SPECIFY HIGHLY INSULATED WINDOWS & DOORS
Step 6

Window performance measurements are determined by the National Fenestration Rating Council. Four performance metrics are published and, in some states, these are shown on a label affixed to the window units.

Window Performance Metrics

U-value (U) is the rate of heat transfer expressed as a decimal number from 0 to 1. Lower numbers mean less heat transfer. A single pane of glass is about U-1.0. A typical double-glazed window would be around U-0.40, and triple-glazed windows would be around U-0.20. The reported U-value takes into account both the glazing and the frame. Solar heat gain coefficient (SHGC) tells how much of the sun's heat is allowed to penetrate the glass. SHGC is also expressed as a decimal from 0 to 1. Lower numbers mean less solar heat gain. Visible transmittance (VT) indicates how well you can see through the glass. These numbers also range from 0 to 1, with higher numbers meaning better visibility. Air leakage (AL) shows how well the window seals against drafts around the operable sash. Lower numbers mean less leakage.

These four metrics can guide your window selection. Ask your window supplier to indicate these values on the estimate.

Low U-Value Windows

Window technology is improving rapidly. Select the most cost-effective windows with a heat loss rate of U-0.25 or lower. In some situations and climates, this may be advanced double-glazed windows, while other situations may call for triple-glazed windows. Let window specifications and your energy model be your guide.

Low U-values are achieved using three important elements:

1. Low-emissivity (Low-E) coatings are microscopically thin layers of metal applied to the inner surfaces of the glass or on layers of clear film suspended between the glass panes. They limit the amount of heat that jumps from one glazing layer to the other. Inert gases fill the space between the panes and allow less heat transfer than air does. The most common gas is argon, but krypton is also used. While many people have expressed concern that inert gases will leak out over time, research has shown this to be an extremely slow process, less than 1% per year.
2. Spacers that hold the panes apart are typically made of aluminum and conduct heat rapidly. High performance glazing units use thermally improved plastic spacers or a plastic "thermal break" in the spacer to reduce heat loss around the edges.
3. Consider triple pane, inert gas-filled windows with approximately 0.20 U-value, such as Harvey Tribute, Thermotech, Atrium Northwest, Cascade, Solar View, Intus, Milgard or Alpen. Some double-pane windows such as Milgard, which use i89 glazing, are achieving U-values close to 0.22 and could be considered.

Window Sizes

More heat flows through the frame than the insulated glass unit. This has two implications. First, look for windows that have the smallest frame profile, because the frame has a higher thermal transmission than triple pane glazing. Second, it is more energy efficient to use fewer, larger windows with the same glazing area than more, smaller windows, because larger windows have a higher glass to frame ratio.

Natural Ventilation

Operable windows can be strategically placed to allow for optimal summer cross ventilation, which will reduce the summer cooling load. Make use of the "stack effect" to ventilate and cool the building, by placing operable windows near high points to allow warmer air to escape and near low points to draw cooler air in. All operable windows should be casement or awning where possible because they seal better than sliders or single-hung windows.

Fixed Window

Select fixed windows for locations not specifically designed for natural ventilation. Fixed windows, followed by casement and awning windows, are the most airtight, and have better U-value compared to similar sliding or single hung windows. Fixed windows also cost less than casement.

Optimize Window to Floor Area (WFA)

Window area is key factor in overall heat loss. Even U-0.20 (R-5) windows will lose heat up to seven times faster than the walls. One way to express window area relative to the size of the house is by calculating the ratio of the window-to-floor area (WFA). The average WFA is about 18% to 22% in production homes and 30% to 40% in custom homes. Based on energy modeling, reducing the window-to-floor ratio to the 14% to 16% range is about optimum for minimizing heat loss. Walls are more airtight, and better insulated than any triple-glazed window, and because windows are far less expensive than walls, reducing windows also saves money.

With fewer windows, take care to place them for optimal light, summer ventilation, southern exposure for passive solar heat gain, and for views. With good design a home can be very livable with the lower WFAs suggested for zero energy design.

Window Orientation

Where possible, place 50% to 60% of the window area facing south. Most of the common living area should be on the south side where it receives light and heat from the sun. Unless shaded in some way, windows facing east and west tend to gain too much heat when it isn't wanted, even in northern climates.

Solar Heat Gain Coefficient

Ideally, windows facing south would have high solar heat gain to gather valuable heat in the winter. Windows facing east and west would have low solar heat gain to reject heat during summer. Experts have suggested that designers specify the SHGC accordingly, and this makes sense. However, be sure to conduct an energy model to make sure the additional window value is worth the potentially higher costs and hassle.

Window Overhangs

Design a solar shading strategy that allows sun to heat the building when needed and reject heat to avoid overheating. Fixed overhangs must be a compromise between similar sun angles in spring and fall when the heating or cooling requirements are much different. Consider using a shorter fixed overhang of 12 to 18 inches along with moveable shading, such as awnings, sun screens, or vegetation. This will allow greater heat gain during spring and less heat gain during fall. Calculate the roof overhang using the handy Susdesign website.

Insulated Shades

It is difficult to determine whether or not insulated shades are cost-effective, as manufacturers' data on their functional U-value is scarce to date. Hunter Douglas has claimed that their Archetella shades have an R-value of about 4.0, which could significantly increase the R-value of the windows, especially at critical times of heat and cold. In order to function properly, insulating window shades must fit tightly to the window opening to minimize air mixing with the room, although making them too tight-fitting may also make them difficult to operate. While insulated shades definitely resist heat loss, they require daily operation, making it difficult to quantify potential benefits. Visit Energy Savers for more information on energy efficient window treatments.

Cost Effective Energy-Efficient Doors

Insulated fiberglass doors are currently the best option for the price and are the most cost effective. Be sure that they have tight gaskets and air seals. The glazing on the door can be a source of air leakage and should be checked during the blower door test. If possible minimize glazing on doors, specify that they have high R-value glass, and verify that there are no air leaks around the glass. Consider a multi-point latching mechanism that will hold the door tight against the weatherstripping. This is especially valuable for doors that are exposed to sun and weather.