DENVER AMENDMENT PROPOSAL FORM
FOR CPD INTERNAL PROPOSALS TO THE 2016 DENVER BUILDING CODE AMENDMENTS AND THE 2018 INTERNATIONAL CODES

2018 CODE DEVELOPMENT CYCLE

1) Name: Robby Schwarz   Date: 3/25/2019

Click or tap here to enter text.

2) Proposals should be drafted in Word with the only formatting that is needed being BOLDING, STRIKEOUT AND UNDERLINING. Please do not provide additional formatting such as tabs, columns, etc.

Please use a separate form for each proposal submitted.

Is separate graphic file provided (Yes or No):

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AMENDMENT PROPOSAL

Please provide all of the following items in your amendment proposal:

**Code Sections/Tables/ Figures Proposed for Revision:**
R403.3.3 Duct Testing (Mandatory)

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

November 15, 2005
R403.3.3 Duct testing (Mandatory). Ducts The duct work in a building or dwelling unit shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine for air leakage. The maximum total leakage rate for duct in any building or dwelling unit under any compliance path by one of the following methods: shall not exceed 6.0 cubic feet per minute (169.9 L/min) per 100 square feet (9.29 m²) of conditioned floor area served, (6cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test. Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.

2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure. Alternatively, a duct leakage test to outside conditioned space with a pressure differential of 0.1 w.g. (25 Pa) with reference to the outside across the entire system including the manufacturers’ air handler may be performed. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators ventilation systems that are not integrated with ducts serving heating or cooling systems.

2. If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

3. Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 6.0 CFM (169.9 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Exception:
1. If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.

Note: Show the proposal using strikeout, underline format. At the beginning of each section, one of the following instruction lines are also needed:

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

Reason statement:
Since the 2006 IECC, it has been a mandatory requirement to seal ductwork. The language has changed very little and in Section R403.3.2 of the 2018 IECC, it now says, “Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.” A separate section is addressing building cavities by stating that, “Building framing cavities shall not be used as ducts or plenums” in order to ensure tight, efficient, and well-performing HVAC systems.

This short historical perspective reminds us that duct leakage has been an important energy conservation issue for quite some time; at least since 2006. However, it was not until the 2009 IECC that mandatory duct leakage testing entered the code. From that point forward the importance of duct leakage on the efficiency and performance of the house has not changed, but more and more confusion has been introduced into the code. Currently, this confusion shows itself primarily in the relationship between testing organizations, HVAC contractors and builders, because there is a requirement to test, but there is no testing threshold target for the Mandatory testing section by which to hold a system to. In addition, when using the performance paths sections R405 and R406, one mistakenly believes that yes, a system must be tested, but no it does not have to be tight. This inconsistency between section R403.3.2 Sealing and R403.3.3 Duct testing is at the heart of this code change.

The 6 CFM/100 square feet of conditioned floor area leakage threshold is currently only a prescriptive threshold target. This makes some sense as duct leakage is a tradable performance metric in the software tools used to demonstrate compliance using sections R405 and R406. However, it also makes no sense as the IECC currently requires a total duct leakage test while sections R405 and R406 require a duct leakage to outside test to assess the performance trade-off. To add to the confusion, a field testing organization cannot report to the HVAC contractor and builder if a home has passed the duct leakage testing requirements of the code when using performance compliance options beyond a worst case guess, because the software tools must be fully populated with data that is observed at both rough and final stages of construction in order to accurately determine tradeoffs.

This code change proposal simplifies the requirement and enforcement of the requirement. Just as whole house air leakage testing has specific blower door threshold targets, creating a minimum and specific threshold target for duct leakage in Section R403.3.3 allows for better and more streamline code adoption and enforcement. From a prescriptive compliance perspective, we know that if the home is equal to or better than the air leakage and duct leakage performance thresholds that it is meeting the minimum efficiency requirements of the code. From a performance perspective, we also need to know if the home is meeting the minimum threshold requirements and then additional compliance flexibility is achieved when or if the home performs better. The unintended consequence of introducing a mandatory and prescriptive duct leakage test has only led to mass confusion in the field and a miss interpretation of the requirements.

I believe that the intent of the current 2018 IECC is that the duct leakage testing threshold is the 4% target. However, interpretation abounds. This proposal incorporates what has passed in the current 2021 IECC CAH and does the following.

The CAH Proposals that were approved are, RE112, RE114, RE115, RE118, RE119. In this Denver Duct leakage proposal, one can comprehend the totality of the changes that will occur in this section if this proposal passes. The following has been added or moved.

1. RE119 alternative testing allowance has been moved to Post construction testing as Duct leakage to Outside testing cannot occur at a rough stage of construction.

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November 15, 2005
2. Allowance for testing without the air handler at a rough stage of construction has been added to Section R403.3.3 in order to provide the same level of flexibility that is offered in Section R403.3.4

3. This proposal lowers RE115’s upper duct leakage target from 8 CFM/sqft of conditioned floor area to 6 CFM/sqft in the mandatory requirement. The rationale for this is two-fold. First, there are energy savings from tighter ducts within the building envelope, as well as health, safety, and durability benefits. Second, if the ducts are at 6 CFM of total leakage, then that number works 90+% of the time for the duct leakage to outside input in the code compliance software for the simulated performance and ERI paths to demonstrate compliance. Therefore, additional testing is not needed unless more trade-offs are needed or desired.

4. Next, an allowance/exception for small dwelling units that are 1,200 sqft or less in size has been added. A 1,200 sqft dwelling unit will have limited ductwork, and it becomes irrational to expect to consistently seal the system below 72 CFM or 6 percent as would be required. If you have a 1,000 sqft unit, the leakage rate at 6 CFM would be 60 CFM. If you had a 500 sqft unit, it would be 30 CFM. This is not practical, and there should be an exception. There was agreement from the proponents of duct leakage CAH proposals that this exception was worth adding to the code.

Lastly, this proposal has taken the best ideas from the current national code development process and incorporated them into a meaningful and enforceable code for the city of Denver.

Note: The following items are required to be included:

**Purpose:** The proponent shall clearly 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.)

**Reasons:** The proponent shall justify changing the 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 which clearly shows why the current does not reflect physical, environmental and customary characteristics that are specific to the City and County of Denver and explains how such proposals will improve the Code.

**Substantiation:** The proponent shall 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 (as needed):** The proponent shall submit a bibliography when substantiating material is associated with the amendment proposal. The proponent shall make the substantiating materials available for review.

**Referenced Standards:**

- Energy Conservatory Duct Leakage to Outside Testing Instructions
  - [http://energyconservatory.com](http://energyconservatory.com)
- ANSI/RESNET/ICC 380-2016 standard

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

**Impact:**

**Cost impact:** The code change proposal will increase the cost of construction

Currently Total duct leakage testing is required. Duct leakage to outside is also required for IECC code sections R405 simulated performance and R406 ERI pathways. Duct leakage to outside is a tradeable feature and is an input in the modeling software used to demonstrate compliance with the code when using sections R405 and R406. Therefore, the code in essence is currently requiring both tests when these compliance options are used. **Price would increase for those who are using the prescriptive path but should remain the same for those using the simulated performance path or the ERI path for compliance.**

**Note:** The proponent shall indicate one of the following regarding the impact of the amendment proposal:

- The effect of the amendment proposal on the cost of construction; Increase, Reduce, No Effect:
- The effect of the amendment proposal on the cost of design; Increase, Reduce, No Effect:
- Is the amendment proposal more- or less-restrictive than the I-Codes; More, Less, Same:

**Departmental Impact:**

The department would need to look for passing reports in order to issue the C.O.

**Note:** Indicate one of the following regarding the impact of the amendment proposal:

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