that if there are conflicts between code that the most restrictive requirement shall govern. This proposal creates alignment of the IECC and the IRC for best health, safety, and building durability instead of raising cost of construction.

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