AAMA ANALYSIS

Thermal Performance Knows No Season

BY KEN BRENDEN

It's easy to think of thermal performance as how efficiently skylights, doors and windows keep out the cold (or more precisely, keep in the heat), but there are important thermal performance considerations to remember when we finally flip our thermostats from "heat" to "cool."

Beat the Heat

The primary issue remains to be heat flow. Whether the direction of heat transfer is inside-out or outside-in, the requirements for reducing heat flow (i.e., minimizing U-factor) are well-known. Insulating (double-pane) glazing with inert gas (e.g., argon) infill, "warm-edge" spacers reduce the U-factor of the insulating glass unit (IGU). Further, the use of framing with inherent or engineered thermal insulating features helps to minimize the U-factor of the entire assembly. Wood, vinyl and fiberglass naturally insulate against heat flow, while aluminum frames are engineered with effective thermal barriers (such as "poured and de-bridged" barriers, thermoplastic or polyamide inserts, gaskets and structural silicone separations) between inner and outer frame elements.

Control Solar Gain

A secondary issue in determining energy performance, albeit one that has risen to near-equal status with thermal conductivity, is solar heat gain, which is measured by the solar heat gain coefficient (SHGC). The lower the coefficient, the less solar heat is admitted. The latest ENERGY STAR® requirements call for substantially lower SHGC in warm southern zones, on the order of 0.20-0.30, while higher SHGCs are permitted in colder northern regions.

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In warmer climates, solar gain can be reduced by altering the reflectivity and color properties of glass using integral tints or reflective surface coatings. However, both have a tendency to reduce the visible light allowed through the windows—a negative for those concerned with green credentials that emphasize beneficial daylighting to supplant artificial lighting. A window optimized for daylighting and for reducing summer heat gain should transmit an adequate amount of light in the visible portion of the electromagnetic spectrum while excluding unnecessary heat gain from the near-infrared part of the spectrum.

Keep it Low (E)

A better choice for such situations is low-emissivity (low-E) glass. Low-E glass has a microscopically thin metallic film (e.g., fluorine-doped tin or silver oxide) that provides approximately 50 percent better thermal performance than uncoated glass by reflecting radiant heat rather than absorbing and conducting it through the glass. Low-E coated glass can reflect as much as 96 percent of infrared radiation back toward the source, keeping interiors cooler in summer and warmer in winter.

Spectrally selective low-E glass is even better. It combines the best qualities of low-E, tinted and reflective glass. It selectively transmits visible light (close to 100 percent of the visible light wavelengths) and reflects the heating infrared wavelengths. Thus the SHGC is low, while the visible transmittance (VT) is high to maximize daylighting. Spectrally-selective low-E glass has the added bonus of blocking most ultraviolet (UV) energy, which helps prevent fading of carpets and furniture.

Note that low-E coatings work best in cooling climates when applied to the internal, or interpane, surface of the exterior lite of an insulating glass unit, where it reflects or rejects the solar heat back outdoors and thus lowers solar heat gain to keep the room cooler. Conversely, in heating-dominated climates, low-E coatings work best applied to the interpane surface of the interior lite.

Gas-filled, low-E insulating glazing and advanced framing materials and configurations have reduced the energy consumption of windows substantially. Their added cost in a typical house can be repaid in a reasonably short period of time in the form of reduced energy use—in summer as well as in winter. ▮

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