

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

## Why test the building envelope with a Blower Door?

Air leakage is responsible for as much as 30% of all the energy lost in a home. Finding and addressing this leakage is often the least expensive way to save that energy. Air leakage tests can also identify potential safety, air quality and moisture problems before they happen. The International Energy Conservation Code, 2009 IECC allows either a Blower door test to prove adequate air tightness, or a visual inspection by the code official of a list of seventeen or more air barrier and insulation components. A Blower Door test takes about 15 minutes to setup and run, plus some time to measure the conditioned volume of the house, but the inspection can take much longer. Generally building officials prefer the blower door test because either it passes or fails

## How tight does the envelope have to be?

The building must have 7 Air Changes per hour at 50 Pa (7 ACH50) or less to pass the 2009 IECC.

- ACH: Air Changes per hour—a measure of how many times the air within the conditioned space (normally a house) is replaced, given the amount of flow measured and the volume of the space.

Measuring Air Changes per hour requires the measurement of the test airflow in CFM required to achieve 50 Pa and the building volume.

- CFM: Cubic feet per minute—measurement of volumetric flow rate related to envelope leakage.

The building must be set up according to the Envelope Air Leakage Test Form included on the last page. To pass 2012 IECC requires 5 ACH50 in climate zones 1 & 2 and 3 ACH50 in all other zones. 2012 IECC currently only applies in Maryland.

## Technician Training

Each State has its own requirements. The code official has the authority to accept or reject the qualifications of an individual or organization. Common certifications are Building Performance Institute (BPI), HERS Rater or RESNET. Getting the tester to perform a field calibration check is good indication they know how to operate the Blower Door test equipment.

## Gauges and Fans should be checked regularly for accuracy

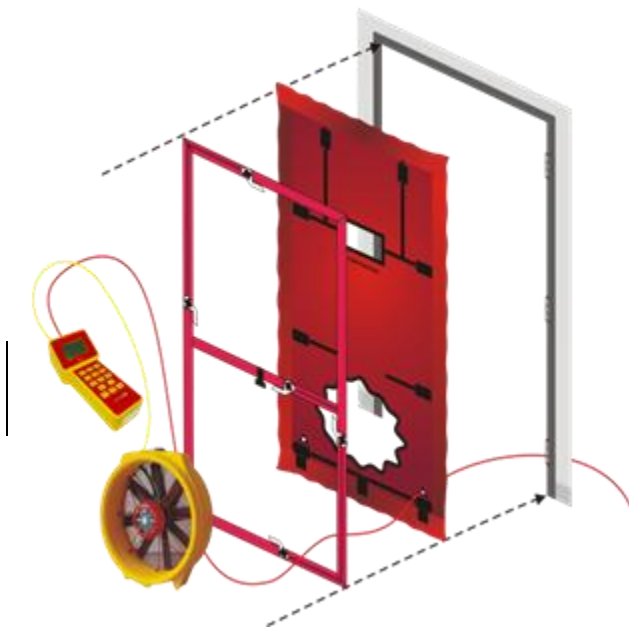
If you are concerned about the accuracy of the system, a field verification of the calibration can be performed onsite using a hole in a flat panel mounted in a window or above the blower door panel Flow Verification Plate. See the Blower Door manual for details.

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## How does a Blower Door work?

A calibrated fan is mounted in an exterior doorway and blows air into or out of a home. The fan creates a test pressure of 50 Pa (similar to a 20 mph wind) which is displayed on Channel A of the gauge. Channel B displays the pressure signal from the fan which may be displayed as CFM or air changes per hour, depending on the selection made on the Mode key.

- A Door Panel temporarily seals a doorway and provides a hole to mount the fan.
- A calibrated Door Fan creates the test pressure and airflow.
- A gauge displays the house leakage



This is the test pressure.

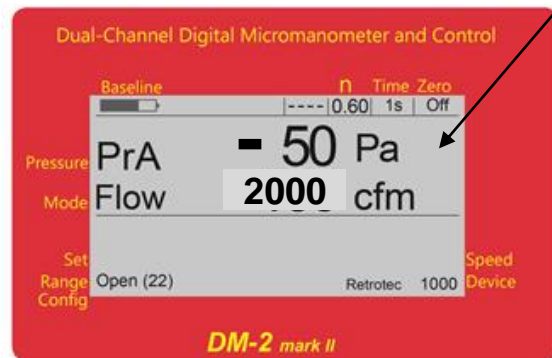


Figure 1: The gauge is displaying the test pressure of -50 Pa and a flow related to envelope leakage of 2,000 CFM.

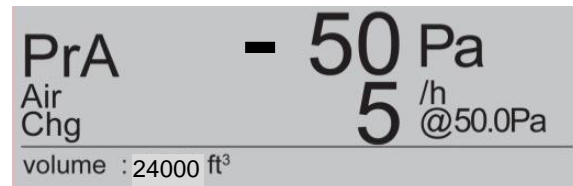


Figure 2: 2,000 CFM can also be displayed as 5 Air changes per hour if the Volume of the building is entered.

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## The Blower Door Air Leakage Test

Follow the steps on the Building Air Leakage Test Form on the last page.

- Step 1: validate and record the conditioned volume measurement
- Confirm building preparation according to Step 2 to 6
- Equipment is to be set up using the Quick Guide or Blower Door Manual if additional guidance is needed
- Note the Range in Step 8, which can be verified in Figure 4
- Note the Device appearing on the gauge in Step 9, which must match the fan has installed
- Verify that a 50 Pa test pressure was achieved for Step 10
- Record the pressure on Channel A and the CFM on Channel B in Step 11.
- Observe the CFM @ 50 Pa which is activated from the Mode key on the gauge.

The home can be pressurized but a depressurization test (blowing air out of the building) is the most common. The advantage is that dampers in exhaust fans and dryers are pulled closed during the test. Note the direction in Step 12 since it might be necessary if the test is repeated.

Air Changes may be read directly off the gauge or can be calculated and the results entered into Step 13. Press [Mode] until “Air Chg @ 50 Pa” is displayed, press [Volume], enter the volume and Air Changes will be displayed. (You may also multiply CFM x 60 to get CFH and divide by volume to get Air Changes.)

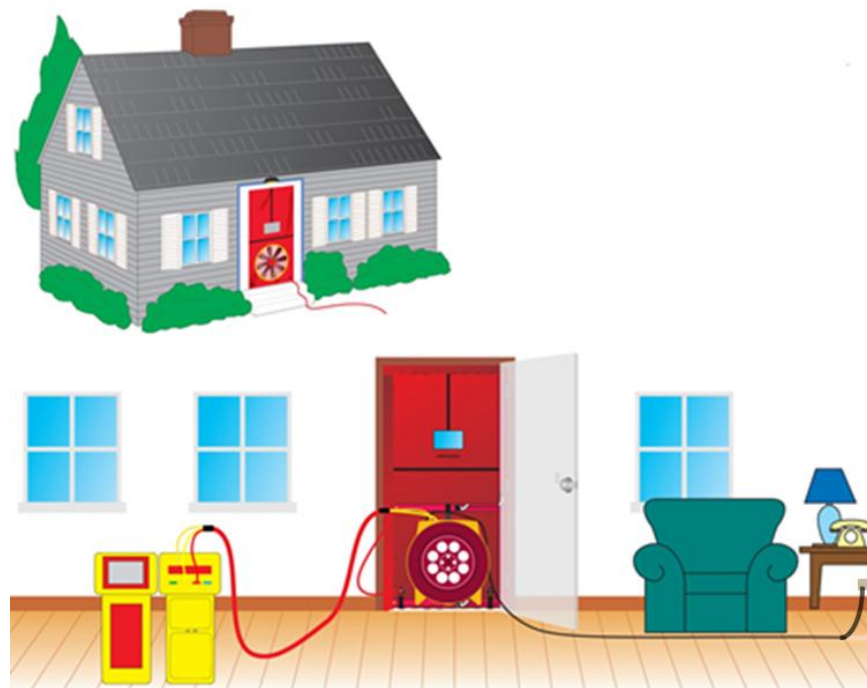


Figure 3 Blower Door Test equipment set up showing typical tubing connections from gauge to fan for depressurization.

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## Prevent the largest sources of error

**Mis-matched Device or Range Setting** ...could cause 25 to 80% errors

Make sure the fan being used for the test is selected as the "Device" on the gauge. If the tester is using the Retrotec 1000 Blower Door, it should show "Retrotec 1000" on the gauge.

Range Rings and Plates are used to supply more airflow for leakier houses, and less for tighter homes. Ensure that the "Range Config" selection on the gauge matches the Range Ring or Plate installed on the fan to prevent large errors. "Open" is for leakier houses and the "L" ranges are for tight houses (or for very small buildings).

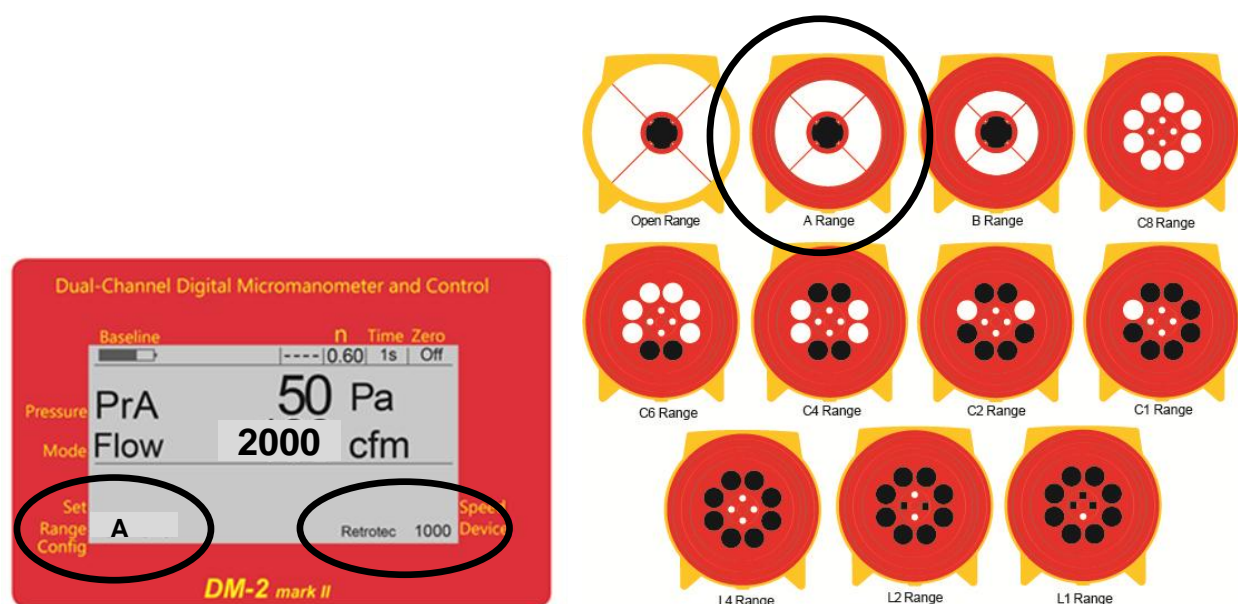


Figure 4: Fan and Range Ring in use during test must match gauge settings for "Device" and "Range Config"

**Damaged, Blocked or Pinched Tubes or Gauge needs calibration...**...could cause 25 to 95% errors

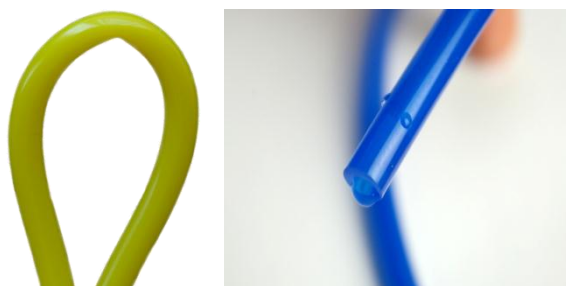


Figure 5: Pinched tube or water blocking tube

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To check for blocked, leaking or pinched tubes, and to check if a gauge needs calibration at the factory, simply connect each of the tubes between the different ports and compare the pressure readings displayed on “PrA” and “PrB”. If the values don’t match within 2%, check the tubes carefully for leaks, pinches or water or other blockages. If tubes are fine, the gauge may need to be sent back to the factory for calibration before results can be relied upon.

- Press [Mode] until "Mode" displays "PrB" (so gauge is reading pressure on both channels).
- Connect the yellow tube between the Red and Yellow ports on the gauge.
- Check that the readings are within 2%
- Repeat with each tube between other ports to check the tubes for leaks and the gauge
- Repeat with a tube between gauges to check gauge to gauge calibration



Figure 6: When a tube is connected between two ports and the readings on “PrA” and “PrB” are within 1%, the gauge is accurate.

These are the most common sources of errors. Use the following table to check set up:

yes/no	Check	Comments
__ yes __ no	“Range Config” on the gauge matches installed Range Ring or Plate	
__ yes __ no	“Device” selected on gauge matches the calibrated fan in use	
__ yes __ no	Gauge channels within 2% indicating no blocked or pinched or leaking tubes on all tubes	

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## Building Air Leakage Test Form

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

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

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

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

Step	√	Task	More details and record results
1		Measure the conditioned volume of the house here and in the gauge	_____ cu ft conditioned volume
2		Prepare building according to Blower Door Quick Guide.	
3		Close and seal all exterior openings for continuous ventilation systems and HRV. Registers are NOT sealed.	
4		Fireplace and stove doors closed and appliance dampers closed but not sealed	Fireplaces should be cool, and open ashes covered to prevent pulling them into the house during the test
6		Open all interior doors within the conditioned area and close doors and windows leading to outside	To induce a uniform pressure inside the enclosure
7		Install Blower Door into open exterior door and make connections according to the Quick Guide	
8		Record Range, "Range Config" on gauge	__ Open(22), __ A, __ B, __ C8, __ C6, __ C4, __ C2, __ C1, __ L4, __ L2, __ L1
9		Record, "Device" on gauge	__ Retrotec 1000, __ Retrotec 2000 __ Retrotec 3000, __ Retrotec 3000SR
10		Create 50 Pa house pressure	
11		Record Pressure "PrA" and "Flow" from gauge Record "Flow" with "@ 50 Pa" displayed	_____ Pa, _____ CFM (with NO "@ 50 Pa" displayed) _____ "CFM @ 50 Pa" displayed
12		Record Fan airflow direction	__ blowing into, __ blowing out of the building
13		Record Air Changes per hour	_____ /h
14		Maximum Allowable Air Changes: <b>7 /hr</b>	__ Pass, __ Fail.
15		Turn HVAC, DHW equipment back ON and remove any temporary sealing tape.	Return home to state you found it in