

# Building Official's Guide to Duct Testing – based on 2009 IECC

## Why test ducts?

Leaky ducts pose health, safety and comfort problems and account for about 25% of the total energy lost in a typical house. Because it's *"by far the most cost effective way to save energy"*\*, building codes now demand higher performance. Although visual duct inspections may be allowed in some states, duct testing provides an easier, faster, verifiable pass /fail test result.

*\*EPA quote*

## How tight must ducts be?

Measured at + or – 25 Pascal test pressure. Expressed in CFM per 100 sq ft of conditioned floor area.	Total Duct Leakage must be less than:	Duct Leakage to Outdoors must be less than:
<b>When test is performed:</b>		
At rough-in with <b>no</b> airhandler:	4 CFM per 100 sq ft of floor area	
At rough-in with air handler:	6 CFM per 100 sq ft of floor area	
Post construction after sheetrock:	12 CFM per 100 sq ft of floor area	8 CFM per 100 sq ft of floor area

The 2009 IECC (International Energy Conservation Code) applies in all new construction, or in existing houses where more than 50% of the ducts are replaced but does NOT apply where all ducts are located outside the conditioned space

## How does a duct tester work?

The Flex Duct connects the calibrated fan to a return register. All other registers are sealed off. The gauge is connected to the supply register closest to the supply plenum and to the fan that creates a test pressure of + or - 25 Pascals (Pa). The gauge displays the test pressure and the corresponding duct leakage flow in cubic feet per minute (CFM). The gauge will also display CFM/100 square feet to compare directly to the requirement in the table, when Floor Area is entered into the gauge.

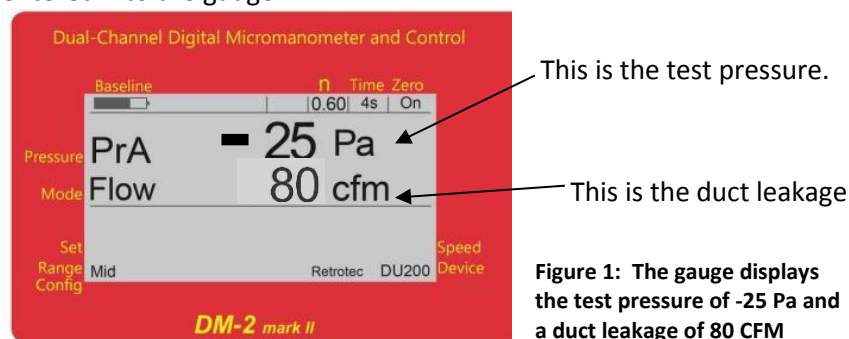


Figure 1: The gauge displays the test pressure of -25 Pa and a duct leakage of 80 CFM

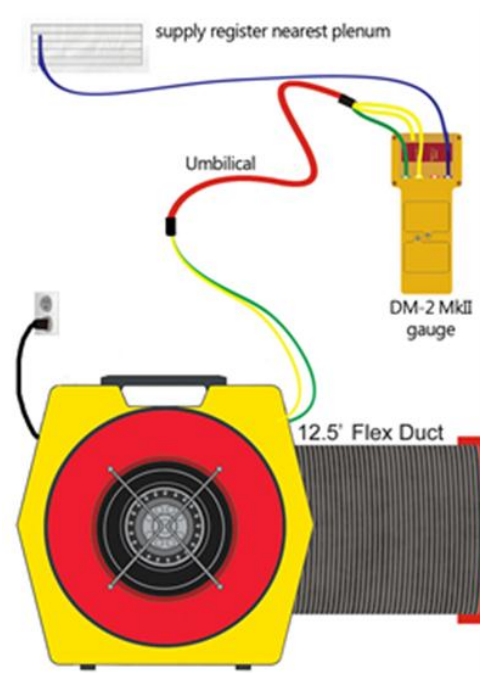


Figure 2 Duct Tester connections

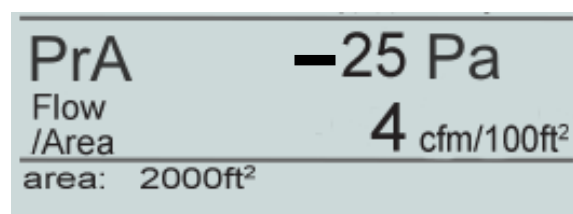


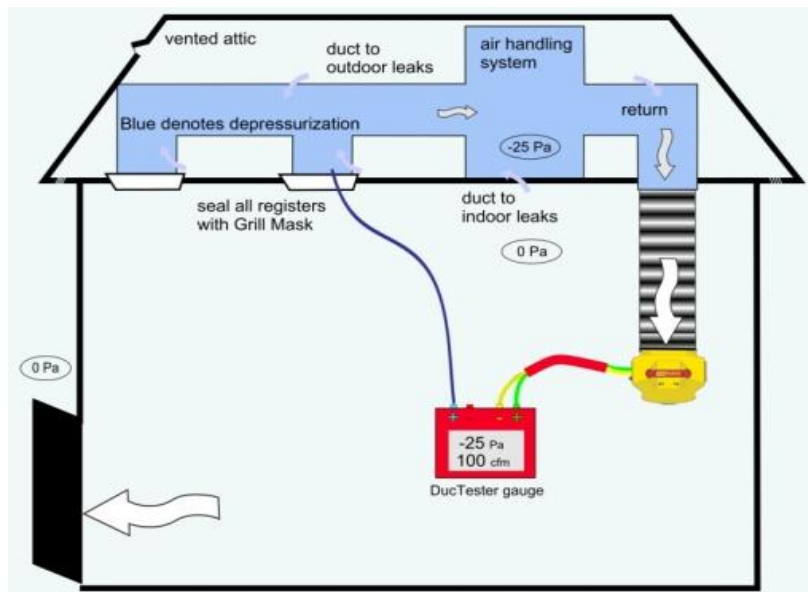
Figure 3: The gauge will also display 4 CFM per 100 square feet when the floor area of 2,000 square feet is entered.

This is the Duct Leakage per 100 square feet

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## Total Duct Leakage Test

Total Duct Leakage is the sum of all leakage from the ducts whether to indoors or outdoors and is performed with one test fan and one gauge as shown in Figure 4. Total Duct Leakage tests may be performed at different times during construction. With each progressive stage of construction, more leak opportunities exist so the allowable leakage increases as shown in the table.



The test may be performed under pressurization where the test fan blows air into the ducts or depressurization where air is sucked out of the ducts.

Depressurization is shown in Figures 4 & 5 and is preferred because the test pressure will pull the seals onto the registers instead of pushing them off as happens under pressurization. Results should be the same.

*Only WA and CA require pressurization testing.*

Figure 4: Total Duct Leakage Test under depressurization

## Duct Leakage to Outdoors Test

Duct Leakage to Outdoors is a measurement of only those leaks to outdoors. Indoor leaks are eliminated by setting the house to the same pressure as the ducts with a Blower Door fan in order to neutralize flow between the ducts and the house. This test requires a Blower Door and typically two gauges although it is possible to run the test with one gauge by sampling first one pressure then the other to set the ducts and house to the same pressure.

The Duct Leakage to Outdoors test may **only** be done post construction. Because indoor leaks are not measured, the allowable leakage post construction is reduced to **8 CFM/100 sq ft** from **12** for the Total Leakage.

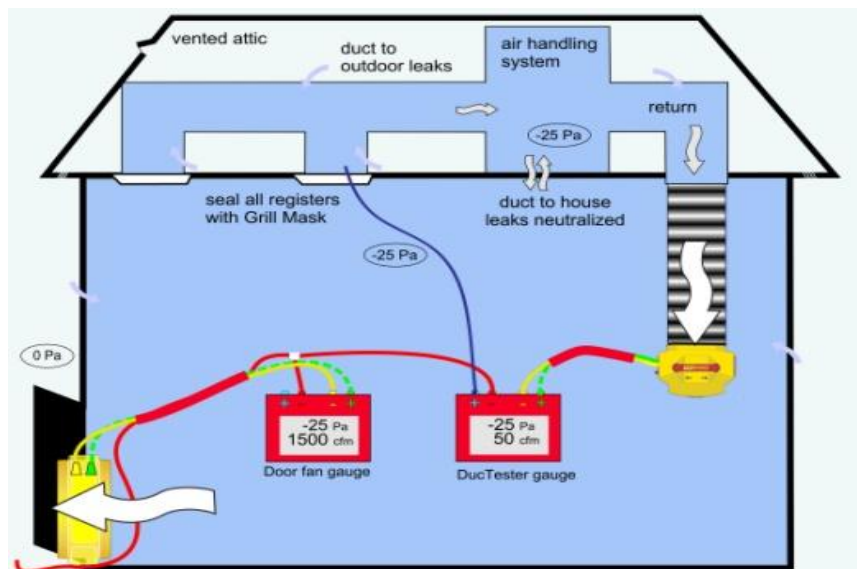


Figure 5: Duct Leakage to Outdoors under depressurization

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## Be aware of the largest sources of error

### Mis-matched Device or Range Setting ...could cause 25 to 400% errors

Make sure the fan being used for the test is selected as the correct "Device" on the gauge. If the tester is using the DucTester from Retrotec, the display must show "Retrotec DU200".

Range Rings are used to supply more airflow for leakier ducts, and less for tighter ducts. If the "Range Config" selection on the gauge does not match the Range Ring installed on the fan, large errors will result. "Mid" will be correct most of the time. "Open" is for leaky ducts that will likely fail (or for large buildings), and "Low" is for tight ducts that will likely pass.



Figure 6: Fan and Range Ring in use during test must match gauge settings for Device and Range Config

### Damaged, Blocked or Pinched Tubes

...could cause 25 to 95% errors

Checking each tube for blockage, leaks or pinches and checking gauge calibration should be done regularly by testers. When tubes are plugged into the gauge as shown in Figure 8 and the readings are more than 2% different, either the tube is blocked or the gauge is faulty. Pressure dropping to zero in about 10 seconds indicates a leak somewhere.



Figure 7: Pinched or water blocking tube



Figure 8: When a tube is connected between Channel A and B the readings must be within 2%. If differences persist after trying different tubes, the gauge may need re-calibration.

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## Check the system regularly for accuracy

A field calibration procedure can be performed onsite using a Flow Verification Plate to check out the gauge, fan, flex duct, and operator all at the same time. If the flex duct has a lot of holes, the system readings may be off.

It is important to check the system regularly for accuracy. If the ducts pass but the system is reading 10% low, then adding 10% to the test result to compensate could make them fail.

The full procedure is outlined in the “DU200 DucTester QuickGuide” which is packed with each Retrotec DucTester system. If the tester does not have a Flow Verification Plate, using a piece of cardboard with a 4 X 4 5/8 inch hole cut in the center should read 100 CFM (+/- 10 CFM) at 25 Pa test pressure.

## Technician Training

Each State has its own requirements for the training and certification required of technicians performing the duct testing. The code official has the authority to accept or reject the qualifications of an individual or organization. HVAC installer, Building Performance Institute (BPI), or RESNET certifications are commonly acceptable. If certifications are lacking or doubt exists, requesting the field check of system calibration is an excellent way to see if the tester knows how to test and has capable equipment.

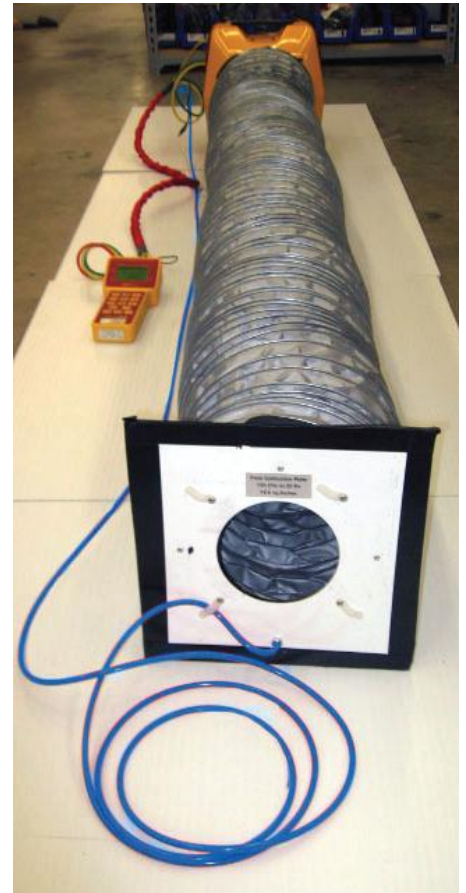


Figure 9: Set up for field check of system calibration

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## Total Duct Leakage Test Form

Test date: ...../20\_\_

Fan Model \_\_\_\_\_ Fan Serial # \_\_\_\_\_ Gauge Serial # \_\_\_\_\_

Address: \_\_\_\_\_ Contact: \_\_\_\_\_ Phone: \_\_\_\_\_

\_\_\_\_\_  
Technician: \_\_\_\_\_

Step	√	Action	Notes, details and check off
1		Locate DucTester near return so flex will reach.	
2		Turn Air-handler off (if installed)	__ Off, __ no airhandler
3		Remove the furnace filter, cover filter opening, and switch the furnace off	
4		Attach flex to return register or access door in the air handler	Attached to __ return register, __ access door
6		Seal all registers	
7		Insert blue tube in a supply register closest to plenum	
8		Open all interior doors and one exterior door	
9		Make connections to the DucTester	__ yellow tube, __ green tube, __ power cord, __ speed control
10		Connect tubes and Speed Control Cable to the gauge	__ blue tube, __ yellow tube, __ green tube, __ speed control
12		Range Configuration, usually it will be Mid	__ Low, __ Mid __ Open
13		Record Flow Direction	__ flow into ducts, __ out of the ducts
14		Enter conditioned floor area of the house into gauge	_____ sq ft
15		Create a 25 Pa pressure in the ducts. Record Pressure (PrA)	_____ Pa
16		Record Flow/100 sq ft with “@ 25 Pa” displayed.	_____ CFM/100 sq ft @ 25 Pa
17		Maximum Allowable duct leakage __ Post Construction: 12 CFM/100 sq ft __ Rough in Air handler installed: 6 CFM/100 sq ft __ Rough in Air handler not installed: 4 CFM/100 sq ft	__ Pass, __ Fail.
18		Unseal registers. Return home as found.	__ HVAC equipment back ON