Site Glazing with High-Tech Glass

by Marc Rosenbaum, P.E.

The revolution in glazings that began in the early 1980s has given designers of low-energy-use buildings a much wider set of options. By choosing the appropriate type of glass, we can determine a window's solar heat gain and transmission of visible light, as well as its ability to block heat loss. But to gain the greatest advantage at a practical cost, the designer must choose and apply the modern glazings thoughtfully. Here's an example from one of my recent jobs.

Superglass to the Rescue

Superglass, a trademark of Southwall Technologies (1029 Corporate Way, Palo Alto, CA 94303; 800/365-8794), has the highest insulating value of any readily available glazing: R-9 in a 1-inch-thick assembly using 1/8-inch-thick glass, or a 1 1/8-inch-thick assembly if 3/16-inch-thick glass is used. The high R-value is achieved by suspending two layers of Southwall's Heat Mirror low-e plastic film between two outer layers of glass. The spaces between the layers are filled with inert krypton gas, which has a thermal conductivity even lower than the argon gas commonly used in low-e glazings.

In reaching this amazing R-value, Superglass gives up some of the visible light transmittance and solar heat gain of lesser glazings. Its visible transmittance is about 65%, compared with 82% for clear double glazing and 75% for double low-e glass. Its ability to transmit solar heat, measured by the solar heat gain coefficient, is about 0.49. This falls toward the bottom of the range of 0.41 to 0.74 demonstrated by the various low-e products, and is well below the 0.78 value for clear double glass.

But these attributes have advantages: The reduced solar gain and greatly reduced heat loss make for a much more comfortable indoor environment, so they can sometimes free the designer to use more glass area than would be prudent with other glazings.

Costs and Benefits

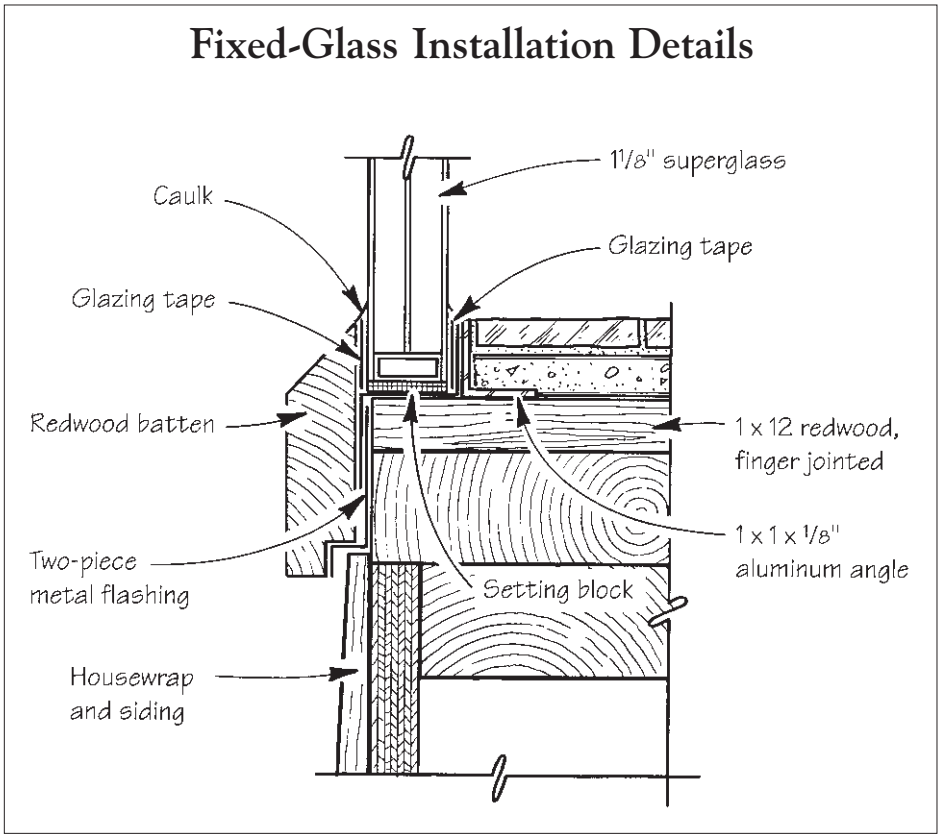
As you might guess, this fancy glass costs more than conventional glazing. If you look at the cost of a commercially available window with Superglass, you're going to see a very hefty upcharge. On a home I designed in 1992, the increase in cost to use Superglass instead of a glazing with a center-of-glass R-value of 4 was about $2,000, spread over 17 large casement windows. At first glance, Superglass didn't seem worth the price: The time it would take to earn a payback on the investment, even in the frigid New Hampshire climate, exceeded the likely lifetime of the sealed Superglass units.

Why the poor payback? In analyzing the performance of the casements using the different types of glazing, I had to take into account the fact that the window sash and frame, which lose more heat than the glass, were the same for both windows. It is important to remember that when we put a window in a wall, we are concerned with the R-value of the entire window unit, not just the center of the glass. To keep the edge losses to a minimum, Southwall assembles the glass with a low-conductivity spacer. Nonetheless, the heat transferred at the edge of the glass is substantially greater than that through the center of the glass. Including the frame of the window and the edge of the glazing assembly, the total unit R-value of the Superglass windows was only about 50% better than the lower-cost windows, even though Superglass has double the center-of-glass R-value. A residential-sized window with Superglass will typically have a unit R-value of about R-4.5, which compares with a low-e argon window of about R-3.

A Better Way

I learned two lessons from pricing these windows. First, in order to get the benefit of the very high R-value glass, I needed to use Superglass in large pieces, to minimize the percentage of the opening that isn't glass. The second lesson was that the stuff was not cost-effective at the prices window manufacturers were charging for it. But I still felt I had a legitimate use for Superglass, so I had a glass fabricator who is licensed to work with Southwall's products make up five 46x76-inch Superglass units, which we decided to site-glaze to the framing of the house (see photo, left).

This window wall of 46x76-inch Superglass units has an overall R-value above 7.



The fixed-glass unit rests on rubber setting blocks with glazing tape forming a seal on both sides. Aluminum angle forms the stop on the inside. Outside, the author chose to use painted redwood instead of metal battens to avoid an institutional look.

The detail we used is essentially the same as in commercial fixed-glass installation. The glass unit sits on two rubber setting blocks and is sandwiched between two layers of ⅛-inch glazing tape (see illustration, left). The inner layer of glazing tape is installed directly to the framing. Metal battens of the kind typically used for commercial installations are available for residential use. But we wanted a more residential look, so we used finger-jointed redwood battens, painted on all sides before installation, attached with wood screws.

Direct-set glass saves money. We paid about $300 for each Superglass unit — less than what a low-e picture window of the same size would have cost. Another benefit is that the wall truly becomes a window wall, because there is no sash and frame to block the view. The total in-place insulating value of the window wall exceeds R-7. ■

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