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Proven Airtightness Essential for Energy Efficient Homes

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The last three decades of home building research and development have demonstrated that airtightness is critical to improving the energy performance and durability of all homes, both new and existing. Home buyers are increasingly aware of the need to conserve energy to reduce operating costs and the impact on the environment, escalating the demand for better built homes. In addition to home buyers, government entities such as the Environmental Protection Agency (EPA) and the Department of Energy (DOE) are taking steps to encourage home builders to build tighter homes. For instance, new buildings must meet certain air-tightness requirements to receive an ENERGY STAR rating. In addition, the DOE and state weatherization programs encourage updating older homes to be more energy-efficient. The 2012 International Residential Code (IRC) and the 2012 International Energy Conservation Code (IECC) require that all residential buildings be built even tighter yet and require testing the airtightness.

A tighter house with less random infiltration and exfiltration will save energy, but the occupants still need fresh, clean air to breathe. A tighter house is also more likely to retain moisture which may lead to mold and other biological growth and can cause structural or cosmetic damage to the home. It is no surprise then, that government requirements for energy efficiency go hand-in-hand with the necessity for mechanical ventilation. A tighter house creates an opportunity for more effective control of indoor air quality (IAQ), through mechanical ventilation.

One of the ways to check a building's performance is a blower door test. A blower door is a tool that demonstrates the airtightness of a home and verifies the performance needed to meet building certification programs. A blower door contains a powerful, calibrated fan that is mounted into a frame that can be temporarily installed in an exterior doorframe. The fan exhausts air from the house creating a slightly negative pressure difference between the inside and outside. Typically a pressure differential of 50 Pa (0.2 inches of water column) is established, forcing air to flow into the home through all the holes and penetrations existing in the building envelope. By measuring the quantity of air that is leaving the house when the entire house is depressurized, a homeowner will have a measure of how air-tight the house is.

This test can be performed multiple times during the construction process, but generally two tests will provide the needed information. The first test will show where the leaks are located, and the second test is conducted to verify that the leaks are sufficiently sealed and that the house performs as desired. In new home construction, the first test should be performed once the air barrier has been completed, including drywall but before all finishing materials are installed, so that leaks can be identified and sealed. To verify the airtightness of the finished home, the final test should be made once all work is completed. In weatherization, the idea is to "test in and test out" to help document how much improvement has been made in the tightness of the building envelope.

An energy-efficient or weatherized house will ensure that heat doesn't easily escape in the winter, and that warmer, humid outdoor air doesn't infiltrate in the summer. This certainly helps a home be more energy efficient, however, the occupants still need a certain amount of fresh air to survive and be comfortable. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) sets the standard for the minimum required ventilation for a home based on the dimensions of the house and the number of occupants or bedrooms. The simplest calculation is 7.5 CFM multiplied by the number of bedrooms +1 more (to account for two people in the master bedroom) plus 1 CFM per 100 square feet of floor area. So for a 2,000 square foot house with four occupants (or three bedrooms), a minimum of 50 CFM of fresh air is needed (7.5*4 + 2,000/100).

Without a supply of fresh air, IAQ is compromised and can become a health hazard. Simply building a house tighter to minimize uncontrolled air flow is not enough. Mechanical ventilation is essential to create a better living environment. The Home Ventilating Institute (HVI) certifies a wide variety of residential ventilation products including bathroom fans, kitchen range hoods and heat and energy recovery ventilators, which can be used to ensure that proper ventilation is provided. HVI certifies the performance of airflow, sound and energy, allowing the most suitable products to be selected for each application. Always look for the HVI-Certified label -- your assurance that the products selected will perform as rated when properly applied and installed.

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