BUILDER'S GUIDE TO ENERGY EFFICIENT HOMES IN LOUISIANA: ENERGY EFFICIENT WINDOWS

by
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The Builder's Guide to Energy Efficient Homes in Louisiana (Builder's Guide) is being updated to reflect new code requirements. This is the ninth in a series of articles that will summarize the information in the guide and highlight updates.

Windows are one of the major sources of heat gain in the summer (cooling) season; and one of the major sources of transmission heat loss during the winter (heating) season. In spite of windows sometimes being a difficult energy conservation problem to overcome, they exist to provide natural light, ventilation, and a view to the outdoors. "Windows connect the interior of the house to the outdoors, provide daylight and ventilation, and are one of the key aesthetic features of the home."[1]

In passive solar homes, windows can provide a significant amount of heat for the heating (winter) season. The fact that windows traditionally have the lowest insulating value (R-Value) in the building envelope has been a major detraction. To make matters even more confusing, the National Fenestration Rating Council (NFRC), one of the foremost window labeling authorities in the U.S., does not label windows with R-Values. U-factor (the thermal transmittance) is how the window industry describes and rates windows. The consumer must look for a low U-factor on the window label to obtain the more energy efficient window.

Window manufacturers have studied windows' low insulation values for many years. They have recently researched and developed numerous features which will increase the overall insulating value of Energy Efficient windows.

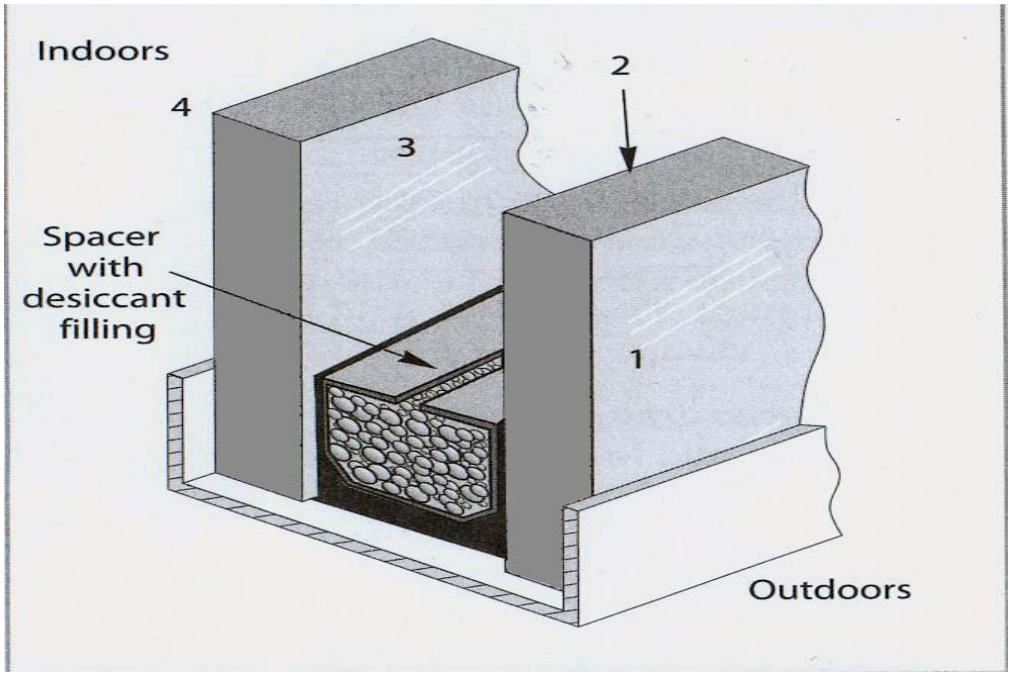
What to look for in an energy efficient window: [2]

1. Good insulating values – low U-Factors, combined with a minimum of double glazed glass for a maximum U-Factor of .65. The window should also have a spacer (thermal break) with a desiccant filling (figure 1). The lower the overall window U-factor the better.
2. Low air leakage rates - Less than .25 cubic feet per minute (cfm) per linear foot of sash opening for double hung windows. Less than .10 cfm per linear foot for casement, awning, and fixed windows.
3. A Visible Transmittance (VT) of .50 to .80.
4. A Solar Heat Gain Coefficient (SHGC) of .40 or less.

The NFRC labels all of it's manufacturer members' windows with all four of the window characteristics mentioned above.

[1] Louisiana Department of Natural Resources, *Builder's Guide to Energy Efficient Homes in Louisiana,* October 2002, p. 91.
[2] Louisiana Department of Natural Resources, *Builder's Guide to Energy Efficient Homes in Louisiana*, October 2002, p. 92.

Figure 1. Low-e Insulated Glass Unit (IGU)



Insulated glass employs a sealed spacer between the two glass panes. A low-e coating on one pane retards emission of radiant heat from that pane. In warm climates, the coating is located on surface #2. In cold climates, the coating is located on surface #3.

SOURCE: John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings,* Saturn Resource management, Inc., Montana, 2004.

Solar and Optical Characteristics:[3]

Solar Heat Gain and Thermal Transmittance (U–factor) are both very important window energy characteristics. Solar heat gain through windows can account for 40% of the total heat removed by an air conditioner. The three factors to measure solar heat gain are as follows:

1. Solar Heat Gain Coefficient (SHGC): Ratio of solar heat passing through the glass to solar heat falling on the glass at a 90 degree angle. It includes radiant heat transmitted as well as heat absorbed and reradiated indoors. Single pane glass has an SHGC of .87. Generally, buildings in hot, sunny climates should have a window glass with an SHGC less than .50. South facing windows used for passive heating should have an SHGC of .70 or more.
2. Shading Coefficient (SC): Compares the solar transmittance of a glass assembly (with its interior and exterior shading devices to that of single pane glass which has a shading coefficient of one (1). The shading coefficient is always less than one, and greater than the SHGC of the glass being considered.

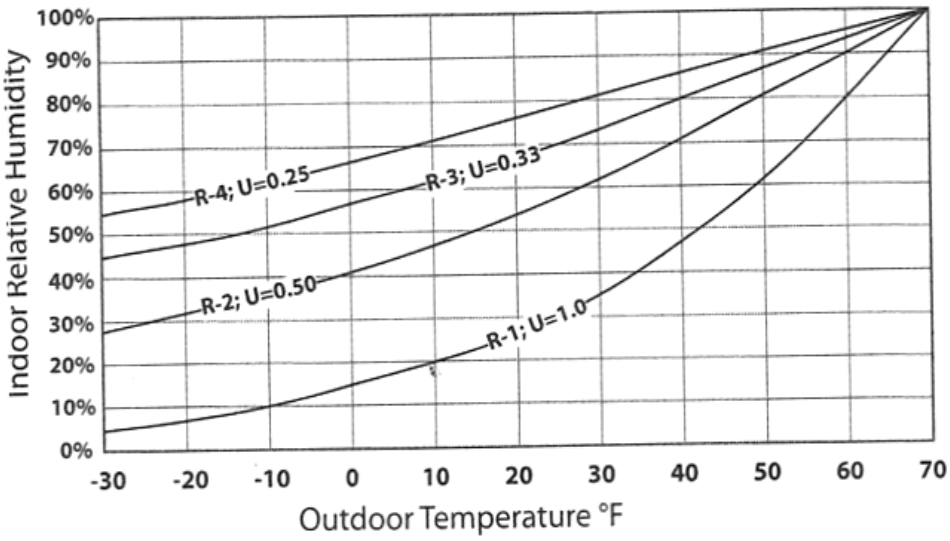
[3] John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource management, Inc., Montana, 2004, p. 123.

3. Visible Transmittance (VT): Measures how much visible light is allowed in by the window's glass. VT is important because it is one of the first things consumers notice about new windows. Also, one of the windows main functions is to admit visible light. Some reflective coatings and tints reduce VT of a window to around 30%, and this isn't acceptable for residential applications.
4. Air leakage: Residential windows are leak tested at a pressure equal to a 25 miles per hour (mph) wind under controlled laboratory conditions. This is a test known as American Society of Testing Materials (ASTM E 283). The test results from the ASTM E283 test are in cfm. Windows are less prone to air leakage than most consumers think. Much window air leakage is from installation of the window in the wall, versus from the window or door itself.[4]

Resistance to Condensation:

Another common complaint of consumers is window condensation. Condensation is mainly a winter problem. Condensation gets worse as the temperature drops. The NFRC now has a window rating of condensation resistance with a scale of 1 to 100. Mitigating condensation problems requires raising the thermal resistance of the window's interior surface or reducing the home's relative humidity and sometimes requires both. (figure 2).

Figure 2. Window Condensation Chart



The indoor relative humidity and thermal resistance of glass determines what outdoor temperature will cause condensation.

SOURCE: John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource management, Inc., Montana, 2004.

[4] John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource management, Inc., Montana, 2004, p. 124.

There are four organizations that serve as "gate keepers" nationally about window thermal and structural characteristics[5].

1. National Fenestration Rating Council (NFRC): Is a private/public collaborative agency created to establish standardized window testing and rating. NRFC simulates window performance with computers, and then verifies these simulations with laboratory testing. NFRC labels are applied to windows made by member manufacturers.

2. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE): Is a professional society providing the theoretical framework for calculating heat flows through windows. ASHRAE's "Handbook of Fundamentals" is the most common reference about window heat flows.

3. Lawrence Berkley Laboratory (LBL): Is North America's most prolific and authoritative research facility. LBL researches and develops new window technologies, and distributes information about windows.

4. American Society for testing and Materials (ASTM): Develops testing methodology for all types of building systems. Windows are tested under ASTM standards for air leakage, water leakage, and structural strength.

More information on energy savings features, and the full text of the *Builder's Guide*, can be found on the DNR Technology Assessment Division website at URL: http://www.dnr.louisiana.gov/tad and click on the *Builder's Guide* link.

[5] John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource management, Inc., Montana, 2004, p. 122.