

## Fenestration – Define Key Terms


Windows, doors, skylights can gain and lose heat through:

- Direct conduction through the glass or glazing, frame, and/or door
- The radiation of heat into a house (typically from the sun) and out of a house from room-temperature objects, such as people, furniture, and interior walls
- Air leakage through and around them.

Many of these properties can be measured for each window and rated according to the following energy performance characteristics:

- **U-factor** is the rate at which a window, door, or skylight conducts non-solar heat flow. It's usually expressed in units of  $\text{Btu/hr-ft}^2\text{-}^\circ\text{F}$ . For windows, skylights, and glass doors, a U-factor may refer to just the glass or glazing alone. NFRC U-factor ratings, however, represent the entire window performance, including frame and spacer material. The lower the U-factor, the more energy-efficient the window, door, or skylight.
- **Solar heat gain coefficient (SHGC)** is the fraction of solar radiation admitted through a window, door, or skylight -- either transmitted directly and/or absorbed, and subsequently released as heat inside a building. The lower the SHGC, the less solar heat it transmits and the greater its shading ability. A product with a high SHGC rating is more effective at collecting solar heat during the winter. A product with a low SHGC rating is more effective at reducing cooling loads during the summer by blocking heat gain from the sun. The building's climate, orientation, and external shading will determine the optimal SHGC for a particular window, door, or skylight.
- **Air leakage** is the rate of air movement around a window, door, or skylight in the presence of a specific pressure difference across it. It's expressed in units of cubic feet per minute (cfm) per square foot of frame area ( $\text{cfm/ft}^2$ ). A product with a low air leakage rating is tighter than one with a high air leakage rating.
- **Visible transmittance (VT)** is a fraction of the visible spectrum of sunlight (380 to 720 nanometers), weighted by the sensitivity of the human eye, that is transmitted through the glazing of a window, door, or skylight. A product with a higher VT transmits more visible light. VT is expressed as a number between 0 and 1. The VT you need for a window, door, or skylight should be determined by your home's daylighting requirements and/or whether you need to reduce interior glare in a space.
- **Light-to-solar gain (LSG)** is the ratio between the SHGC and VT. It provides a gauge of the relative efficiency of different glass or glazing types in transmitting daylight while blocking heat gains. The higher the number, the more light transmitted without adding excessive amounts of heat. This energy performance rating isn't always provided.
- **Window Rating System:** The National Fenestration Rating Council (NFRC) operates a voluntary program that tests, certifies, and labels windows, doors, and skylights based on their energy performance ratings. The NFRC label provides a reliable way to determine a window's energy properties and to compare products. An example of an

NFRC label is shown in Figure 1. The mandatory measures for windows, glazed doors, and skylights address the airtightness of the units (air leakage), how their U-factor and SHGC are determined, as well as VT.

	<p><b>World's Best Window Co.</b></p> <p>Millennium 2000+          Vinyl-Clad Wood Frame          Double Glazing • Argon Fill • Low E          Product Type: <b>Vertical Slider</b></p>	
<b>ENERGY PERFORMANCE RATINGS</b>		
U-Factor (U.S./I-P) <b>0.30</b>	Solar Heat Gain Coefficient <b>0.30</b>	
<b>ADDITIONAL PERFORMANCE RATINGS</b>		
Visible Transmittance <b>0.51</b>	Air Leakage (U.S./I-P) <b>0.2</b>	
Condensation Resistance <b>51</b>	<b>—</b>	
<p><small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.  <a href="http://www.nfrc.org">www.nfrc.org</a></small></p>		

**Figure 1 Example of an NFRC label**