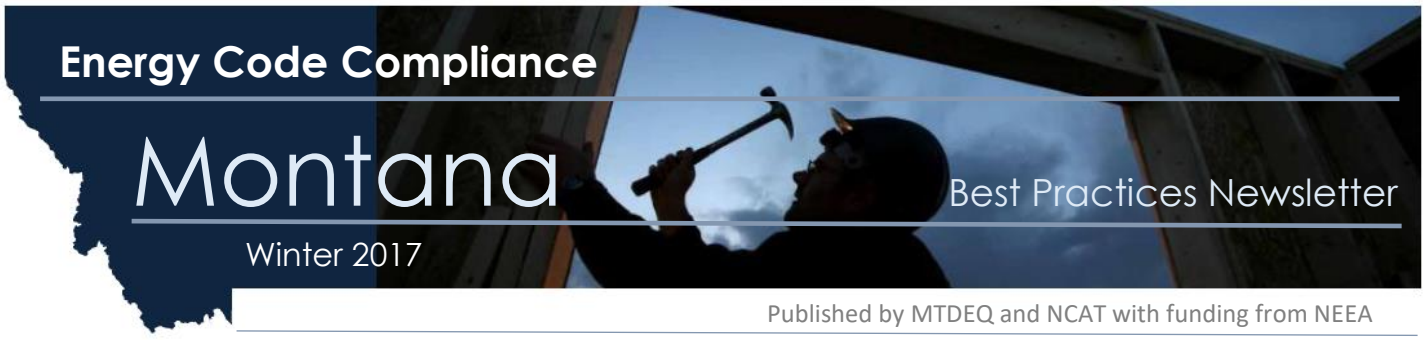

Energy Code Compliance

Montana Best Practices Newsletter

Winter 2017

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"Live in the sunshine, swim the sea, drink the wild air..."

Ralph Waldo Emerson

Contents

Duct Sealing and Tightness Testing

Why are Tight Ducts Important?

Tightly sealed ducts can reduce utility bills. Tight ducts improve indoor air quality because leaky ducts in attics, unfinished basements, crawl spaces, and garages can allow dirt, dust, moisture, pollen, pests, and fumes to enter the home. When ducts are leaky, the heating and cooling system has to work harder to condition the home. Duct sealing, along with proper insulation, allows the installation of a smaller, less costly heating and cooling system. Leaky ducts located outside the building thermal envelope are more important, from an energy point-of-view, than leaky ducts located within the conditioned space. However leaky interior ducts can cause indirect air leakage to the outside and impact occupant comfort. When ducts are properly sealed, they deliver conditioned air more effectively to all rooms—helping to ensure a more constant temperature and improved comfort throughout the home.

Montana Energy Code Amendments

Code Citation: 2012 IECC, R403.2.2 [Duct] Sealing (Mandatory)

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.

Duct tightness testing shall be verified by either of the following:

1. **Postconstruction test: Leakage to the outside of a condition space or total leakage shall be less than or equal to four cfm per 100 square feet of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. [25 Pa] across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. *[Shown as amended.]***
2. **Paragraph #2 in the 2012 IECC regarding rough-in testing was deleted.**

Exception: The duct tightness testing is not required for ducts and air handlers located entirely within the building thermal envelope.

There are two significant Montana amendments regarding duct tightness testing.

1. The 2012 IECC allowed only one type of duct tightness test, the total duct leakage Test. The Montana amendment allows either a total duct leakage test or a leakage to the outside test. While each of these tests measures a significantly different duct leakage characteristic the maximum allowed leakage for both tests is the same, four cfm per 100 square feet of conditioned floor area.

2. The 2012 IECC allowed testing at rough-in, before construction was complete. The Montana amendment deleted that provision. Therefore construction must be complete before duct tightness testing is performed.

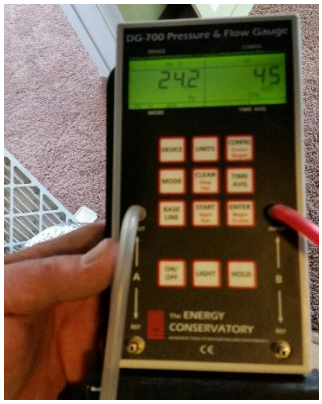
The loophole. By establishing the same allowable leakage rate for both the total duct leakage test and the leakage to the outside test the Montana amendment created a loophole. In the 2009 IECC when bother types of tests were allowed by the code, the allowable leakage for the leakage to the outside test was only 2/3 of that allowed for the total duct leakage test. By using a leakage to the outside test this loophole allows leakier ducts than would be allowed by a total duct leakage test.

Is Partial Duct System Testing an Acceptable Practice?

Should a builder be allowed to test only that portion of the duct system that is located outside the building thermal envelope? The energy code language does not address this issue directly. However, there are two reasons why this approach should not be deemed acceptable. The first reason is the use of the phrase “across the entire system” by the code when addressing duct testing requirements. The second reason has to do with the physics of the test procedure. Testing only isolated sections of ducts outside the building thermal envelope will not capture indirect leakage to the outside. For example, a leaky supply duct in a floor joist cavity could pressurize that cavity resulting in air leakage to the outside through a poorly sealed rim joist. While the code language is somewhat ambiguous, partial duct testing is clearly not a good practice and should be discouraged.

Who may conduct duct tightness testing?

The code provides no guidance regarding who may conduct duct tightness testing. Therefore it the code official determines who may conduct duct tightness testing

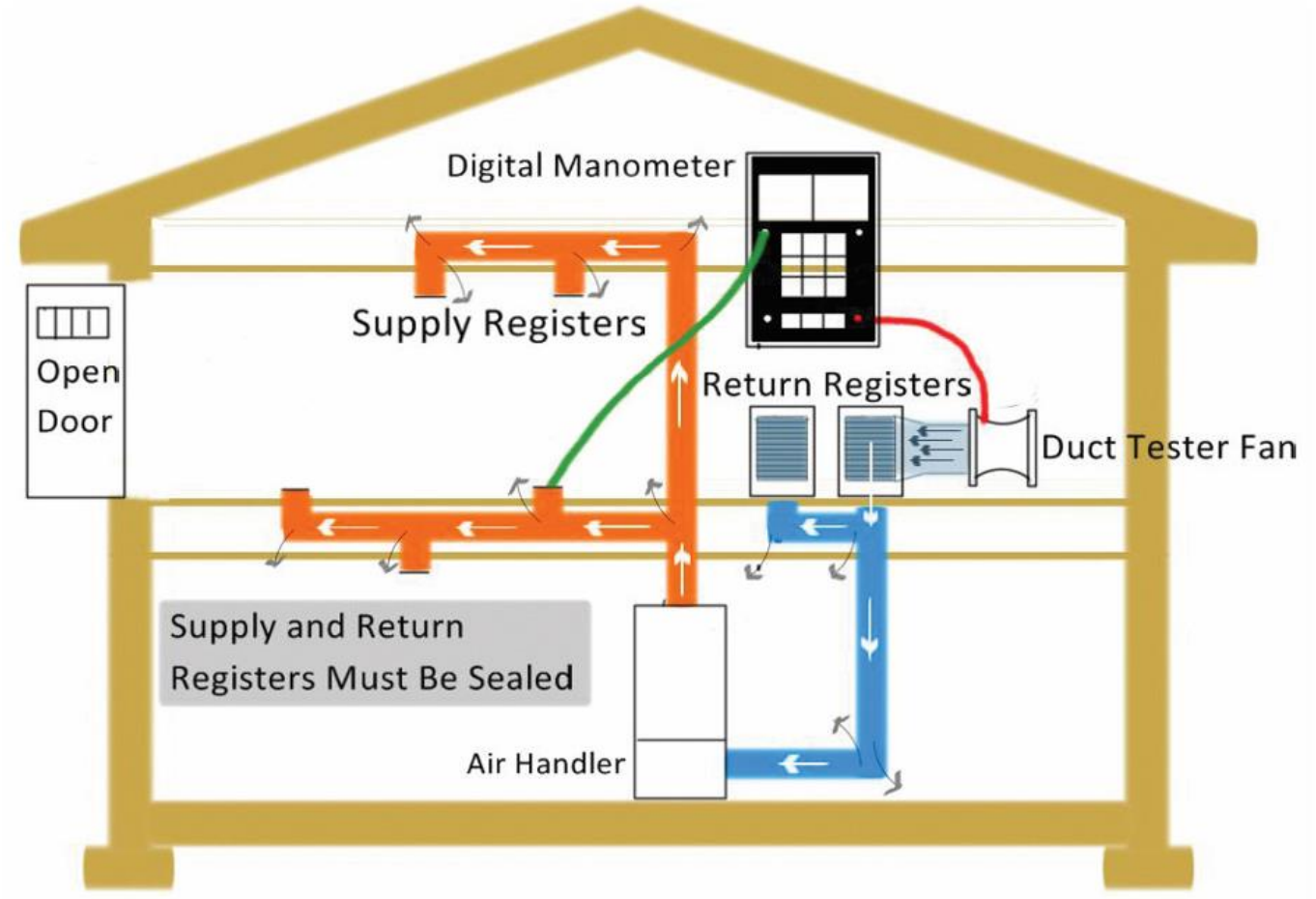


A duct tightness test involves the use of a duct tightness fan (shown above at the left), a digital manometer (center), and in the case of a duct leakage to the outside test, a blower door fan (right).

Duct Tightness Test Procedures

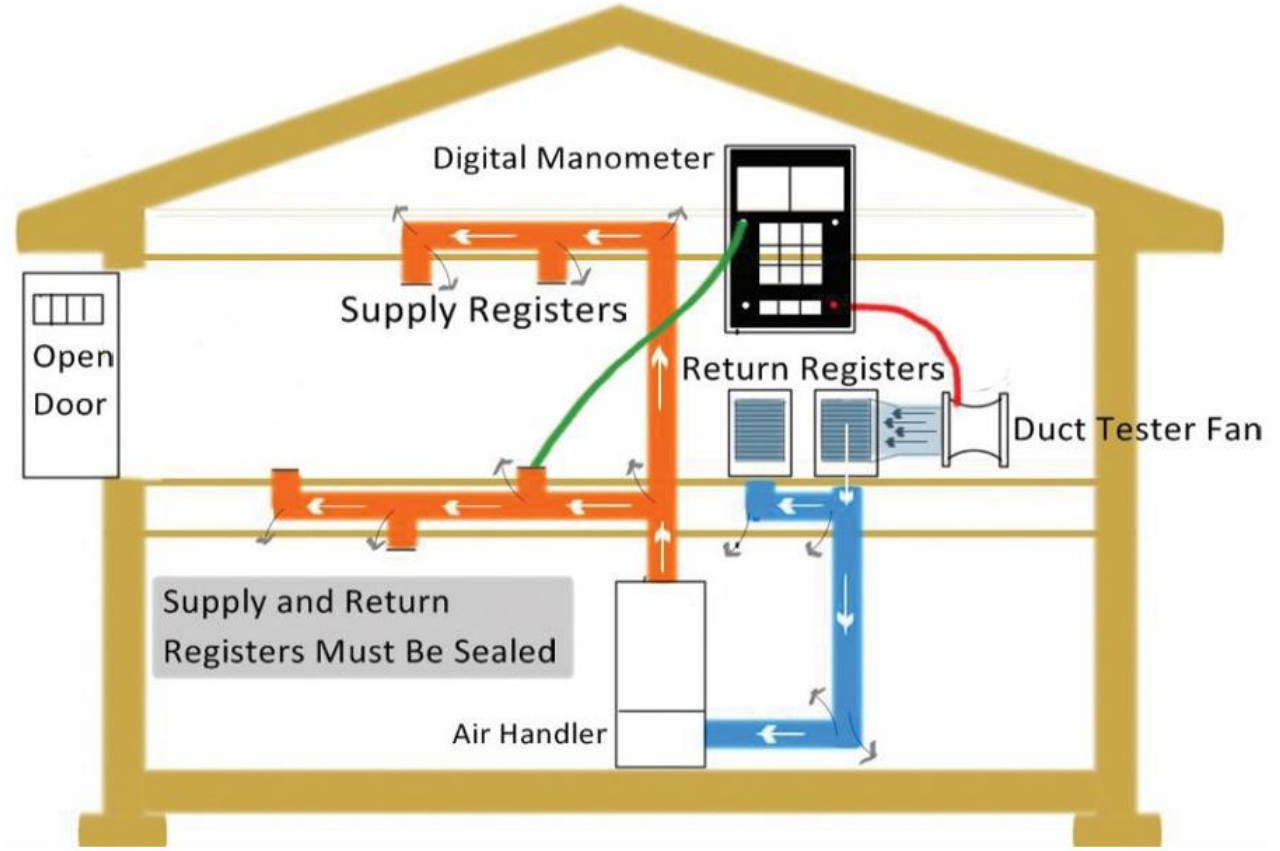
A duct tightness test involves using a fan to force air into the duct system and measuring how much air leaks out through cracks and holes (the supply and return registers are taped closed for the test). ***A duct pressure test is not required if the air handler and all ducts are located inside the building thermal envelope.***

Two types of duct tightness testing are allowed by the Montana energy code. The ***total duct leakage*** test measures the duct leakage from the entire duct system regardless of whether it is located inside or outside the conditioned space. To conduct a total duct leakage test, all supply and return registers are sealed. The duct tightness tester fan is attached at the air handler cabinet or the return register nearest the air handler. The air flow required to bring the duct system to 25 Pascals pressure with reference to the house is equal to the air leaking out of the duct system at that pressure. The total duct leakage test is simpler and takes less time to perform than the duct leakage to the outside test.



Total Duct Leakage Test

The ***duct leakage to the outside*** test is more complex because the blower door fan must also be used to pressurize the house to 25 Pa with reference to outside. The duct tester fan is then used to bring the pressure in the duct system to zero with reference to the house. Since air requires an opening and a pressure difference to flow, the duct leakage to the outside test eliminates air leakage within the house from the test results (since duct pressure is the same pressure as the house). Therefore, the only leakage measured with the duct tester fan will be outside of the conditioned space.



Duct Leakage to the Outside Test

Duct Sealing

Code Citation: 2012 International Mechanical Code (IMC), 603.9 Joints, Seams, and Connections
All joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes.

Section R403.2.2 of the IECC, as noted previously, requires that ducts, air handlers, and filter boxes be sealed. That section goes on to say that joints and seams shall comply with either the International Mechanical Code (IMC) or International Residential Code (IRC) as applicable. Because Montana did not adopt Chapter 16 of the IRC which addresses duct sealing, the relevant reference is the IMC. Section 603.9 of the IMC requires that ducts be sealed and specifies acceptable sealant systems. Duct sealing materials must be listed and labeled in accordance with UL 181A.

Duct Tightness Test Reporting

The 2012 IECC does not specifically require a duct tightness testing report. However Section R401.3 requires that the results of the test be included on the permanent certificate posted on the electrical distribution panel. The local code official determines if a report must be submitted and the character of that submission. Good practice is to require relevant test information along with the final test results in the report submitted to the building department as a confirmation of the procedure employed by the tester. An example of such a report is included below. If you would like an electronic copy of this report form, email NCAT at daleh@ncat.org and request the standard duct test report form.

Montana Energy Code Duct Leakage Test Record Form

Test: Date_____ **Time** _____

Tester Name (Printed)_____ Phone_____

Company _____

Tester Email _____

Tester Signature _____

_____ Ft² House Conditioned Floor Area (CFA)

_____ CFM25 Maximum Allowable Duct Leakage [CFA / 100 x 4 cfm]

Fan: Model_____ Serial #_____ Manometer: Model____ Serial #_____

Toe-kick Supply Registers

Are unducted toe-kick supply registers present? **Y N**

If present, were supply registers below cabinets sealed for test? **Y N**

Unvented Crawlspace Supply Registers

Are supply registers present in unvented crawlspace? **Y N**

If present, were supply registers in crawlspace sealed for test? **Y N**

Total Duct Leakage Test

_____Attachment Location of duct blaster fan (Return Grill or Air Handler Cabt.)

_____Duct Pressure Measurement Location

_____Rings Installed for Test (Configuration)

_____Pa Duct Pressure Reading WRT House

_____CFM25 Duct Test Fan Flow Reading (Total Leakage)

Duct Leakage to Outside Test

_____Attachment Location of duct tester fan (Return Grill or Air Handler Cabt.)

_____Duct Pressure Measurement Location

_____Pa Building Pressure WRT outside

_____Duct Testing Fan Ring Configuration

_____Pa Duct Pressure Reading WRT House

_____CFM25 Duct Test Fan Flow Reading (Duct Leakage to Outside)

Keeping Ducts Inside – A Best Practice

The code allows ducts to be located outside the building thermal envelope. But keeping ducts inside eliminates the need for duct tightness testing and reduces energy use. Duct leakage in unconditioned spaces can be a cause of builder callbacks for comfort issues, moisture problems, and high energy bills. Indoor air quality can also be compromised since any air leaks will pull unconditioned replacement air into the living space from the attic, crawlspace, or basement. Even when ducts are tightly sealed, conduction losses can increase heating and cooling energy usage. The benefits from locating all of the ducts inside the building thermal envelope include:

- Reduced installation costs from short, straight, and un-insulated ducts with no tightness testing.
- Reduced equipment costs from smaller capacity equipment needed to meet reduced loads.
- Reduced duct system costs from smaller equipment with lower air volume.
- Reduced operating cost from reduced loads met by lower capacity equipment.

Besides, as any home inspector knows, attic ducts are often crushed, ripped, or completely disconnected. Since homeowners rarely visit all the nooks and crannies of their attics, these problems can remain uncorrected for years.

Duct tightness testing will identify significant duct problems such as disconnected duct joints. This is one reason why duct tightness testing is good practice even when all of the ducts are located within the building thermal envelope.

DEQ
Montana Department of Environmental Quality

For questions, suggestions, or to be removed from the newsletter distribution list email daleh@ncat.org.

Energize Montana Energy Code Website:

http://deq.mt.gov/Energy/EnergizeMT/EnergyCode