WEB BASED
APPLICATION SPECIFIC
INSTALLATION INSTRUCTIONS

Glass and Glazing

High Performance Glass and Its Properties

Equally important to conveying the reasons why vinyl is the preferred framing material when purchasing Replacement Windows, are the advantages of the type of insulated glass that comes with the window. Part of the technology that state-of-the-art replacement windows offer is the insulated glass unit and its ability to retard the passage of heat out of their home in the winter, and into their home in the summer. The group of glazings currently available have become known as "High Performance" Glass.

"High Performance" is a term used to describe better performing insulated glass. It is now used by almost everyone to describe their insulated glass with a one surface, inside, coating. There is even a better performing insulated glass that has a film suspended between the panes of glass. This film has a similar performance-coating to further help it reduce heat transfer.

To understand what these High Performance Glazings do, and what they are being asked to do, it is better to review in detail how heat loss can occur through glass.

Heat Loss through glass can occur three basic ways:

Conduction is heat loss due to transfer from one part of a body to another part; or from one body to another body in direct contact.

Convection is the transfer of heat from one point to another within a fluid by mixing one portion of the fluid with another.

Radiation is the transfer of heat from one body to another by wave motion, without heating the space between the two bodies.

Traditional window design minimizes conduction (which mostly occurs through the frame pieces) by using non-conducting materials like wood or vinyl. Conductive heat loss through the glass itself has been effectively eliminated by using two panes of glass and separating them with an airspace (dual pane insulated glass).

Convection (between the glass surfaces through the "fluid" air) is minimized by enlarging the space between the inner and outer panes of the glass.

Radiant Heat Loss had been largely ignored (Solar Radiation, Ultra Violet radiation, and Infrared Radiation) because it passed so easily through the glass, and through the air between the glass (emissivity), and conventional ways of blocking it diminished sometimes desirable solar heat gain and visibility.

High-tech coating methods allow a process where an ultra-thin metallic coating is applied on one surface of a glass panel, or separating film, and the coating retards the passage of radiation (low emissivity) enough to improve the performance of the insulated glass unit without significant loss in solar heat gain or visibility.

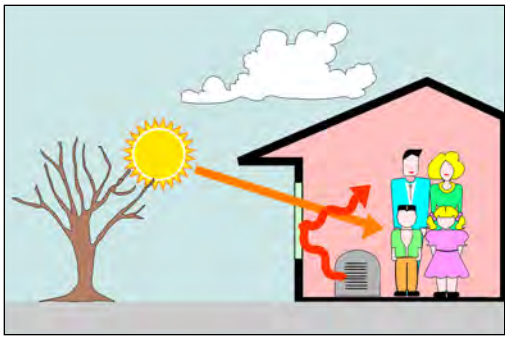
Low Emissivity Coatings Retard Heat Transfer

A dual pane insulated unit with one Low "E" Glass panel and one regular panel performs equally as well as a triple pane insulated unit. In fact, a Low "E" unit blocks 85% to 90% of radiant heat, and improves the overall performance of a standard dual pane unit by as much as 55%!

There are two processes that deposit the coating on the glass. Sprayed-on Soft Coat (Sputtered Coating) has a higher effectiveness on blocking radiant heat (up to 90%), but can reduce visible light, and has to have extreme care when touched or handled due to the sensitivity of the coating.

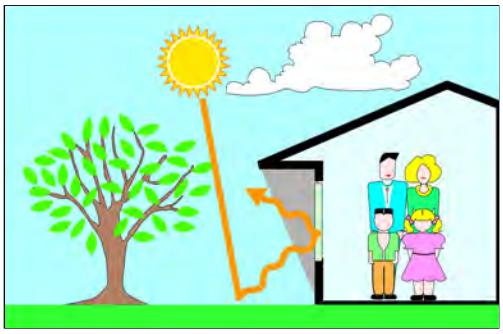
Fused-on Hard Coat (Pyrolytic Coating) has a 5% lower effect on radiant heat (85%), but on average lets in more visible light than soft coat, and it requires less handling care since it is as hard as the glass itself.

Winter Efficiency



Visible light in a Low "E", dual pane insulated unit, is only reduced 5 to 6% over a single pane unit. There is no real noticeable loss in visibility. As far as Solar Heat gain, most interior solar heat gain results from direct sunlight on the interior surfaces of the room which heats them up. In the winter, with the lower angle of the sun, direct sunlight falls on the interior surfaces for maximum heat gain. And, because the Low "E" glass keeps the heat in (no loss of the re-radiated heat) the retained solar heat gain is greater than with the regular glass.

Summer Efficiency



In the summer, the sun (which is very directional in its wave emissions) has a much higher angle of incidence which prevents much of the direct sunlight from entering the home. Shade from trees, and the way in which the house faces, can substantially reduce the amount of direct sunlight entering the home that would heat-up the interior. The real problem in the summer is the super-heated driveways, exterior bricks, etc. that radiate multi-directional heat waves that would enter the home through the windows, even long after the sun has set. Low "E" prevents the passage of this re-radiated heat into the home, keeping it cooler.

All-Season Performance

The added benefit in all seasons, is the blockage of Ultra Violet Radiation. This aids in the prevention of fading of carpet, drapes, and furniture. The least expensive Low "E" Glass will block about 60% of UV Radiation. Insulated Glass units with suspended coated film can block up to 90% of UV Radiation.

Other Factors that Affect Performance

There are different glass thicknesses. Most Vinyl Replacement Windows utilize 3/4" or 7/8" insulated glass units. The insulating value of a dual pane unit is based on its ability to block heat passage due to conduction and convection.

Most data indicates that the maximum resistance to heat flow of an airspace is reached at a thickness of 5/8" to 3/4". For glass spacing greater than this, decreasing conduction is offset by increasing convection, and there is little increase in net resistance.

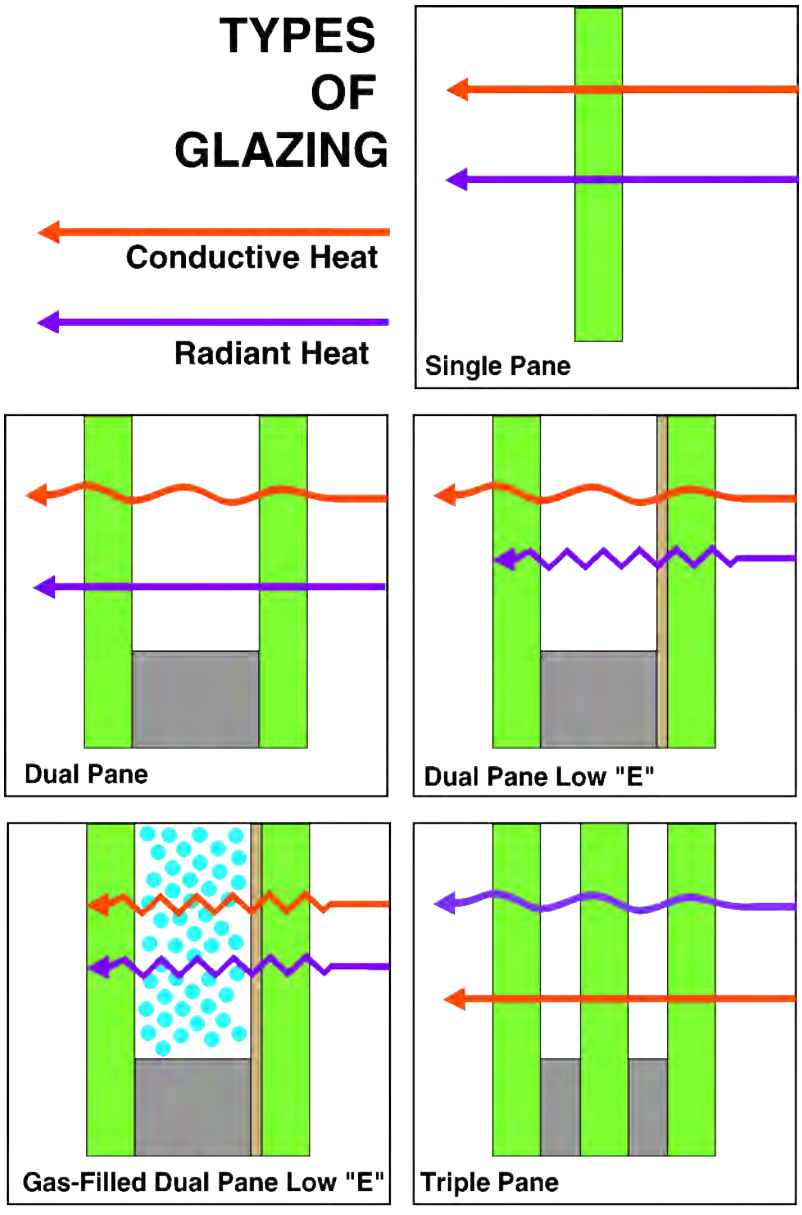
There are possibilities other than increasing airspace that can be explored. Radiant heat loss can be reduced by lowering the emissivity of the glass. There are two other ways to improve the balance between the effects of conduction and convection:

1. The airspace can be limited to its maximum effectiveness zone (5/8" - 3/4"), but the number of air spaces can be increased; or

2. the air in the space between the glass can be replaced with a gas that has a greater ability to block conduction.

The first is the principle behind Triple Glazing which is, in effect, two units of insulating air (between two outer panes of glass) separated by a single center pane of glass. And units with suspended film barriers also effectively create two dead air spaces - one on either side of the film without the additional weight of the third pane of glass.

The second method is successful because it uses inert Argon or Krypton gas as a substitute for the air between the two panes of glass. These gases are superior to plain air (even in spaces larger then 3/4") in reducing heat loss. Gas filling, used in conjunction with Low "E" coating, or suspended film units, is even more effective because conduction represents a larger fraction of the total heat transfer of coated units than of uncoated glass units.



Learn the advantages of different glazing options

The only realistic way to judge and compare glazing options offered in vinyl windows is to look at the U-value of the glass unit. And since glass represents approximately 75% of the surface area of the average window, the U-value of the glass is very significant.

Typical Glazing "U" Values

The Chart below contains some examples of Glass U-values. These values represent typical readings taken at the center of the glass unit. Though the U-value in particular windows may vary somewhat, the U-values in the chart are representative enough to be a good basis for comparison.

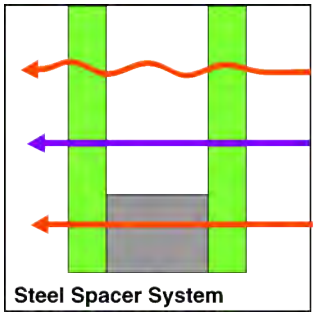
Glazing Type	U-Value*
Single Pane Glass	1.075
Double Pane 7/8"	.511
Double Pane Low "E" 7/8"	.340
Triple Glaze Low "E" 7/8"	.322
Double Pane Gas Filled 7/8"	.281
Triple Glaze Low "E" w/gas 7/8"	.253
Insulated Glass with Suspended Coated Film	.250

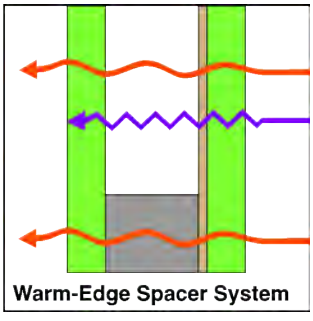
*Approximate Winter U-Value. describes the Heat Loss in BTU's per hour, per square foot, per degree difference between inside and outside surfaces. A lower U-value is better.

A word about spacer systems

Separating the two or three panes of glass is a spacer. Spacers used to be only made out steel. Steel is a good conductor, and warm air could migrate out of the window around the edges of the window because the glass and the spacer did little to block the heat flow. This problem was especially severe in aluminum windows. In wood windows and vinyl windows, the frame material protects the glass and the spacer from severe temperature differences (between inside warm and outside cold), limiting the inefficient energy effect of the metal spacer.

New technologies in spacers have provided window glazing systems with spacers that separate the glass panels, but limit the amount of conducted heat. These are called "warm edge" glazing systems.


Steel Spacer System


Warm-Edge Spacer System

Some of the test/performance data will show a marked improvement. However, these tests were conducted on glazing panels, outside the window frame. Once inside a vinyl or wood frame, the glazing panel edge is protected from the severe temperature differences used in the test. This is another reason why vinyl windows offer superior energy performance.