

### Steel Door + Window Systems

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This guide has been prepared as a basic introduction to standard types of glass. It is by no means intended to be utilized for the interpretation of building codes, regulations, or statutes governing glass or glazing. Information contained herein is subject to change in accordance with manufacturer's product line updates as well as building industry regulations.

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*Our technical manuals are prepared as tools designed to inform our customers of technical data as it relates to our products and services. It is our goal to help you make informed decisions when designing, specifying, ordering, installing, or maintaining Stiles products.*

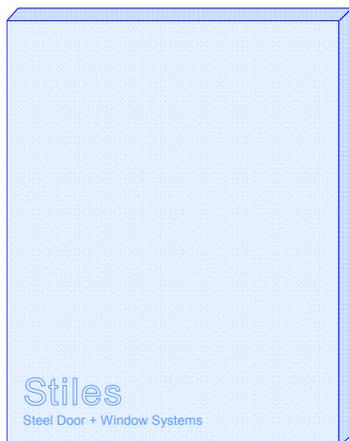
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## Types of Glass

## Annealed Glass

Annealed glass is not a safety or security product. Commonly referred to a "plate" glass (in 3/16" or 1/4" thicknesses, and "double-strength" or "window glass" in 1/8" and 3/32" thicknesses). The term "annealed" is derived from the manufacturing process. Annealed glass can be factory or field cut. Annealed glass poses the greatest risk of human injury of any glass type, as the glass breaks into large, jagged shards and does not remain stable in the opening after breakage occurs. Most household windows, as well as commercial storefront glass is annealed (where code dictates such).

Annealed glass is available in a vast variety of textures and colors. Stained glass also falls into the "annealed" category. Laminated safety glass is produced by securing two lites of annealed glass together with a PVB interlayer.

**BREAKAGE PATTERN**

BREAKS IN RANDOM, JAGGED PIECES  
THROUGHOUT GLASS LITE

NO SAFETY ASPECTS - GREAT POTENTIAL OF  
INJURY

DOES NOT REMAIN IN TACT AFTER BREAKAGE  
OCCURS

## The Float Glass Process

Float glass is a term for perfectly flat, clear glass (basic product). The term "float" glass is derived from the production method, introduced in the UK by Sir Alastair Pilkington in the late 1950's, of which 40% of today's flat glass is manufactured. The raw materials (silica sand, calcium, oxide, soda and magnesium) are properly weighted and mixed and then introduced into a furnace where they are melted at 1500° C. The molten glass then flows from the glass furnace into a bath of molten tin in a continuous ribbon. The glass, which is highly viscous, and the tin, which is very fluid, do not mix and the contact surface between these two materials is perfectly flat. When it leaves the bath of molten tin the glass has cooled down sufficiently to pass to an annealing chamber called a lehr. Here it is cooled at controlled temperatures, until it is essentially at room temperature.

## Types of Glass

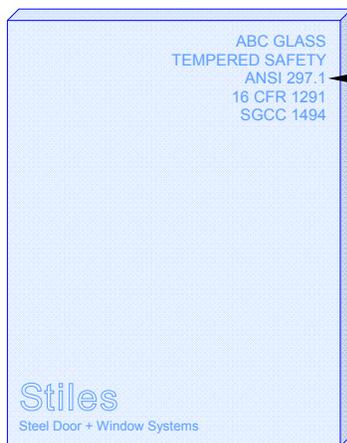
### Tempered Glass

Tempered glass greatly increases impact resistance over standard annealed glass. It is about four times as strong as annealed glass. However, it is breakable. When it breaks, the surface tension created by the tempering process causes it to shatter into hundreds of small pieces, rather than the large jagged shards characteristic of annealed glass. Although it offers more breakage resistance than ordinary annealed glass, its applications have a safety rather than security orientation. Its major disadvantage is that once broken, the entire lite disintegrates. Tempered glass can not be cut. A lite of annealed glass must first be cut to size and then tempered in a tempering furnace.

All tempered glass bears a small acid-etched label, usually found in the bottom right or left hand corner of the glass. This label, or "bug" as it is commonly called, signifies compliance to various standards. Tempered glass is used extensively in entrance doors, sidelites, shower doors, and automobile side glass. It is not required in transoms.

Note: For safety glass and glazing information, See [Safety Glazing Requirements](#)

Note: For bullet resistant glass and glazing information, See [Security Glass & Glazing Guide](#)



TEMPERED GLASS LOGO

ETCHED INTO GLASS TO SIGNIFY COMPLIANCE

FOUND IN BOTTOM CORNER OF GLASS LITES



**BREAKAGE PATTERN**

BREAKS IN UNIFORM, ROUNDED PIECES THROUGHOUT GLASS LITE

FAR LESS CHANCE OF INJURY THAN ANNEALED GLASS

DOES NOT REMAIN IN TACT AFTER BREAKAGE OCCURS

#### TEMPERED GLASS OPTIONS

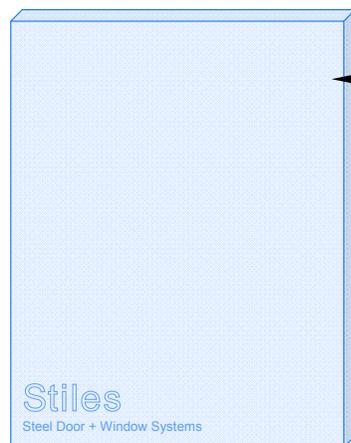
STD THICKNESS	WEIGHT (lb / sq ft)	STD COLORS
1/8"	1.62	
5/32	2.02	
3/16"	2.43	
1/4"	3.24	Clear Bronze
5/16"	4.06	Gray Blue / Blue Green
3/8"	4.87	
1/2"	6.49	Architectural Textures Patterned Glass
5/8"	8.11	
3/4"	9.73	
1"	12.98	

# Types of Glass

## Low-E Glass

Low-emission or low-emissivity glass (Low-E) is a clear glass, it has a microscopically-thin coating of metal oxide. This allows the sun's heat and light to pass through the glass into the building. At the same time it blocks heat from leaving the room, reducing heat loss considerably.

Low-E glass production includes: 1) On-line coated (pyrolytic process): this is a clear glass which has been coated with a metal oxide through pyrolysis when the glass leaves the tin bath (at 650°C). The coating is therefore very resistant to mechanical damage, and this Low-E glass can be cut, tempered or laminated just as normal uncoated glass. 2) Off-line coated (magnetron process): is a clear glass which has received, on one of its faces, a silver coating applied by magnetically-enhanced cathodic sputtering. This type of Low-E must be used exclusively in insulating glass, with the coating on an internal face. It can be tempered and laminated.

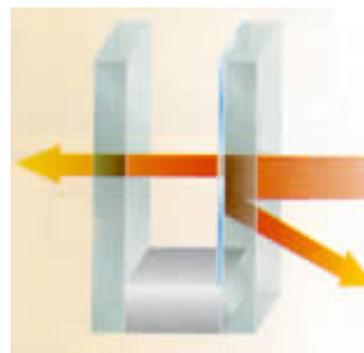


MICRO-THIN COATING OF METAL OXIDE ON FACE OF GLASS

LOW-E MAY BE ANNEALED, TEMPERED, OR LAMINATED (VARIOUS BREAKAGE PATTERNS)



Regular Glass



Low-E Glass

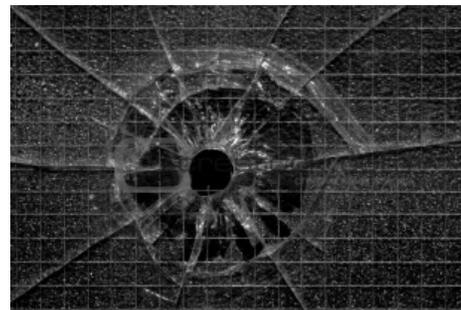
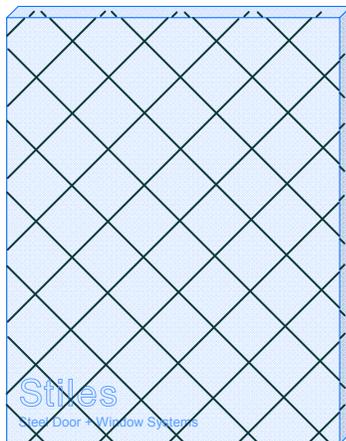
# Types of Glass

## Wire Glass

Primarily a safety product, wire glass is used extensively in fire rated doors. The wire mesh prevents the glass from shattering out of the frame during the intense heat of a fire. A disadvantage is that such lites have little or no impact resistance. This product is extremely dangerous in correctional facilities and psychiatric institutions, as it breaks easily, and, once broken, allows shards with exposed sharp wires to be used as weapons. This type of glazing does not hold up well in environmental areas that subject the glazing to heavy amounts of humidity and moisture or chemical exposure, as rust will eventually weep up the wire mesh between the laminations of the glazing, expanding and forcing outward eventually cracking the glazing. Full perimeter sealing of the glass lite during installation will prevent this type of failure.

Commonly available in 1/4" thickness, with either 1/2" or 3/4" mesh. Square or diamond wire patterns available, as is the option of either clear glass or obscure glass (smooth-rough finish). Wire glass meets the requirements of ANSI Z97.1-1984, but does not meet the impact requirements of CPSC 16 CFR 1201.

Note: For safety glass and glazing information, See [Safety Glazing Requirements](#)



**NOTE:**

Due to the low impact resistance of wire glass, the 2003 IBC now prohibits the use of wire glass in schools and athletic facilities, Visit [www.iccsafe.org](http://www.iccsafe.org) for information on the IBS.

Check your local, State, and Federal building codes prior to specifying or ordering wire glass.

**BREAKAGE PATTERN**

GLASS IS ANNEALED. BREAKS INTO LARGE JAGGED PIECES.

MOST GLASS PIECES REMAIN IN TACT AFTER BREAKAGE OCCURS.

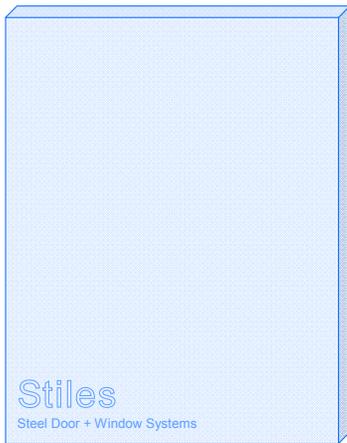
WIRE GLASS OPTIONS		
STD. THICKNESS	DESCRIPTION	WEIGHT (lb / sq ft)
1/4"	Clear Polished Wire Glass, Square or Diamond Pattern	3.4
1/4"	Smooth-Rough Obscure Wire Glass, Square or Diamon Pattern	3.4

# Types of Glass

## Heat Strengthened Glass

Heat strengthened glass increases the impact resistance over standard annealed glass, for the same given size and thickness. It is about twice as strong as annealed glass. It is more resistant to wind loading and impacts than annealed glass though less resistant than tempered. When broken, it fractures into large, jagged pieces similar to annealed glass, but normally somewhat smaller in shard size.

Note: For safety glass and glazing information, See [Safety Glazing Requirements](#)



### BREAKAGE PATTERN

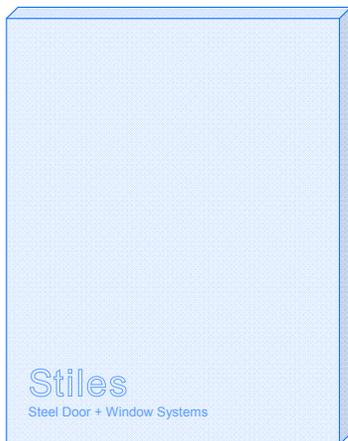
SIMILAR TO ANNEALED GLASS. BREAKS INTO LARGE JAGGED PIECES.

GLASS PIECES DO NOT REMAIN IN TACT IN OPENING ONCE BREAKAGE OCCURS.

## Chemically Strengthened Glass

Chemically strengthened glass increases impact resistance over standard annealed glass. It is also about 3-4 times stronger than annealed glass. However, it too is breakable. When it breaks, the surface tension created by the tempering bath process causes it to shatter into hundreds of small pieces, rather than the large jagged shards characteristic of plate glass, but larger than heat tempered glass.

Note: For safety glass and glazing information, See [Safety Glazing Requirements](#)



### BREAKAGE PATTERN

BREAKS IN UNIFORM, ROUNDED PIECES THROUGHOUT LITE, SIMILAR TO TEMPERED GLASS.

FAR LESS CHANCE OF INURY THAN ANNEALED GLASS

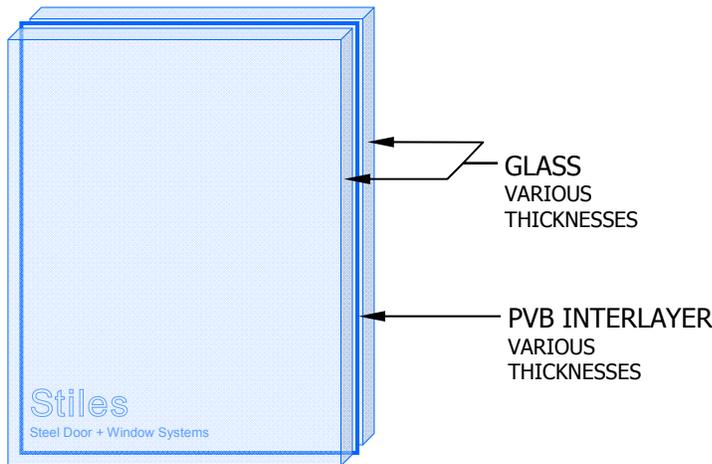
# Types of Glass

## Laminated Safety Glass

Used in automobile windshields, along with architectural applications. This glazing product is manufactured with either annealed and/or tempered glass and varying polyvinyl butyral (PVB) interlayers from .015 inches to .030+ inches thick. It comes in various thicknesses making it suitable for a wide variety of safety, limited security, and sound control applications.

Note: For safety glass and glazing information, See [Safety Glazing Requirements](#)

Note: For bullet resistant glass and glazing information, See [Security Glass & Glazing Guide](#)



**BREAKAGE PATTERN**

"COBWEB" OF BREAKS AT POINT OF IMPACT.  
GLASS STAYS IN TACT IN OPENING DUE TO INTERLAYER.

### BASIC LAMINATED GLASS OPTIONS

THICKNESS	CONFIGURATION (Glass - Interlayer - Glass)	WEIGHT (lb / sq ft)	STD COLORS
1/4"	Lami - 0.015 - Lami	2.93	Clear Bronze Gray Blue / Blue Green
1/4"	Lami - 0.030 - Lami	3.01	
1/4"	1/8" - 0.015 - 1/8"	3.33	
1/4"	1/8 - 0.030 - 1/8	3.42	
5/16"	1/8 - 0.060 - 1/8	3.58	
5/16"	1/8 - 0.090 - 1/8	3.75	
3/8"	3/16 - 0.030 - 3/16	5.05	
7/16"	3/16 - 0.060 - 3/16	5.21	
7/16"	3/16 - 0.090 - 3/16	5.38	
1/2"	1/4 - 0.030 - 1/4	6.67	
9/16"	1/4 - 0.060 - 1/4	6.83	
9/16"	1/4 - 0.090 - 1/4	7.00	
13/16"	3/8 - 0.060 - 3/8	10.09	
13/16"	3/8 - 0.090 - 3/8	10.26	

NOTE: All laminated safety glass meets CPSC 16 CFR 1201 and ANSI Z97.1

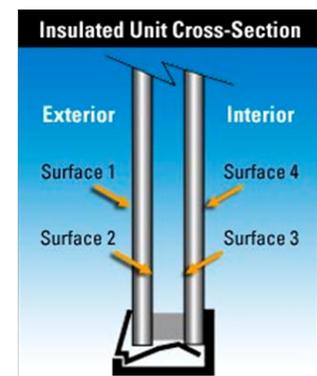
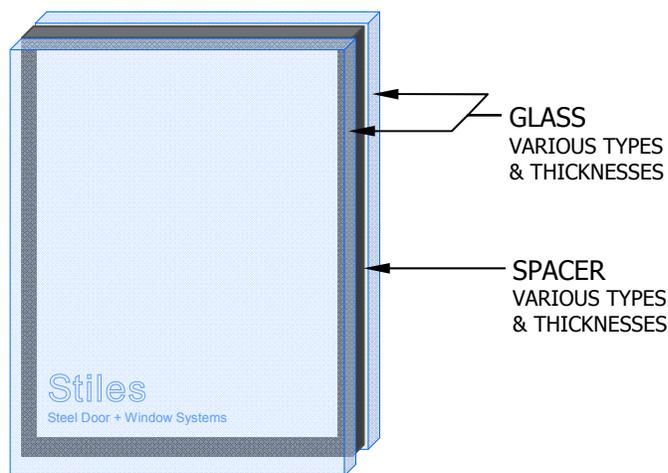
Laminated safety glass may require acid-etch labeling.

## Types of Glass

### Insulated Glass

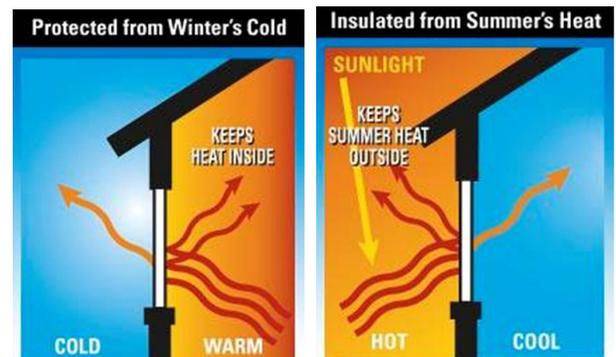
Insulated glass is a multi-glass combination consisting of two or more panes enclosing a hermetically-sealed air space. The most important function of insulated glass is to reduce thermal loss, which offers many advantages: lower energy consumption, perfect transparency by reducing the incidence of condensation on the warm air side, and the possibility of using larger glazed areas without increasing energy consumption.

Insulated glass is a glazed unit composed of two or more glass panes separated by spacers filled with dehydrated air or argon gas. The sheets are connected by a spacer, using sealants to reduce water vapor penetration. The whole unit is hermetically assembled by a secondary edge seal which gives structural robustness to the insulating glass. The spacer contains a desiccant which absorbs humidity from within the air space. The insulating glass unit (IGU) is made manually or in an automated plant.



### Insulated Glass Benefits

There are many benefits of utilizing insulated window and door products. They not only lower your energy costs, but also improve comfort, decrease condensation, and diminish the effects of fading. Insulated units are also highly effective in reducing unwanted sound transmission.



In the summer, heat is transmitted through the glass and is absorbed by the walls, furniture, floors, etc. By using window and door products with a low solar heat gain coefficient, the solar radiation coming into the building is decreased. This reduces the amount of heat entering the building, thereby improving the comfort level and lessening the amount of energy needed for cooling during warm weather months. Moreover, during the cooler seasons, insulated products create warmer interior glass surfaces, reducing frost and condensation from forming.

Another benefit is that during daylight hours, sunlight is transmitted through the glass and is absorbed by the walls, furniture and flooring. Many materials, such as carpet, curtains, upholstery, artwork and wood may fade upon exposure to sunlight. Window glass selection influences the type and intensity of ultraviolet (UV) rays, which causes fading and degradation.

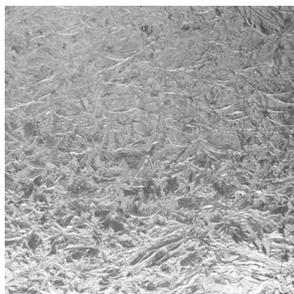
# Types of Glass

## Common Textured & Patterned Glass

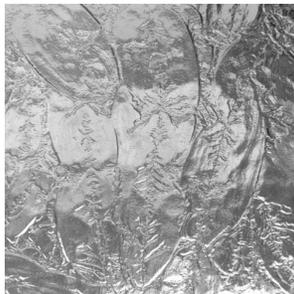
Patterned glass is a not-perfectly-smooth structure with different patterns impressed on it. The depth, size and shape of the patterns largely determine the magnitude and direction of reflection. Patterned glass usually transmits only slightly less light than clear glass. It can be used for a variety of applications.

Patterned glass is made with a rolled glass process. The semi-molten glass is squeezed between two metal rollers. The bottom roller is engraved with the negative of the pattern. Thickness is controlled by adjustment of the gap between the rollers.

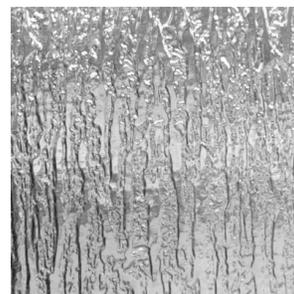
### Common Architectural Clear Patterned & Textured Glass



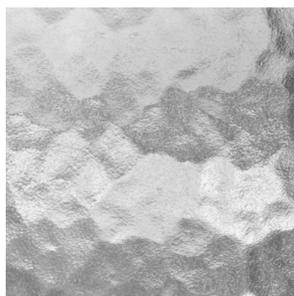
DOUBLE GLUE CHIP



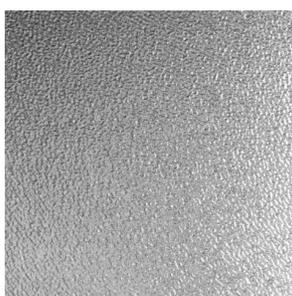
GLUE CHIP



RAIN



AQUATEX



P-516



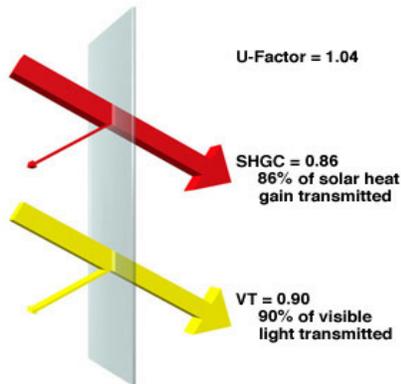
HAMMERED

## Tinted Glass

Tinted glass is a normal float-clear glass into whose melt colorants are added for tinting and solar-radiation absorption properties. This reduces heat penetration in buildings. Colored glass is an important architectural element for the exterior appearance of façades. It is also used in interior decoration (doors, partitions, staircase panels, mirrors, etc.)

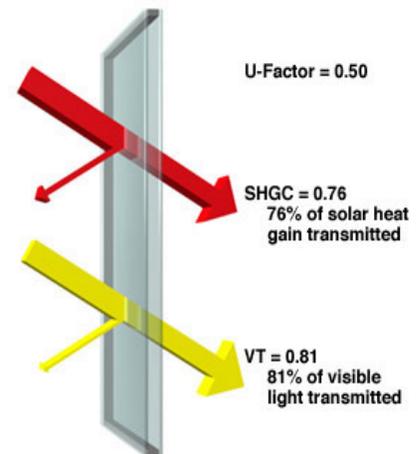


## Types of Glass



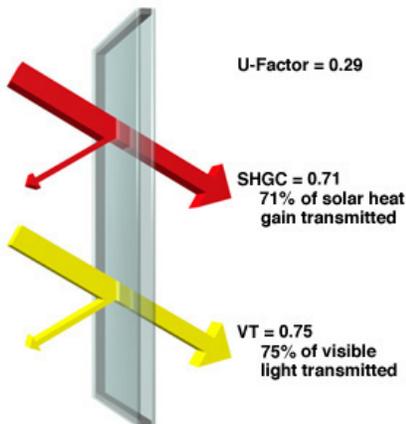
### Single-Glazed with Clear Glass

This figure illustrates the performance of a typical single-glazed unit with clear glass. Relative to all other glazing options, single-glazed with clear glass allows the highest transfer of energy (i.e. heat loss or heat gain depending on local climate conditions) while permitting the highest daylight transmission.



### Dual-Glazed with Clear Glass

This figure illustrates the performance of a typical double-glazed unit with two lites of clear glass. The inner and outer layers of glass are both clear and separated by an air gap. Double glazing, compared to single glazing, cuts heat loss in half due to the insulating air space between the glass layers. In addition to reducing the heat flow, a double-glazed unit with clear glass will allow the transmission of high visible light and high solar heat gain.



### Dual-Glazed with High-Solar-Gain Low-E Glass, Argon Gas Filled

This figure illustrates the characteristics of a typical double-glazed window with a high-transmission, Low-E glass and argon gas fill. These Low-E glass products are often referred to as pyrolytic or hard coat Low-E glass, due to the glass coating process. This is typical of a Low-E glass product designed to reduce heat loss but admit solar gain. High solar gain Low-E glass products are best suited for buildings in heating-dominated climates. This Low-E glass type is also the product of choice for passive solar design projects due to the performance attributes relative to other Low-E glass products which have been developed to reduce solar gain.

In heating-dominated climates with a modest amount of cooling or climates where both heating and cooling are required, Low-E coatings with high, moderate or low solar gains may result in similar annual energy costs depending on the house design and operation. While the high solar gain glazing performs better in winter, the low solar gain performs better in summer. Low solar gain Low-E glazing is ideal for buildings located in cooling-dominated climates.

**U-factor (U-value).** A measure of the rate of non-solar heat loss or gain through a material or assembly. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value.

