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TESTING FOR AIR LEAKAGE - USING THE BLOWER DOOR

Why should contractors be aware of the benefits of using a blower door?

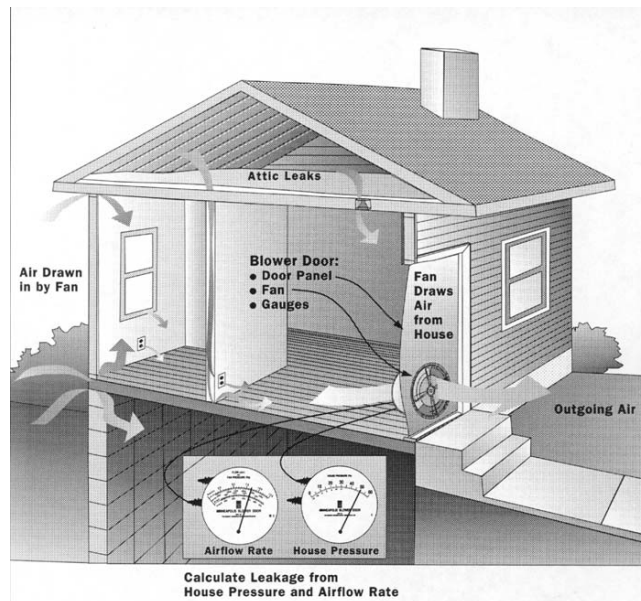
- Reduce customer complaints about comfort
- Under the 2009 IRC Chapter 11 N1102.4.2.1, blower door testing is an Air Leakage Testing Option
- Have third party verification for client/customer
- Improve indoor air quality
- Reduce the likelihood of moisture forming inside wall cavities

What's a Blower Door?

- A device that is used to pressurize or depressurize a building to measure the air leakage rate
- Assists in locating air leakage sites
- Assists in diagnosing duct leakage
- Sets economic limits to air sealing
- Assists in infrared analysis for air leakage as well as insulation effectiveness
- Qualifies the home for Energy Star

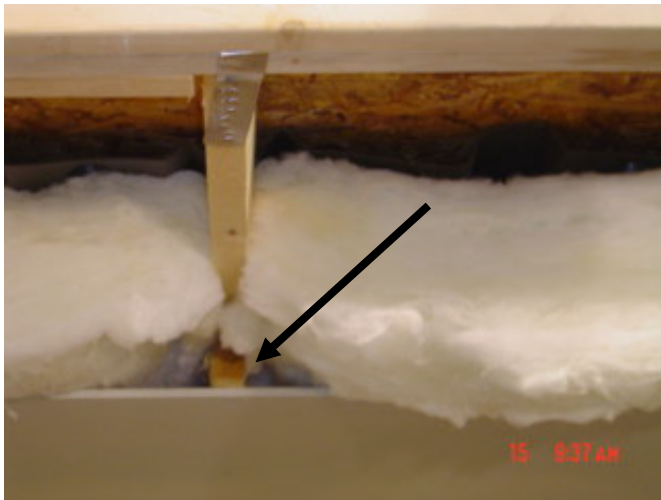


The author performing a blower door test



The Energy Conservatory

Blower door readings are normally taken under -50 Pascal's (a Pascal is a unit of pressure like inches of water column) of pressure. When in operation it creates a pressure equivalent to a 20 mile per hour wind force on all sides of the building, which is unnatural. That way, the Technician can measure total building air leakage. Readings at -50 Pascal's can be used to calculate how the building leaks air naturally, and the approximate size of all the holes in the building shell.



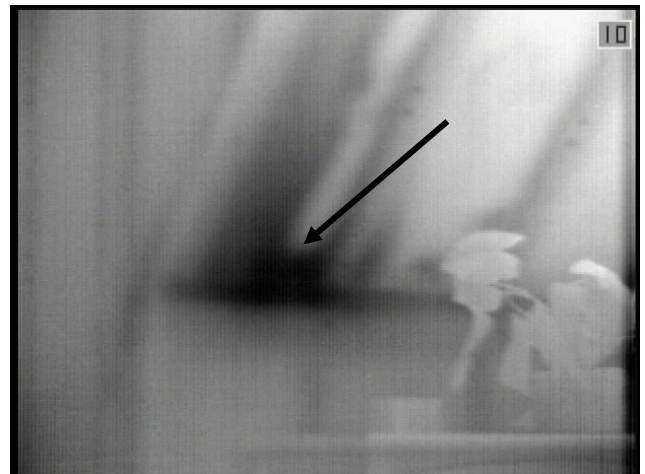
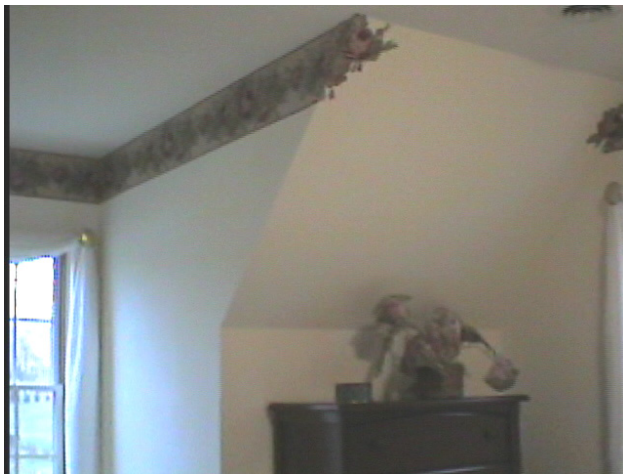
Poorly Installed Insulation

Insulation that has not been installed properly can easily be seen by auditors, inspectors and code officials.

The photo to the left shows insulation with gaps along the rafter and is not in contact with the drywall.

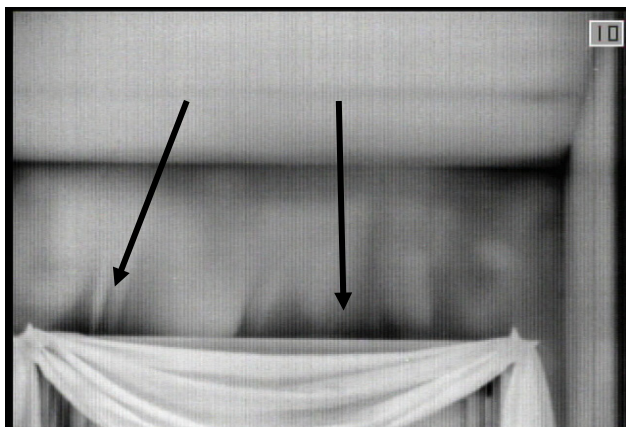
The below infrared photograph shows the result.

The black area denotes a colder surface which could become the first area for mold growth.

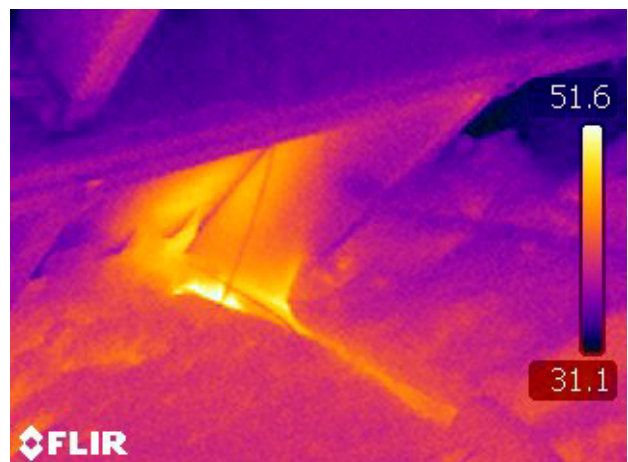


Air leakage sites can be easily identified with the use of a blower door and infrared camera.

Cold air is denoted by the fingers on the wall above this window.



By pressurizing the building with a blower door technicians can find escaping heat into an attic. This warms the roof sheathing and is a common cause of ice damming.



Selling Home Performance Work

Building Performance professionals and IRC code officials use blower door pressures at -50 Pascal's of pressure as described earlier. Homeowners won't likely understand this data. What does get their attention is telling them how many times all the air leaks out of their home per hour, or how big the hole is in their house allowing air to escape. They will soon put a dollar value to these numbers on their own.

Basic Blower Door Math and Conversions

- **CFM₅₀** = Air leakage with blower door
- **CFM_{natural}** = Air flow, cubic feet/minute natural or how air leaks out of their house naturally
- **ACH natural** = Natural air change in air changes per hour.
- **N factor** = is a numerical factor reflecting wind speed, shielding of the building, the height of the building as well as what climate zone the building is in. N factors for PA and MD ranges from 11.7 – 22.2. Lawrence Berkeley Labs (LBL) has developed this procedure and is used by ASHRAE to design ventilation standards.



IRC N1102.4.2.1 Testing options: “Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 Pascal's.”

To convert CFM 50 to ACH 50

$$\frac{\text{CFM 50 x 60 minutes}}{\text{House volume}}$$

Example:

Blower door reading @-50 Pascal's = 4500 CFM with a house volume of 9000 cu ft. House is located in Baltimore, MD. Using an N factor of 18.2

$$\frac{4500 \text{ CFM 50 x 60 minutes}}{\text{House volume}} = \frac{270,000}{9000} = 30 \text{ ACH at 50} \quad \text{This home would not pass.}$$

To convert ACH 50 to ACH natural

$$\frac{\text{ACH 50}}{\text{N factor}}$$

$\frac{30}{18.2} \text{ ACH 50}$
N factor = 1.64 Air changes per hour naturally. As a reference, Energy Star homes must come in at .35 ACH naturally to qualify.

To directly convert a blower door CFM 50 reading to Air Changes per hour naturally

$$\frac{\text{CFM50 x 60 minutes}}{\text{Volume of building x N factor}}$$

To calculate the size of the hole in the building / Approximate Leakage Area

$$\frac{\text{CFM50}}{10} = \frac{4500}{10} = 450 \text{ sq in hole in the building}$$