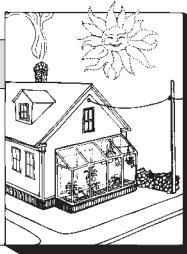


Window Worries

by J.D. Ned Nisson



A glass scientist explained to me once that float glass is actually a "supercooled liquid" that never completely solidifies. "The glass in your windows is slowly flowing away," he said. "In fact, if you measure the glass in a 100-year-old window, you'll see that it is thickest near the bottom because it is flowing down."

Few people would lose sleep over the fact that their window glass may melt away in a few hundred years. There is some concern, however, over the degradation and disappearance of newer elements in windows, namely the low-emissivity coating and argon gas filling which are responsible for the insulating power of high-performance glazings.

How long does that low-e coating last? Is there a way to tell that it is there and working properly? Does argon gas leak out of the window over time? If so, how does it affect performance? Is there a way to tell whether the gas is there in the first place? What about krypton gas — is it for real?

These questions are not merely academic. If the low-e coating were to stop working and the argon gas were to leak out, the heat loss through a window would double and the glass would lose

much of its ability to resist moisture condensation. Manufacturers warrant their glazing against seal failures, but not against loss of R-value.

The good news is that there appears to be little cause for concern. I recently had the opportunity to visit several fabrication plants and product development labs and came away confident that high quality glazing should lose little if any R-value over time.

Rusting Glass

Low-e glass was introduced in the U.S. nearly ten years ago and is now a standard feature of many residential windows sold in the northern states. The key component in low-e glass is an ultra-thin metallic coating which has an invisible "shininess." It is invisible to the eye, but reflective to long-wave radiation (such as the heat radiated from a wood stove or other warm surface).

Some types of low-e coatings ("soft-coat" or "sputtered") degrade when exposed to air and moisture. A chemical reaction similar to rusting dulls the low-e surface which then loses its ability to retard heat flow.

When such low-e "rusting"

occurs, the homeowner will know it. Not only does the degraded coating become visible, but the moisture that caused the problem fogs the glass surface. This should occur only if the sealed unit fails completely.

Leaking Argon

Argon-filled glass first appeared in the U.S. about five years ago and quickly became adopted into most low-e windows. Argon occurs naturally at very low concentrations in the air we breathe. It is invisible, odorless, tasteless, and chemically inert.

Argon gas improves the performance of windows because it has a lower conductivity (higher R-value) than air and also because it is heavier and more viscous than air and thus less likely to convect. The combination of these two attributes causes argon-filled glass to be R-0.5 to R-1.0 higher than air-filled units. For example, a low-e glass unit with a 1/2-inch air space has a center-of-glass R-value of R-3.2 with air between the panes; its center-of-glass R-value is R-4.0 with argon.

Argon is cheap to buy and easy for fabricators to install. For typical residential windows, the cost for the gas may range from 5¢ to 25¢ per window. It is either injected into the glass unit through the edge spacer or forced in using special vacuum chambers.

Krypton?

No, it's not a Superman joke. Krypton gas is even more effective than argon. Unfortunately it costs about 500 times as much to buy. The only commercially available residential window with krypton is the Hurd "Insol-8" line which uses a mixture of argon and krypton.

The window industry is struggling to develop a standard test method and rating system for gas

leakage from insulating glass units. Meanwhile manufacturers have been measuring the rate of gas leakage from typical glass units both in the laboratory and in the field. The results are encouraging.

Cardinal Glass, which supplies most of the glass for Andersen windows, has been field testing 20 gas-filled glass units since 1987. After the first two years exposure in a south-facing test rack, the argon concentration dropped less than 0.1%. At that rate, the loss in R-value over 20 years would be negligible. Even if the leakage rate were ten times as high,

If the low-e coating were to stop working and the argon gas were to leak out, the heat loss through a window would double and the glass would lose much of its ability to resist moisture condensation.

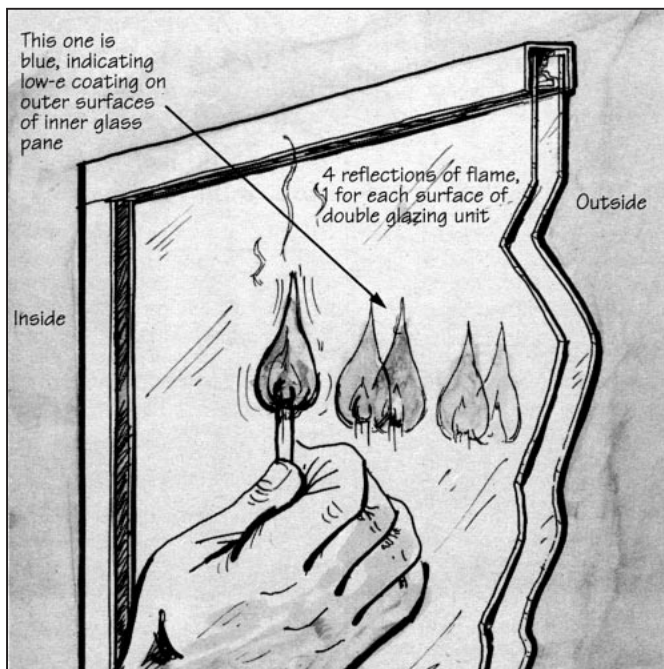
ten times as high, the impact would not be enormous. For example, with an initial gas loss rate of 5% per year, an R-4.0 gas-filled window would still be R-3.5 after 20 years.

There is no easy way for a consumer to determine whether the argon has leaked out of a sealed insulating glass unit. One good clue that it was gas-filled is a visible filling nipple in the metal edge spacer (see Figure 1).

Manufacturers have spent considerable effort developing edge seal systems that resist gas escape. Unfortunately, most of those developments, such as dual edge seals (Figure 2) are hidden from view in a completed window and



Figure 1. One way to tell that a window is gas-filled is by the plugged filling hole which is usually visible as a small nipple on the inside of the metallic edge spacer.



To identify a low-e coating, hold a small flame up to a double-glazed window and view the four reflections — one for each glass surface. The surface with the low-e coating will show a bluish reflection. Usually it is the outer surface of the inner glass.

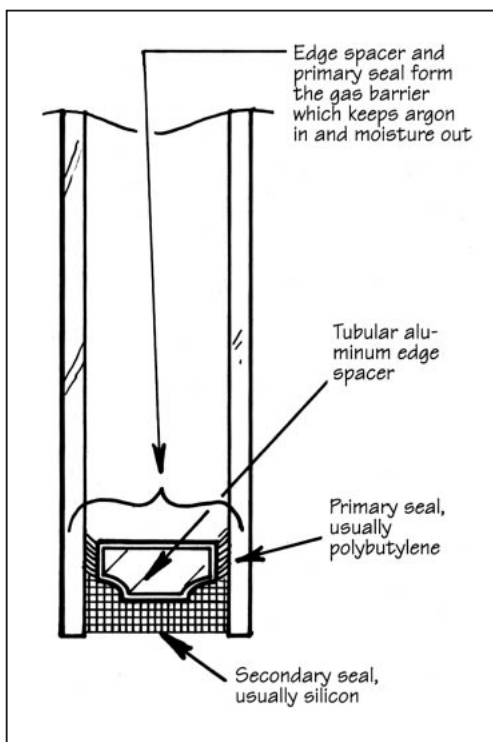


Figure 2. A dual-seal system, common on high-quality windows, is the most effective for holding in argon. The primary seal, together with the aluminum edge spacer, prevents argon leakage and air and moisture intrusion; the secondary seal is mostly structural.

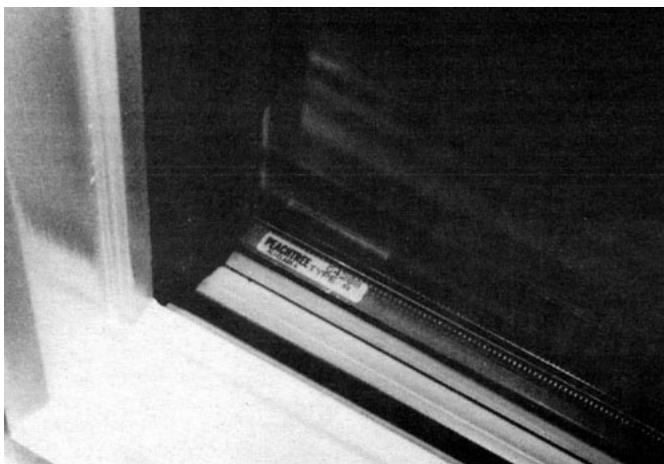


Figure 3. You can judge the quality of a window's edge seal by its certified rating — usually indicated on a label as in the Peachtree window in the photo, or by an embossed label on the corner of the glass. High-performance windows should have "A" rated glass units.

are not mentioned in typical specification sheets.

The only detectable indication of edge seal quality is a rating certification label which is either adhered to the edge spacer or embossed on the glass at the corner (Figure 3). Glass units are rated "A," "B," or "C" to indicate seal durability as measured in a torturous accelerated aging test (ASTM E773 and E774) which involves exposure to intense UV light, and moisture and temperature extremes. High-performance windows should have only "A" rated glazing.

R-value Loss Not a Worry

This all boils down to the conclusion that gradual R-value degradation over time should not

be a problem with high-performance windows. The only circumstance in which a gas-filled, low-e window loses substantial R-value is edge seal failure. In this case, both the low-e coating (if the soft-coat type) would be damaged and the argon may have leaked. In that situation, however, the glass unit almost always will be replaced anyway because of the aesthetic problems of a fogged unit. ■

J.D. Ned Nisson is president of Energy Design Associates Inc., a New York City-based building systems consulting firm, and editor of Energy Design Update of Arlington, Mass., a monthly technical newsletter on energy-efficient building design and construction.