Build Tight and Ventilate Right

Energy code technical support

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Energy Savings

Why is it a good idea to construct tighter building envelopes? The most cited answer is reduced energy use. When fossil fuels became more expensive and home heating costs became a bigger part of the household budget, the first step in reducing energy bills was to add insulation.

However, people discovered that more insulation helped but more insulation coupled with a tighter shell made an even greater improvement. The tighter shell forced the heat to flow slowly through the insulation rather than allowing it to bypass riding on escaping air. Today, experts agree that energy costs can be reduced by as much as **30%** by sealing the leaks in a home and ensuring that the insulation cannot be bypassed by heated or cooled air.

Above depicts microbial growth due to uncontrolled moisture-filled airflow in an attic

Building Durability

Reduced energy costs are not the only benefit to building a tighter building envelope. When a building is constructed tightly, and careful attention is paid to how water (both vapor and bulk) is managed, the house stays drier. A building that gets wet due to roof or flashing leaks, holes in the air barrier that allow escaping air to carry water vapor into buffer spaces, or improperly placed or sealed vapor retarders, will begin to grow mold or fail structurally in a short period of time. While a continuous air barrier will not stop roof or flashing leaks, **it will stop uncontrolled air flow which may carry water vapor, and become trapped, condense, and create microbial growth issues.**

If the warm air is allowed to exfiltrate to colder buffer spaces, the water vapor in the rapidly cooling air will condense on any available cold surface. This dampens the surface and introduces conditions favorable for mold growth. Exfiltration, condensation and potential mold growth will not occur if the air barrier is continuous, well sealed, and touching the insulation it is protecting.

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Image shows water damage due to poor flashing and/or drainage plane technique

Human Comfort

Another very important reason to seal a home tightly is to increase human comfort. When air moves through a home, driven either by the wind or the natural buoyancy of hot air escaping through holes in the upper part of the building, it cools the occupants.

A second aspect of human comfort that is affected by uncontrolled air leakage in a home, is the affect that it has on indoor relative humidity (RH). Most people are comfortable when the temperature is between 65-75 degrees and the RH is between 30 and 50 percent.

However, during the winter, the cold outdoor air does not contain very much moisture. When this cold, dry air enters the house, it reduces the RH of the existing air in the home. It is not uncommon to see indoor relative humidity between 10-15 percent in cold climates during the winter in a leaky home. This low relative humidity level causes dry skin, itchiness, chapped lips and exacerbates breathing disorders.

An example of excess interior moisture, condensing on a cooler window surface

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Technical Reference The 2012 International Energy Conservation Code (IECC) finally codified what has been known and practiced by progressive builders since the late 80's: That it is okay to build a very tight building shell as long as the bulk and vapor water management is in place, and continuous mechanical ventilation is installed to dilute indoor air pollutants and supply fresh air for the occupants.

The 2013 State of Rhode Island Energy Conservation Code (SBC-8), based on the 2012 IECC, does not set a specific tightness threshold. The air tightness of the building is required to be measured, using a blower door at a test pressure of 50 Pa difference between the interior and exterior of the home, and reported in writing to the appropriate building official having jurisdiction in writing.

Constructing a tight building envelope and quantifying that aspect of the building then allows for correct ventilation. This is the first step to ensuring a healthy, comfortable indoor environment.

Section R403.5 of the 2012 IECC establishes that every house shall have a mechanical ventilation system, and the physical requirements of that system are defined in Section M1507.3 of the 2012 International Residential Code (IRC). The rate that a home is required to be ventilated to on a continuous basis is set in Table M1507.3.3 (1) of the 2012 IRC. These ventilation rates have been calculated to ensure that indoor pollutants are diluted and occupants have adequate fresh air regardless of outdoor conditions.

A tightly built home, with a known quantity of natural infiltration, that has continuous mechanical ventilation, which is set by the 2012 IRC, is a more energy efficient, comfortable and healthy home than one with the air infiltration rate left to chance, unmeasured and under or over ventilated.