About Vinyl windows

Vinyl windows have been around for 35 years. Vinyl is energy efficient, durable, rot proof, insect proof and weather resistant. It's made with chemicals that inhibit UV-degradation. Vinyl is colored throughout and requires no painting.

Windows are thermal holes. An average home may lose 30% of its heat or air-conditioning energy through its windows. Energy-efficient windows save money each and every month. There are even some cases where new windows can be net energy gainers. The payback period for selecting energy-efficient units ranges from two years to ten years. In new construction, their higher initial cost can be offset because you'll probably need a smaller, less expensive heating and cooling system. And more-durable windows may cost less in the long haul because of lowered maintenance and replacement costs. Plus, you'll be more comfortable the whole while you live with them.

Keeping heat in (or out)

Windows lose and gain heat by conduction, convection, radiation and air leakage. This heat transfer is expressed with U-values, or U-factors. U-values are the mathematical inverse of R-values. So an R-value of 2 equals a U-value of 1/2, or 0.5. Unlike R-values, lower U-value indicates higher insulating value.

Conduction is the movement of heat through a solid material. Touch a hot skillet, and you feel heat conducted from the stove through the pan. Heat flows through a window much the same way. With a less conductive material, you impede heat flow. Multiple-glazed windows trap low-conductance gas such as argon between panes of glass. Thermally resistant edge spacers and window frames reduce conduction, too.

The rate at which a window loses heat through the combination of the four is called its U-value. It is the inverse of the R-value, so the lower the U-value, the greater the insulative value of the window.
Convection is another way heat moves through windows. In a cold climate, heated indoor air rubs against the interior surface of window glass. The air cools, becomes more dense and drops toward the floor. As the stream of air drops, warm air rushes in to take its place at the glass surface. The cycle, a convective loop, is self-perpetuating. You recognize this movement as a cold draft and turn up the heat. Unfortunately, each 1°F increase in thermostat setting increases energy use 2%. Multiple panes of glass separated by low-conductance gas fillings and warm edge spacers, combined with thermally resistant frames, raise inboard glass temperatures, slow convection and improve comfort.

Radiant transfer is the movement of heat as long-wave heat energy from a warmer body to a cooler body. Radiant transfer is the warm feeling on your face when you stand near a woodstove. Conversely, your face feels cool when it radiates its heat to a cold sheet of window glass. But radiant-heat loss is more than a perception. Clear glass absorbs heat and reradiates it outdoors. Radiant-heat loss through windows can be greatly reduced by placing low-E coatings on glass that reflect specific wavelengths of energy. In the same way, low-E coatings keep the summer heat out.

Air leakage siphons about half of an average home's heating and cooling energy to the outdoors. Air leakage through windows is responsible for much of this loss. Well-designed windows have durable weatherstripping and high-quality closing devices that effectively block air leakage. Hinged windows such as casements and awnings clamp more tightly against weatherstripping than do double-hung windows. But the difference is slight; well-made double hungs are acceptable. How well the individual pieces of the window unit are joined together also affects air leakage. Glass-to-frame, frame-to-frame and sash-to-frame connections must be tight. The technical specifications for windows list values for air leakage as cubic feet per minute per square foot of window. Look for windows with certified air-leakage rates of less than 0.30 cfm/ft2. Lowest values are best.

Low-E glass reflects heat energy while admitting visible light. This keeps heat out during the summer and during the winter. In the winter, low-angle visible light passes into the house and is absorbed by the home's interior.

Letting in the right amount of sun

In a cold climate we welcome the sun's heat and light most of the time. And once we capture the heat, we don't want to give it up. In a warm climate, we don't want the heat, but we do want the light. Advances in window technology let us have it both ways.

Less than half of the sun's energy is visible. Longer wavelengths--beyond the red part of the visible spectrum--are infrared, which is felt as heat. Shorter wavelengths, beyond purple, are ultraviolet (UV). When the sun's energy strikes a window, visible light, heat and UV are either reflected, absorbed or transmitted into the building.

Enter low-E glass coatings, transparent metallic oxides that reflect up to 90% of long-wave heat energy, while passing shorter wave, visible light. In hot climates, they reflect the sun's long-wave heat energy while admitting visible light, thereby keeping the house cooler in the summer. And in cold climates, they reflect long-wave radiant heat back into the house, again while admitting visible light. This shorter wavelength visible light is absorbed by floors, walls and furniture. It reradiates from them as long-wave heat energy that the reflective, low-E coating keeps inside. Low-E coatings work best in heating climates when applied to the internal, or interpane, surface of the interior pane. Conversely, in cooling climates, low-E coatings work best applied to the interpane surface of the exterior pane.

Low-E coatings improve the insulating value of a window roughly as much as adding an additional pane of glass does. And combining low-E coatings with low-conductance gas fillings, such as argon or krypton, boosts energy efficiency by nearly 100% over clear glass. Argon and krypton are safe, inert gases, and they will leak from the window over time. Studies suggest a 10% loss over the course of 20 years, but that will reduce the U-value of the unit by only a few percent. The added cost for low-E coatings and low-conductance gas fillings is only about 5% of the window's overall cost. It's a no-brainer.

It's warm in the sun

Manufacturers have long used shading coefficient (SC) to describe how much solar heat their windows transmit. A totally opaque unit scores 0, and a single pane of clear glass scores 1 on this comparative scale. A clear double-pane window scores 0.84 because it allows 84% as much heat to pass as a single pane of glass.

Solar-heat-gain coefficient (SHGC) is the new, more accurate tool that is replacing SC to describe solar-heat gain. SHGC is the fraction of available solar heat that successfully passes through a window. It, too, uses a scale of 0, for none, to 1 for 100% of available light. The key difference is that SHGC is based on a percentage of available solar heat rather than on a percentage of what comes through a single pane of glass. It considers various sun angles and the shading effect of the window frame.

Glass coatings are formulated to select specific wavelengths of energy. It is possible to have a glass coating that blocks long-wave heat energy (low SHGC) while allowing generous amounts of visible light (high VT) to enter a home. This formulation is ideal in warm climates. A low SHGC can reduce air-conditioning bills more than if you increased the insulative value of your window with an additional pane of glass. I recommend a SHGC under 0.40 for hot climates. In cold climates you want both high VT and high SHGC. I recommend an SHGC of 0.55 and above in the North. In swing climates such as

Washington, D.C., choosing a SHGC between 0.40 and 0.55 is reasonable because there is a trade-off between cooling and heating loads. For people in swing climates, Arasteh suggests, "Think about your specific comfort needs when specifying SHGC. If you like wearing sweaters and hate being overheated in the summer, then a low SHGC may be the choice for you." Choose the blend of glass coatings that works best in your climate and exposure.

Preventing UV-damage

Windows that block UV-radiation reduce fabric fading. Expect to find windows off the shelf that block more than 75% of the UV-energy. Contrary to conventional wisdom, some visible light fades fabric, too. Some manufacturers use the Krochmann Damage Function to rate a window's ability to limit fabric-fading potential. It expresses the percentage of both UV and of that portion of the visible spectrum that passes through the window and causes fading. Lower numbers are better.

Keeping warm around the edges

If you've lived in a cold climate, you've seen condensation and even frost on windows. When warm indoor air cools below its dewpoint, liquid water condenses on the glass. Condensation typically develops around the edges of window glass. No surprise. The edge is where most multiple-pane glazing is held apart by highly conductive aluminum spacers.

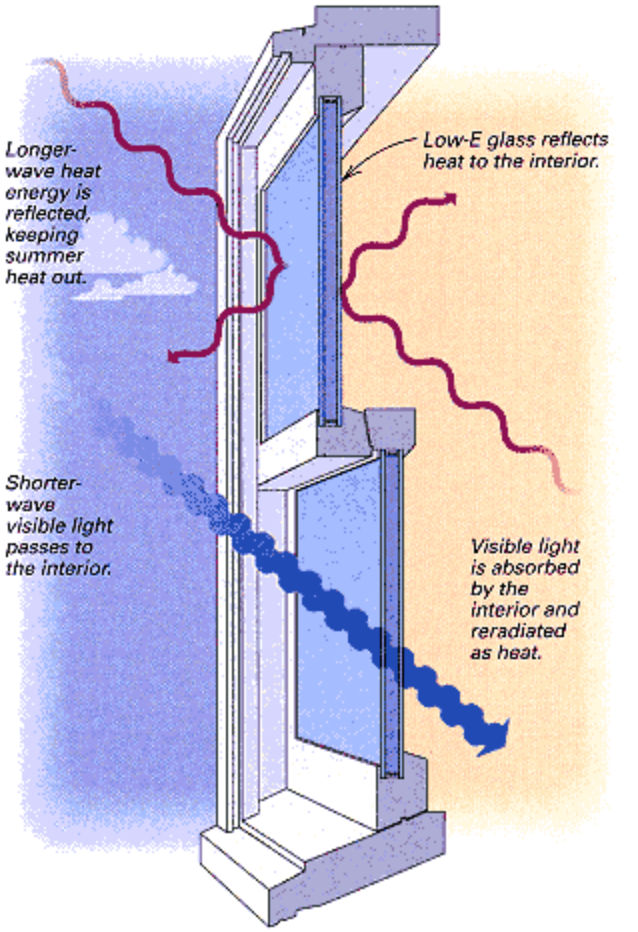
The coldest part of a multiple-glazed window is around its edges. It's worse with true divided-lite windows; because each lite has edge spacers, the ratio of cold edge to warm center is much higher than with regular insulated windows. Moist conditions support mold growth, and hasten decay and paint failure. Condensation is the No. 1 reason for window-related callbacks. Warm edges reduce the chance of condensation forming.

The material the spacer is made from affects the rate that heat travels through a window's edge. Many window makers now offer warm edge spacers as standard fare. Aluminum spacers are not acceptable. The best windows use less conductive materials such as thin stainless steel, plastic, foam and rubber. Warm edge spacers can improve the U-value of a window by 10% and boost the edge temperature by around 5°F, thereby reducing condensation.

Energy-efficient glazing

Energy-efficient glazing reduces winter condensation. When low glass temperatures cause inside air to reach its dew point, water condenses on the window. The chart indicates the points where indoor humidity and outdoor temperature combine to cause condensation on various types of glazing. This chart is based on center-of-the-glass temperatures, but the edges are always colder, and condensation usually begins there.

by Paul Fisette


Longer-wave heat energy is reflected, keeping summer heat out.
Low-E glass reflects heat to the interior.
Shorter-wave visible light passes to the interior.
Visible light is absorbed by the interior and reradiated as heat.