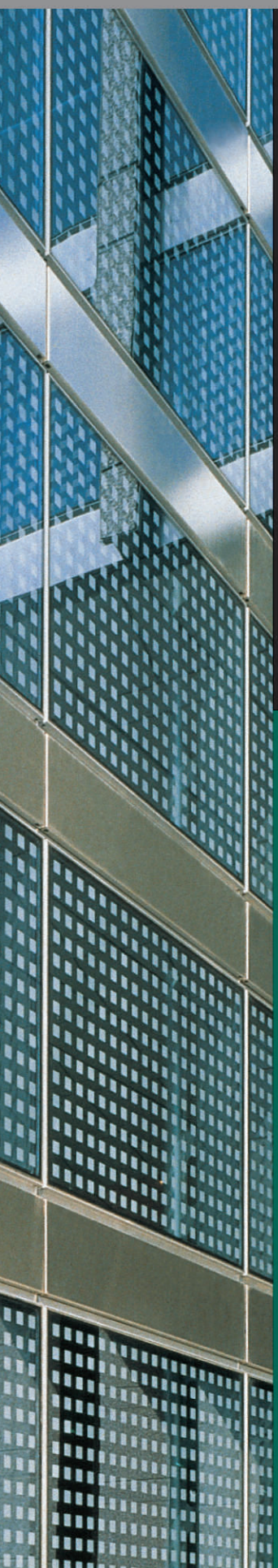
VIRACON



Viraspan™ decorative silk-screened & spandrel glass

specs & tech

designing for the eye we see where you're going

It all starts with taking your "what if" questions and turning them into "why not" answers. Chances are, we've recommended a solution for a similar job over the past 35 years. And chances are today, we can give you a point of view other fabricators just don't feel comfortable talking about. Trust, confidence, peace of mind—it's what specific performance solutions, aesthetic experience and the technical expertise to fabricate customized solutions can do for you. You'll also find a wide selection of spandrel and decorative glass, ceramic frits, silk-screened patterns, Low-E and reflective coatings to achieve the specific designs, transmission levels and the solar control options you're looking for. After all, the last thing we want is for you to have to make design changes that compromise your vision. And your clients'. It's simple; when it comes to working with you on specific performance and aesthetic glazing ideas; we're good visionaries. Challenge us, you'll see.

From imaginative aesthetics to strict environmental and energy issues to critical budget requirements, we know how to help you figure out a way to make it all work. That's what being a leader is all about. Architects, designers, contractors and visionaries throughout the world have come to rely on our proven experience to make Viracon their "go to" company when it comes to exploring options. And getting answers. The fact is, after 35-plus years, 100,000 buildings and 500,000,000 square feet of glazing installed in some of the world's most remarkable buildings, you learn a thing or two about what's the best thing to do. Today, we perform more glass fabricating processes at a single site than any other fabricator. Sit down, tell us your thoughts, challenge us. The sky's the limit.

Moscone Convention Center (Expansion)

San Francisco, CA

Architect: Gensler

Glazing Contractor: Enclos Corp.

Photographer: Wes Thompson

viraconsulting™

FIELD SALES REPRESENTATIVES
We're here to help with design assistance, budget costing, return on investment costing, spec writing and review as well as act as a liaison between architects and glazing contractors. We also work closely with the glazing contractor to offer assistance with initial costs, final pricing negotiations, product information and job site inspections. Just ask.

ACCOUNT REPRESENTATIVES & CUSTOMER SUPPORT
Call on us to help with quoting, product performance data, pricing, project coordination, samples and mockups. All it takes is a phone call.

techelp

Need an answer—fast? Our Architectural Technical Services group, along with our Architectural Design group, can assist you with specification and design assistance, performance and environmental analyses, structural calculations, energy payback, hurricane requirements and security threat levels. No problem.

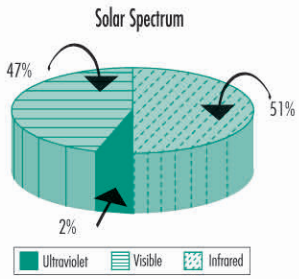


Figure 1

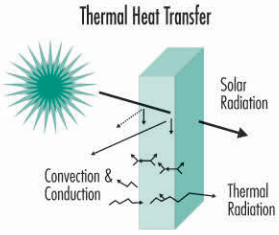


Figure 2

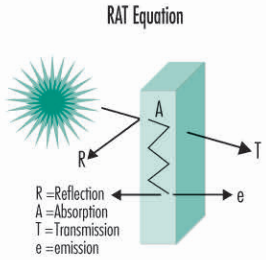


Figure 3

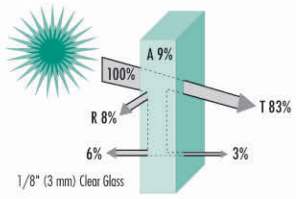


Figure 4

TERMS AND DEFINITIONS

Solar Spectrum

The solar spectrum, commonly referred to as sunlight, consists of ultraviolet light (UV), visible light and infrared (IR). The energy distribution within the solar spectrum is approximately 2 percent UV, 47 percent visible light and 51 percent IR (see Figure 1). One aspect of the solar spectrum is its wavelength in which nanometer (nm) is the unit of length [1 nm = 10^{-9} m].

UV is invisible to the human eye and has a wavelength range of ~300 - 380 nm. The damaging effects on long-term UV exposure results in fabric fading and plastic deterioration.

Visible light is the only portion of the solar spectrum visible to the human eye. It has a wavelength band of ~380 - 780 nm.

IR is invisible to the human eye, has a wavelength range of ~790 - 3000 nm and has a penetrating heat effect. Short-wave IR converts to heat when it is absorbed by an object.

Heat Transfer Methods

Heat transfers from one place to another via convection, conduction or radiation. Convection occurs from the upward movement of warm, light air currents. Conduction occurs when energy passes from one object to another. Radiation occurs when heat is sent through space and is capable of traveling to a distant object where it can be reflected, absorbed or transmitted (see Figure 2).

Solar Energy

When solar energy meets glass, portions of it are reflected, absorbed or transmitted—giving you the RAT equation (see Figure 3).

RAT Equation

The RAT equation accounts for 100 percent of solar energy, which is equal to the sum of solar reflectance, absorption and transmittance. For example, with a single pane of 1/8" (3 mm) clear glass, 83 percent of solar energy is transmitted, 8 percent is reflected and 9 percent is absorbed by the glass. Of the solar energy absorbed, portions are emitted back towards the exterior and towards the building interior (see Figure 4).

Solar Control

The visible light and IR portions of solar energy are an essential part of sunlight, since they represent nearly 100 percent of the solar spectrum. As a result, each plays an important role when glass is selected as a glazing material for commercial building applications. To enhance thermal performance, thin metallic films are applied to one or more glass surfaces.

CONTINUING EDUCATION

We also work with professional organizations and firms worldwide to provide AIA accredited educational seminars. As a registered provider with the AIA/Continuing Education System (AIA/CES), architects can receive 1.5 continuing learning units (LU's) with AIA/CES, including health, safety and welfare credits. You can schedule a presentation by visiting our web site at www.viracon.com or by calling 800-533-2080.

Low-Emissivity Coatings (low-e)

Low-emissivity coatings, which are applied to glass, reflect invisible long-wave infrared or heat. They reduce heat gain or loss in a building by redirecting the heat. In addition, they provide greater light transmission, low reflection and reduce heat transfer.

VIRACON'S GLASS

Vision/Spandrel Match for Non-Vision Areas

Often a project may require spandrel glass to harmonize with the vision areas of your building. However, this is sometimes difficult to achieve when high-light transmitting or low-reflective glass types are used. Instead, the use of low-light transmitting and high-reflective glass types provide the least contrast between vision and spandrel areas under a variety of lighting conditions.

In addition, variable sky conditions can also influence our perception of glass color and general appearance. On a bright, sunny day, the exterior light intensity is approximately 50 to 100 times greater than the interior lighting level.

When viewing the glass from the outside, the dominant visual characteristic is the exterior reflection. On gray, overcast days, a greater visual disparity is created between vision and spandrel areas. This is due to the transparency of the vision glass and the perception of depth created by interior lighting. The non-vision areas tend to look flat and two-dimensional by contrast.

Because spandrel glass is virtually opaque, it can only be viewed in reflection. On the other hand, vision glass possesses a degree of transmission. As the transmission of the vision glass increases during overcast conditions, interior lighting becomes more prevalent. Viracon recommends viewing glass samples or full-size mockups to match vision and spandrel glass areas when the visible light transmission of the vision glass exceeds 14 percent.

Greater contrast between vision and spandrel areas occurs when using uncoated, tinted glass (green, bronze, blue, etc.) or high transmission, Low-E coatings. Under these conditions, insulating spandrel units can create the illusion of depth and approximate the vision glass more closely. By keeping the vision and spandrel glass construction similar (the same exterior glass color, coating, etc.), the contrast can be minimized under various lighting conditions. Viracon recommends using a neutral colored ceramic frit on the number four surface.

Spandrel Products

Viracon offers two types of spandrel products—ceramic frit and opacifier films for use in commercial building designs.

Viraspan™ Ceramic Frit

Viracon offers designers the freedom to choose from a wide array of Viraspan ceramic frit colors—offering the flexibility you need to create a unique design.

You can choose from the following 12 standard colors or create custom colors: dark bronze (V-900), dark gray (V-901), evergreen (V-902), subdued gray (V-903), bronze (V-904), subdued bronze (V-905), black (V-907), gray (V-908), warm gray (V-933), medium gray (V-948), blue (V-911) and opaque white (V-175).

Or, you can choose our Translucent Frits, Simulated Acid-Etch (V-1085) and Simulated Sandblast (V-1086). These frits offer a translucent glass product that's easier to maintain and handle than actual acid-etched or sandblasted glass. Both products can be used in vision or spandrel applications. Applied in a silk-screen process, standard or custom patterns may be created, full coverage is also an option, but only with V-1085 and V-1086 frits when used in a vision application.

First, Viracon applies a ceramic frit enamel onto the number two surface of uncoated glass. Ceramic frit paint is comprised of minute glass particles, pigment and a medium in order to mix the glass and pigment together. Then, the enamel is fired to create a permanent coating.

If you require insulating glass for spandrel areas, Viracon applies the ceramic frit to either the number two, three (if reflective #2) or four surface to create an opaque appearance. This combination creates consistency between vision and spandrel glass areas.

Viraspan™ Premier

Viraspan Premier is a glass product that provides a non-glass appearance for spandrel building areas. The product has a proprietary surface treatment on 1/4" (6mm) clear glass that offers a matte finish to the spandrel glass, reducing glare and eliminating the reflective appearance of glass. Viraspan Premier can be used in place of aluminum panels, for example, while offering both aesthetic and cost advantages.

Opacifier Film

If you require monolithic reflective glass, Viracon applies a polyester opacifying film to the interior of the glass surface over the reflective coating. Full coverage ceramic frit cannot be used on the same surface with reflective coatings.

Metallic Opacifier

If a metallic panel is the look desired for spandrel wall areas, Viracon can provide monolithic glass with a metalllic opacifier film. The product was developed with clear or low-iron glass to achieve the maximum metallic appearance. Or it may be combined with a tinted glass substrate to gain color. Combinations of metallic opacifier film and tinted glass substrates generally minimize the metallic/shimmer affect.

Decorative Silk-screened Glass for Vision Areas

Silk-screening ceramic frit onto glass lets a designer create a subtle or bold look for a building—using patterns and color. Silk-screened glass also improves solar control performance.

Using the same technology as Viraspan spandrel glass, you can incorporate standard or custom colors into a specific design element. Or, you can use one of Viracon's three standard silk-screen patterns (see chart below).

In the past, white ceramic frit has been the predominant color used in decorative applications. However, there has been an increase in the use of dark ceramic frits, such as neutral gray and black for a more subtle, less noticeable look. These colors also help reduce reflection and offer alternative design options without adversely affecting performance.

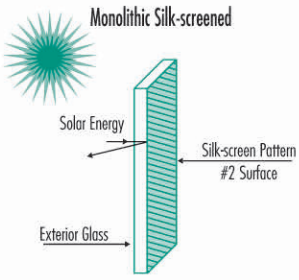


Figure 5

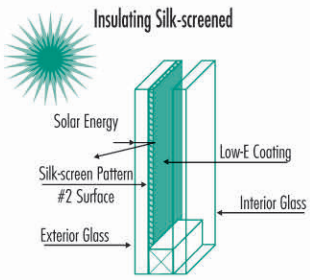
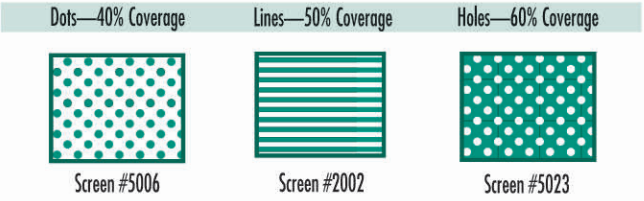


Figure 6

The first step in silk-screening involves washing the annealed glass. Then, the ceramic frit paint is applied to one side of the glass (see Figure 5). Next, it is fired within a tempering furnace to create a permanent coating. The glass is always either heat strengthened or fully tempered to prevent glass breakage due to thermal stresses under sunlit applications.

Viracon's silk-screened decorative patterns can be combined with clear or tinted glass substrates, as well as with high-performance coatings to reduce glare and decrease solar transmission.

SILK-SCREEN PATTERNS



For an insulating glass unit, Viracon recommends applying the silk-screen pattern to the second surface for optimum solar performance. The sealed air space protects the ceramic frit for easy maintenance, as well as meeting Viracon's long-term durability architectural glass product requirements (see Figure 6).

Viracon can also apply the silk-screen pattern to the third or fourth surface of an insulating or laminated glass unit. The results are an increase in solar absorption on the interior glass ply and a higher shading coefficient. Silk-screening on these two surfaces becomes more apparent from the interior during nighttime conditions, which complements indirect interior lighting.

Furthermore, silk-screened ceramic frit can also be applied to the second, third, or fourth glass surface in a laminated vision glass application (see Figure 7). If you combine laminated glass with other types of glass to form an insulating glass unit, the ceramic frit must be protected within the air space or be applied to the roomside of an insulating glass unit (see Figure 8).

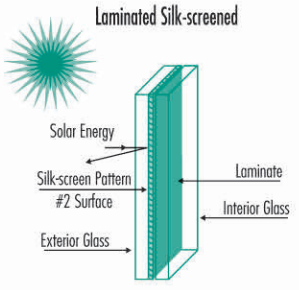


Figure 7

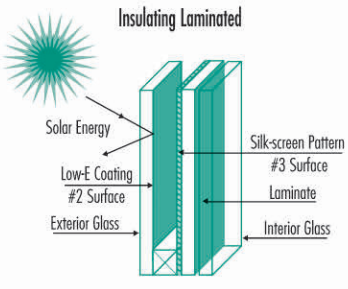


Figure 8

Moiré Pattern

When using silk-screen patterns in architectural building applications, there may be a potential to see a Moiré pattern develop in the glass when viewed in certain light conditions and at specific solar angles. Coupled with these are the inherent dynamics of the construction process.

Moiré is an optical phenomenon that presents itself as a "wavy, rippled or circular" pattern under some conditions. The Moiré image is a pattern formed when two regularly spaced patterns "overlap," but are not aligned. Common examples may be woven fabric and window screens. In this case, the Moiré pattern appears to "shimmer" when light is reflected from the surface.

Architectural float glass will reflect light from each of its surfaces. When silk-screen patterns are applied to the #2 surface of an insulating glass unit, the image is reflected off of the #3 glass surface. It's the interference of the reflected image from the #3 surface, by the silk-screen pattern applied to the #2 surface, that causes the Moiré pattern.

The condition may be further pronounced by the air contained in the air space of the insulating glass unit. Air will expand when heated and contract when cooled. This is known as the Ideal Gas Law. Glass deflection may create the condition necessary for the Moiré pattern to occur, or may further distort the reflected image of the silk-screen pattern. With large glass sizes there is more potential for movement that can create a possible condition for the Moiré pattern effect to occur. Buildings under construction may have a higher potential to exhibit Moiré patterns because the glass temperatures have not been stabilized by controlled temperatures.

While it may be impossible to identify when the potential for Moiré pattern may occur, the following general recommendations may be helpful:

1. Line patterns closely spaced, or two glass surfaces having a silk-screen pattern applied (insulating glass) may be more prone to exhibiting a Moiré pattern.
2. To a lesser degree, silk-screened patterns using dots and holes, closely spaced may also be susceptible.
3. Insulating glass units used in spandrel areas may also be more prone to this phenomenon.
4. Large glass sizes with an aspect ratio (length to width ratio) of less than 2:1.
5. Highly transparent glass (clear, low-e coating).
6. Shadow box applications.

Viracon recommends that a full size mock-up be evaluated on all projects considering the use of silk-screen patterns. The mock-up should be installed at the building site and viewed under a variety of lighting and temperature conditions.

ENERGY TERMS

Visible Light Transmittance
The percentage of visible light (380 - 780 nm) that is transmitted through the glass.

Solar Transmittance
The percentage of ultraviolet, visible and near infrared energy (300 - 3000 nm) that is transmitted through the glass.

Visible Light Reflectance
The percentage of light that is reflected from the glass surface(s).

Solar Reflectance
The percentage of solar energy that is reflected from the glass surface(s).

NFRC U-Value
A measure of heat gain or heat loss through glass due to the differences between indoor and outdoor temperatures. These are center pane values based on NFRC standard winter nighttime and summer daytime conditions.

U-values are given in BTU/(hr*ft²*°F) for the English system. Metric U-values are given in W/(m²*°K). To convert from English to metric, multiply the English U-value by 5.6783.

NFRC winter nighttime U-values are based on an outdoor temperature of 0°F (-17.8°C), an indoor temperature of 70°F (21°C) and a 12.3 mph (19.8 km/h) outdoor air velocity.

NFRC summer daytime U-values are based on an outdoor temperature of 89°F (32°C), an indoor temperature of 75°F (24°C), a 6.2 mph (10.1 km/h) outdoor air velocity and a solar intensity of 248 BTU/(hr*ft²*°F) (782 W/m²).

R-Value
Thermal resistance is expressed in ft²*hr*°F/BTU. It is the reciprocal of U-value. The higher the R-value, the less heat is transmitted through the glazing material.

Shading Coefficient
Shading coefficient is the ratio of solar heat gain through a specific type of glass that is relative to the solar heat gain through a 1/8" (3 mm) ply of clear glass under identical conditions (see Figure 9). As the shading coefficient number decreases, heat gain is reduced, which means a better performing product.

Shading Coefficient (SC)

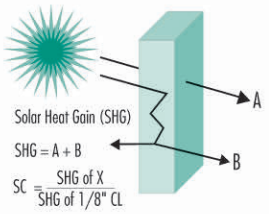


Figure 9

Relative Heat Gain (RHG)
The amount of heat gained through glass taking into consideration U-value and shading coefficient. Using the NFRC standard, relative heat gain is calculated as follows:

English System:
RHG = Summer U-value x 14°F + shading coefficient x 200.

Metric System:
RHG = Summer U-value x 7.8°C + shading coefficient x 630.

Solar Heat Gain Coefficient (SHGC)
The portion of directly transmitted and absorbed solar energy that enters into the building's interior. The higher the SHGC, the higher the heat gain.

Light to Solar Gain Ratio (LSG)
The ratio is equal to the Visible Light Transmittance divided by the Solar Heat Gain Coefficient. The Department of Energy's Federal Technology Alert publication of the Federal Energy Management Program (FEMP) views an LSG of 1.25 or greater to be Green Glazing/Spectrally Selective Glazing.

European U-Value (formerly K-Value)
Based on ISO-DP10292 draft standard conditions. It is based on an outdoor temperature of 5.5°C, an indoor temperature of 20.5°C and a 4.8 m/s outdoor air velocity.

The solar and optical data presented in this guide is based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley Laboratories (LBL) new WINDOW 5.2 software. In some cases performance data changed in comparison to previous versions of LBL's WINDOW program.

SOLARSCREEN™ CODE CHARTS

Coating Type	Outboard Glass Substrate		Nominal Visible Light Transmittance of Coating
VE = Low-E	1 = Clear*	9 = Versalux® Blue 2000	40 = 40%
	2 = Green*	10 = Versalux® Green 2000*	42 = 42%
	3 = Gray*	11 = Arctic Blue™	52 = 52%
	4 = Bronze*	12 = Atlantica™	55 = 55%
	5 = Blue*	13 = Starphire™	85 = 85%
	6 = Blue-Green*	14 = Caribia™	2M = 70%
	7 = Azuria™*	15 = UltraWhite™	
	8 = EverGreen™		

*Detailed performance data is provided on the following pages with these glass substrates. Contact us for performance data with other glass substrates.

SILK-SCREENED MONOLITHIC GLASS—DOTS (TABLE 1)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	61%	55%	37%	18%	28%	14%	1.02	.92	.74	161	.64	.95	5.7
Green	51%	31%	16%	14%	28%	8%	1.03	.93	.57	127	.49	1.05	5.7
Gray	31%	30%	15%	8%	27%	7%	1.03	.93	.57	127	.49	.63	5.7
Bronze	37%	35%	14%	9%	27%	8%	1.02	.92	.60	134	.52	.71	5.7
Blue	38%	31%	19%	10%	27%	8%	1.02	.92	.58	129	.50	.77	5.7
Blue-Green	52%	35%	19%	14%	28%	9%	1.03	.93	.60	133	.52	1.01	5.7
Azuria™	47%	22%	25%	13%	28%	7%	1.03	.93	.51	115	.44	1.07	5.7
Green 2000	46%	23%	9%	12%	27%	7%	1.03	.93	.52	117	.44	1.04	5.7

SHGC refers to Solar Heat Gain Coefficient.
LSG refers to Light to Solar Gain ratio.

SILK-SCREENED MONOLITHIC GLASS—LINES (TABLE 2)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	54%	49%	31%	20%	33%	15%	1.02	.92	.69	151	.60	.91	5.7
Green	46%	28%	13%	16%	33%	9%	1.03	.93	.55	123	.47	.97	5.7
Gray	27%	27%	12%	8%	32%	7%	1.03	.93	.55	122	.47	.58	5.7
Bronze	33%	31%	12%	10%	32%	9%	1.02	.92	.58	128	.49	.67	5.7
Blue	34%	28%	16%	11%	32%	8%	1.02	.92	.55	123	.47	.73	5.7
Blue-Green	47%	31%	16%	16%	33%	10%	1.03	.93	.57	127	.49	.95	5.7
Azuria	42%	20%	21%	14%	33%	8%	1.03	.93	.49	111	.42	1.00	5.7
Green 2000	41%	21%	7%	13%	33%	7%	1.03	.93	.50	113	.43	.95	5.7

SILK-SCREENED MONOLITHIC GLASS—HOLES (TABLE 3)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	48%	44%	25%	23%	39%	17%	1.02	.92	.64	141	.55	.87	5.7
Green	40%	25%	11%	18%	38%	10%	1.03	.93	.52	117	.45	.89	5.7
Gray	24%	24%	10%	9%	37%	8%	1.03	.93	.52	117	.45	.53	5.7
Bronze	29%	28%	9%	11%	38%	9%	1.02	.92	.55	122	.47	.61	5.7
Blue	30%	25%	13%	12%	38%	9%	1.02	.92	.53	118	.45	.66	5.7
Blue-Green	41%	27%	13%	18%	38%	10%	1.03	.93	.54	121	.46	.88	5.7
Azuria	37%	17%	17%	16%	38%	8%	1.03	.93	.47	107	.40	.92	5.7
Green 2000	36%	18%	6%	15%	38%	8%	1.03	.93	.48	109	.41	.87	5.7

1. The performance data for Tables 1 - 3 applies to 1/4" (6 mm) monolithic glass with a silk-screen pattern on the second surface. Table 1 features a standard white dot pattern at 40 percent coverage, Table 2 features a standard white line pattern at 50 percent coverage, and Table 3 features a standard white hole pattern at 60 percent coverage.
2. Silk-screened glass requires heat treating.

VIRACON

SILK-SCREENED LAMINATED GLASS—DOTS (TABLE 4)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	58%	43%	<1%	19%	28%	14%	.97	.88	.65	142	.56	1.04	5.3
Green	49%	26%	<1%	15%	27%	9%	.97	.88	.54	120	.46	1.07	5.3
Gray	29%	23%	<1%	8%	26%	7%	.97	.88	.53	117	.45	.65	5.3
Bronze	35%	27%	<1%	10%	27%	8%	.97	.88	.55	122	.47	.75	5.3
Blue	37%	25%	<1%	10%	27%	8%	.97	.88	.53	119	.46	.80	5.3
Blue-Green	50%	28%	<1%	15%	27%	9%	.97	.88	.56	123	.48	1.04	5.3
Azuria	45%	19%	<1%	14%	27%	8%	.97	.88	.49	111	.48	.94	5.3
Green 2000	44%	20%	<1%	13%	27%	7%	.97	.88	.50	112	.43	1.02	5.3

SILK-SCREENED LAMINATED GLASS—LINES (TABLE 5)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	52%	38%	<1%	22%	32%	16%	.97	.88	.61	134	.52	1.00	5.3
Green	44%	23%	<1%	17%	32%	9%	.97	.88	.52	116	.44	.99	5.3
Gray	26%	21%	<1%	9%	31%	8%	.97	.88	.51	113	.43	.61	5.3
Bronze	31%	24%	<1%	11%	31%	9%	.97	.88	.53	118	.45	.70	5.3
Blue	33%	22%	<1%	11%	31%	8%	.97	.88	.51	115	.44	.74	5.3
Blue-Green	44%	25%	<1%	17%	32%	10%	.97	.88	.53	118	.45	.99	5.3
Azuria	40%	17%	<1%	15%	32%	8%	.97	.88	.48	108	.41	.98	5.3
Green 2000	39%	17%	<1%	14%	31%	8%	.97	.88	.48	109	.41	.95	5.3

SILK-SCREENED LAMINATED GLASS—HOLES (TABLE 6)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	45%	34%	<1%	24%	36%	17%	.97	.88	.57	126	.49	.93	5.3
Green	38%	20%	<1%	18%	36%	10%	.97	.88	.49	111	.42	.91	5.3
Gray	23%	18%	<1%	9%	35%	8%	.97	.88	.49	109	.42	.54	5.3
Bronze	27%	21%	<1%	11%	36%	9%	.97	.88	.50	113	.43	.64	5.3
Blue	29%	19%	<1%	12%	36%	9%	.97	.88	.49	111	.42	.68	5.3
Blue-Green	39%	22%	<1%	19%	36%	11%	.97	.88	.50	113	.43	.90	5.3
Azuria	35%	15%	<1%	16%	36%	9%	.97	.88	.46	104	.39	.90	5.3
Green 2000	34%	15%	<1%	15%	36%	8%	.97	.88	.46	105	.40	.85	5.3

1. The performance data for Tables 4 - 6 applies to 9/16" (13.5 mm) laminated glass units constructed with two plies of 1/4" (6 mm) glass, .060" (1.52 mm) clear pvb and a white silk-screen pattern on the second surface. Table 4 features a standard white dot pattern at 40 percent coverage, Table 5 features a standard white line pattern at 50 percent coverage, and Table 6 features a standard white hole pattern at 60 percent coverage.
2. Both glass plies of a silk-screened laminated glass unit require heat treating.

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SILK-SCREENED INSULATING GLASS—DOTS (TABLE 7)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	55%	44%	28%	21%	31%	16%	.47	.49	.62	131	.54	1.02	2.8
Green	47%	26%	13%	16%	30%	9%	.47	.49	.44	95	.38	1.22	2.8
Gray	28%	24%	12%	9%	29%	8%	.47	.49	.43	92	.37	.75	2.8
Bronze	33%	28%	11%	10%	30%	9%	.47	.49	.46	100	.40	.83	2.8
Blue	35%	25%	16%	11%	30%	8%	.47	.49	.44	95	.38	.91	2.8
Blue-Green	47%	29%	16%	17%	30%	10%	.47	.49	.47	100	.40	1.18	2.8
Azuria	43%	19%	20%	15%	30%	8%	.47	.49	.37	81	.32	1.33	2.8
Green 2000	42%	20%	7%	14%	30%	8%	.47	.49	.38	82	.32	1.30	2.8

SILK-SCREENED INSULATING GLASS—LINES (TABLE 8)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	49%	39%	23%	23%	35%	17%	.47	.49	.57	121	.49	1.01	2.8
Green	41%	23%	11%	18%	34%	10%	.47	.49	.41	89	.35	1.17	2.8
Gray	25%	21%	10%	9%	34%	8%	.47	.49	.40	87	.35	.71	2.8
Bronze	30%	25%	10%	11%	34%	9%	.47	.49	.43	94	.37	.80	2.8
Blue	31%	23%	13%	12%	34%	9%	.47	.49	.41	89	.35	.89	2.8
Blue-Green	42%	26%	13%	18%	35%	11%	.47	.49	.43	94	.37	1.14	2.8
Azuria	38%	17%	17%	16%	34%	8%	.47	.49	.35	76	.30	1.27	2.8
Green 2000	37%	18%	6%	15%	34%	8%	.47	.49	.35	78	.30	1.23	2.8

SILK-SCREENED INSULATING GLASS—HOLES (TABLE 9)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	43%	35%	19%	25%	39%	18%	.47	.49	.52	111	.45	.96	2.8
Green	36%	21%	9%	19%	39%	10%	.47	.49	.38	83	.33	1.10	2.8
Gray	22%	19%	8%	9%	38%	8%	.47	.49	.38	82	.32	.68	2.8
Bronze	26%	22%	8%	12%	38%	10%	.47	.49	.41	88	.35	.75	2.8
Blue	27%	20%	10%	12%	38%	9%	.47	.49	.38	84	.33	.82	2.8
Blue-Green	37%	23%	10%	19%	39%	11%	.47	.49	.40	88	.35	1.06	2.8
Azuria	34%	15%	13%	17%	39%	9%	.47	.49	.33	72	.28	1.20	2.8
Green 2000	33%	16%	5%	16%	39%	8%	.47	.49	.33	73	.29	1.12	2.8

1. The performance data for Tables 7 - 12 applies to insulating glass units constructed with two plies (clear inboard) of 1/4" (6 mm) glass, a 1/2" (13 mm) air space and a white silk-screen pattern on the second surface. Table 7 & 10 features a standard white dot pattern at 40 percent coverage, Table 8 & 11 features a standard white line pattern at 50 percent coverage, and Table 9 & 12 features a standard white hole pattern at 60 percent coverage.
2. Silk-screened glass requires heat treating.
3. Solarscreen™ coated products (except VE-85) are designed as second surface coatings.

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SILK-SCREENED LOW-E INSULATING GLASS—DOTS (TABLE 10)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
VE 1-2M	49%	23%	6%	20%	24%	28%	.29	.26	.33	69	.28	1.76	1.5
VE 1-85	53%	33%	16%	20%	27%	22%	.31	.29	.47	97	.40	1.33	1.6
VE 1-55	33%	19%	8%	20%	21%	23%	.31	.29	.31	65	.27	1.21	1.6
VE 1-52	35%	22%	13%	23%	17%	22%	.32	.30	.35	73	.30	1.15	1.7
VE 1-42	26%	17%	9%	25%	17%	22%	.31	.29	.28	60	.24	1.08	1.6
VE 1-40	25%	15%	6%	23%	22%	25%	.31	.29	.25	54	.21	1.20	1.6
VE 2-2M	41%	17%	3%	15%	23%	11%	.29	.26	.27	58	.23	1.80	1.5
VE 2-85	45%	21%	8%	16%	26%	10%	.31	.29	.33	71	.29	1.54	1.6
VE 2-55	27%	13%	4%	16%	21%	10%	.31	.29	.24	52	.20	1.37	1.6
VE 2-52	29%	14%	6%	18%	17%	11%	.32	.29	.26	56	.22	1.32	1.7
VE 2-42	22%	11%	5%	19%	17%	11%	.31	.29	.22	48	.19	1.15	1.6
VE 2-40	21%	10%	3%	17%	22%	11%	.31	.29	.20	45	.17	1.25	1.6
VE 3-2M	25%	12%	3%	8%	23%	12%	.29	.26	.22	48	.19	1.30	1.5
VE 3-85	27%	18%	7%	8%	25%	10%	.31	.29	.30	64	.26	1.03	1.6
VE 3-55	16%	10%	4%	8%	21%	10%	.31	.29	.22	48	.19	.86	1.6
VE 3-52	17%	12%	6%	9%	17%	10%	.32	.29	.24	52	.21	.83	1.7
VE 3-42	13%	9%	4%	10%	17%	10%	.31	.29	.20	45	.17	.76	1.6
VE 3-40	13%	8%	3%	9%	22%	11%	.31	.29	.19	41	.16	.79	1.6
VE 4-2M	30%	14%	3%	10%	23%	14%	.29	.26	.24	52	.21	1.41	1.5
VE 4-85	32%	20%	7%	10%	26%	12%	.31	.29	.33	71	.29	1.10	1.6
VE 4-55	20%	12%	3%	10%	21%	12%	.31	.29	.23	51	.20	.99	1.6
VE 4-52	21%	14%	6%	11%	17%	11%	.32	.29	.26	56	.22	.95	1.7
VE 4-42	16%	10%	4%	12%	17%	12%	.31	.29	.22	47	.19	.82	1.6
VE 4-40	15%	9%	3%	11%	22%	13%	.31	.29	.20	44	.17	.89	1.6
VE 5-2M	31%	14%	4%	10%	23%	14%	.29	.26	.25	53	.21	1.47	1.5
VE 5-85	33%	20%	9%	11%	26%	10%	.31	.29	.32	68	.28	1.19	1.6
VE 5-55	20%	12%	5%	11%	21%	10%	.31	.29	.23	50	.20	1.02	1.6
VE 5-52	22%	13%	7%	12%	17%	10%	.32	.29	.25	54	.22	.99	1.7
VE 5-42	16%	10%	6%	13%	17%	11%	.31	.29	.21	46	.18	.91	1.6
VE 5-40	16%	9%	4%	12%	22%	11%	.31	.29	.19	43	.17	.93	1.6
VE 6-2M	42%	18%	4%	16%	23%	13%	.29	.26	.28	60	.24	1.76	1.5
VE 6-85	46%	23%	9%	16%	26%	11%	.31	.29	.35	75	.31	1.47	1.6
VE 6-55	28%	14%	5%	16%	21%	11%	.31	.29	.25	54	.21	1.33	1.6
VE 6-52	30%	15%	8%	18%	17%	12%	.32	.29	.27	58	.23	1.29	1.7
VE 6-42	22%	12%	6%	20%	17%	12%	.31	.29	.23	49	.20	1.11	1.6
VE 6-40	22%	10%	4%	18%	22%	12%	.31	.29	.21	46	.18	1.20	1.6
VE 7-2M	38%	14%	5%	14%	23%	8%	.29	.26	.25	53	.21	1.81	1.5
VE 7-85	41%	17%	12%	14%	26%	8%	.31	.29	.28	60	.24	1.71	1.6
VE 7-55	25%	10%	6%	14%	21%	8%	.31	.29	.21	46	.18	1.39	1.6
VE 7-52	27%	11%	9%	16%	17%	9%	.31	.29	.23	49	.19	1.41	1.7
VE 7-42	20%	9%	7%	17%	17%	9%	.31	.29	.19	43	.17	1.18	1.6
VE 7-40	20%	8%	5%	15%	22%	9%	.31	.29	.18	41	.16	1.22	1.6
VE 10-2M	37%	14%	2%	13%	23%	8%	.29	.26	.24	52	.21	1.76	1.5
VE 10-85	40%	17%	4%	13%	26%	8%	.31	.29	.28	61	.24	1.66	1.6
VE 10-55	24%	10%	2%	13%	21%	8%	.31	.29	.21	46	.18	1.36	1.6
VE 10-52	26%	11%	3%	15%	17%	8%	.32	.29	.23	49	.19	1.37	1.7
VE 10-42	20%	9%	3%	16%	17%	9%	.31	.29	.19	43	.17	1.15	1.6
VE 10-40	19%	8%	2%	15%	22%	8%	.31	.29	.18	41	.16	1.18	1.6

1. The performance data above applies to insulating glass units constructed with two plies (clear inboard) of 1/4" (6 mm) glass, a 1/2" (13 mm) air space, a white silk-screen pattern and Low-E coating on the second surface. This table features a standard white dot pattern at 40 percent coverage.
2. Silk-screened glass requires heat treating.

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SILK-SCREENED LOW-E INSULATING GLASS—LINES (TABLE 11)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
VE 1-2M	44%	20%	5%	22%	27%	27%	.29	.26	.30	64	.26	1.69	1.5
VE 1-85	47%	29%	13%	23%	30%	22%	.31	.29	.43	89	.37	1.28	1.6
VE 1-55	29%	17%	7%	22%	23%	23%	.31	.29	.28	61	.24	1.21	1.6
VE 1-52	31%	20%	11%	25%	19%	22%	.32	.29	.32	68	.28	1.10	1.7
VE 1-42	23%	15%	8%	26%	18%	22%	.31	.29	.26	56	.22	1.05	1.6
VE 1-40	23%	13%	5%	25%	23%	25%	.31	.29	.23	50	.20	1.13	1.6
VE 2-2M	37%	15%	3%	17%	26%	11%	.29	.26	.25	54	.22	1.68	1.5
VE 2-85	40%	19%	6%	17%	30%	11%	.31	.29	.31	66	.27	1.47	1.6
VE 2-55	24%	11%	3%	17%	22%	11%	.31	.29	.22	48	.19	1.28	1.6
VE 2-52	26%	13%	5%	19%	18%	11%	.32	.29	.24	52	.21	1.23	1.7
VE 2-42	19%	10%	4%	20%	18%	12%	.31	.29	.20	45	.18	1.08	1.6
VE 2-40	19%	9%	3%	19%	23%	11%	.31	.29	.19	42	.16	1.18	1.6
VE 3-2M	22%	11%	2%	9%	26%	11%	.29	.26	.21	46	.18	1.23	1.5
VE 3-85	24%	16%	6%	9%	29%	10%	.31	.29	.28	60	.24	.99	1.6
VE 3-55	15%	9%	3%	9%	22%	10%	.32	.29	.21	45	.18	.81	1.6
VE 3-52	16%	11%	5%	9%	18%	10%	.32	.29	.22	49	.19	.82	1.7
VE 3-42	12%	8%	4%	10%	18%	10%	.31	.29	.19	42	.16	.73	1.6
VE 3-40	11%	7%	2%	9%	23%	11%	.31	.29	.18	39	.15	.75	1.6
VE 4-2M	27%	13%	2%	11%	26%	14%	.29	.26	.23	49	.19	1.39	1.5
VE 4-85	29%	18%	6%	11%	29%	12%	.31	.29	.31	66	.27	1.06	1.6
VE 4-55	18%	11%	3%	11%	22%	12%	.31	.29	.22	48	.19	.92	1.6
VE 4-52	19%	12%	5%	12%	18%	12%	.32	.29	.24	53	.21	.88	1.7
VE 4-42	14%	9%	4%	12%	18%	12%	.31	.29	.20	45	.18	.77	1.6
VE 4-40	14%	8%	2%	12%	23%	13%	.31	.29	.19	42	.16	.85	1.6
VE 5-2M	28%	13%	3%	11%	26%	11%	.29	.26	.23	49	.20	1.38	1.5
VE 5-85	30%	17%	8%	12%	29%	10%	.31	.29	.30	63	.26	1.14	1.6
VE 5-55	18%	10%	4%	12%	22%	10%	.31	.29	.21	47	.18	1.01	1.6
VE 5-52	19%	12%	6%	12%	18%	10%	.32	.29	.23	51	.20	.97	1.7
VE 5-42	15%	9%	5%	13%	18%	11%	.31	.29	.20	44	.17	.85	1.6
VE 5-40	14%	8%	3%	12%	23%	11%	.31	.29	.18	41	.16	.88	1.6
VE 6-2M	38%	16%	3%	17%	26%	13%	.29	.26	.26	55	.22	1.71	1.5
VE 6-85	41%	20%	8%	18%	30%	12%	.31	.29	.33	69	.28	1.45	1.6
VE 6-55	25%	12%	4%	18%	22%	12%	.31	.29	.23	50	.20	1.24	1.6
VE 6-52	26%	14%	6%	19%	18%	12%	.32	.29	.25	55	.22	1.20	1.7
VE 6-42	20%	10%	5%	21%	18%	13%	.31	.29	.21	47	.18	1.09	1.6
VE 6-40	19%	9%	3%	19%	23%	13%	.31	.29	.20	43	.17	1.13	1.6
VE 7-2M	34%	13%	4%	15%	26%	9%	.29	.26	.23	49	.20	1.70	1.5
VE 7-85	37%	15%	10%	15%	30%	9%	.31	.29	.26	56	.23	1.59	1.6
VE 7-55	22%	9%	5%	15%	22%	8%	.31	.29	.20	43	.17	1.31	1.6
VE 7-52	24%	10%	8%	17%	18%	9%	.32	.29	.21	46	.18	1.33	1.7
VE 7-42	18%	8%	6%	18%	18%	9%	.31	.29	.18	41	.16	1.12	1.6
VE 7-40	17%	7%	4%	17%	23%	9%	.31	.29	.17	39	.15	1.15	1.6
VE 10-2M	33%	12%	2%	14%	26%	8%	.29	.26	.23	49	.19	1.74	1.5
VE 10-85	36%	15%	4%	15%	30%	8%	.31	.29	.26	57	.23	1.54	1.6
VE 10-55	22%	9%	2%	15%	22%	8%	.31	.29	.20	43	.17	1.28	1.6
VE 10-52	23%	10%	3%	16%	18%	9%	.32	.29	.21	46	.18	1.28	1.7
VE 10-42	17%	8%	2%	17%	18%	9%	.31	.29	.18	41	.16	1.08	1.6
VE 10-40	17%	7%	1%	16%	23%	9%	.31	.29	.17	39	.15	1.12	1.6

1. The performance data above applies to insulating glass units constructed with two plies (clear inboard) of 1/4" (6 mm) glass, a 1/2" (13 mm) air space, a white silk-screen pattern and Low-E coating on the second surface. This table features a standard white line pattern at 50 percent coverage.
2. Silk-screened glass requires heat treating.

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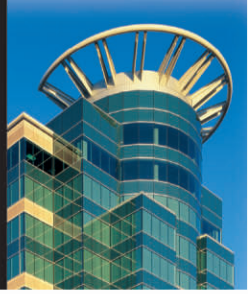
SILK-SCREENED LOW-E INSULATING GLASS—HOLES (TABLE 12)

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC	LSG	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
VE 1-2M	39%	18%	4%	24%	30%	26%	.29	.26	.27	58	.24	1.60	1.5
VE 1-85	42%	26%	11%	25%	34%	23%	.31	.29	.38	81	.33	1.26	1.6
VE 1-55	25%	15%	5%	25%	24%	23%	.31	.29	.26	56	.22	1.15	1.6
VE 1-52	27%	18%	9%	27%	20%	23%	.32	.29	.29	62	.25	1.08	1.7
VE 1-42	20%	13%	6%	28%	19%	23%	.31	.29	.24	51	.20	1.01	1.6
VE 1-40	20%	11%	4%	26%	24%	25%	.31	.29	.21	46	.18	1.09	1.6
VE 2-2M	32%	13%	2%	19%	29%	12%	.29	.26	.23	50	.20	1.62	1.5
VE 2-85	35%	17%	5%	19%	33%	11%	.31	.29	.28	60	.24	1.46	1.6
VE 2-55	21%	10%	3%	19%	24%	11%	.31	.29	.21	45	.18	1.18	1.6
VE 2-52	23%	11%	4%	20%	20%	12%	.32	.29	.22	49	.19	1.19	1.7
VE 2-42	17%	8%	3%	21%	19%	12%	.31	.29	.19	42	.16	1.06	1.6
VE 2-40	17%	7%	2%	20%	24%	12%	.31	.29	.18	40	.15	1.10	1.6
VE 3-2M	19%	10%	2%	9%	29%	11%	.29	.26	.19	43	.17	1.14	1.5
VE 3-85	21%	14%	5%	9%	33%	10%	.31	.29	.26	56	.22	.95	1.6
VE 3-55	13%	8%	2%	9%	24%	10%	.31	.29	.19	43	.17	.75	1.6
VE 3-52	14%	9%	4%	10%	20%	10%	.32	.29	.21	46	.18	.76	1.7
VE 3-42	10%	7%	3%	10%	19%	10%	.31	.29	.18	40	.15	.67	1.6
VE 3-40	10%	6%	2%	10%	24%	10%	.31	.29	.17	38	.14	.71	1.6
VE 4-2M	23%	11%	2%	12%	29%	13%	.29	.26	.21	45	.18	1.29	1.5
VE 4-85	25%	16%	5%	12%	33%	12%	.31	.29	.28	61	.24	1.05	1.6
VE 4-55	15%	10%	2%	12%	24%	12%	.31	.29	.21	45	.18	.86	1.6
VE 4-52	16%	11%	4%	12%	20%	12%	.32	.29	.23	49	.19	.85	1.7
VE 4-42	12%	8%	3%	13%	19%	12%	.31	.29	.19	42	.16	.76	1.6
VE 4-40	12%	7%	2%	12%	24%	13%	.31	.29	.18	39	.15	.79	1.6
VE 5-2M	24%	11%	3%	12%	29%	11%	.29	.26	.21	46	.18	1.34	1.5
VE 5-85	26%	15%	6%	12%	33%	10%	.31	.29	.27	58	.23	1.13	1.6
VE 5-55	16%	9%	3%	12%	24%	11%	.31	.29	.20	44	.17	.94	1.6
VE 5-52	17%	10%	5%	13%	20%	11%	.32	.29	.22	48	.19	.89	1.7
VE 5-42	13%	8%	4%	14%	19%	11%	.31	.29	.19	41	.16	.79	1.6
VE 5-40	12%	7%	2%	13%	24%	11%	.31	.29	.17	39	.15	.82	1.6
VE 6-2M	33%	14%	3%	19%	29%	13%	.29	.26	.24	51	.20	1.65	1.5
VE 6-85	36%	18%	6%	19%	33%	12%	.31	.29	.30	63	.26	1.37	1.6
VE 6-55	22%	11%	3%	19%	24%	12%	.31	.29	.21	47	.18	1.21	1.6
VE 6-52	23%	12%	5%	21%	20%	13%	.32	.29	.23	51	.20	1.16	1.7
VE 6-42	17%	9%	4%	22%	19%	13%	.31	.29	.20	44	.17	1.02	1.6
VE 6-40	17%	8%	2%	21%	24%	13%	.31	.29	.18	41	.16	1.05	1.6
VE 7-2M	30%	11%	3%	17%	29%	9%	.29	.26	.21	46	.18	1.66	1.5
VE 7-85	32%	13%	8%	17%	33%	9%	.31	.29	.24	52	.21	1.53	1.6
VE 7-55	20%	8%	4%	17%	24%	9%	.31	.29	.18	41	.16	1.23	1.6
VE 7-52	21%	9%	6%	18%	20%	9%	.32	.29	.20	43	.17	1.23	1.7
VE 7-42	16%	7%	5%	19%	19%	10%	.31	.29	.17	38	.15	1.05	1.6
VE 7-40	15%	6%	3%	18%	24%	9%	.31	.29	.16	37	.14	1.09	1.6
VE 10-2M	29%	11%	1%	16%	29%	9%	.29	.26	.21	45	.18	1.61	1.5
VE 10-85	31%	13%	3%	16%	33%	9%	.31	.29	.24	52	.21	1.49	1.6
VE 10-55	19%	8%	1%	16%	24%	9%	.31	.29	.18	41	.16	1.19	1.6
VE 10-52	20%	9%	2%	17%	20%	9%	.32	.29	.20	44	.17	1.19	1.7
VE 10-42	15%	7%	2%	18%	19%	9%	.31	.29	.17	38	.15	1.01	1.6
VE 10-40	15%	6%	1%	17%	24%	9%	.31	.29	.16	37	.14	1.05	1.6

1. The performance data above applies to insulating glass units constructed with two plies (clear inboard) of 1/4" (6 mm) glass, a 1/2" (13 mm) air space, a white silk-screen pattern and Low-E coating on the second surface. This table features a standard white hole pattern at 60 percent coverage.
2. Silk-screened glass requires heat treating.

VIRACON



Setting Block Location
Weep Hole Location

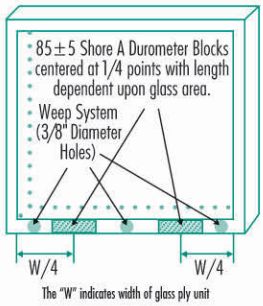


Figure 10

Clearance, Bite and
Dimensional Tolerances

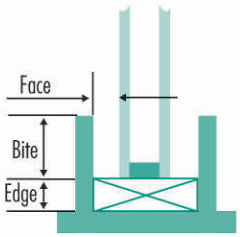


Figure 11

Typical Glazing Detail

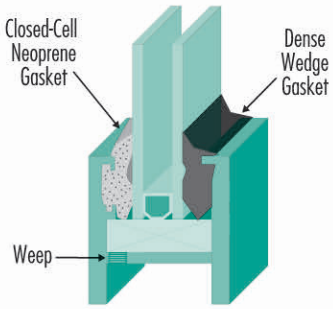


Figure 12

Glazing Guidelines

All glass plies must be supported on two silicone or silicone compatible setting blocks. The blocks should have a durometer hardness of 85±5. They should also be centered at quarter points and be 1/16" (1.6 mm) less than the channel width (see Figure 10).

Lockstrip gasket systems also require setting blocks. For additional recommendations, contact the appropriate gasket manufacturer (see Figure 11).

Inadequate edge clearances can cause glass breakage as a result of glass-to-frame contact. For recommended face and minimum edge clearances, as well as minimum glass bites, refer to the chart below.

Weep System

Do not expose the edges of laminated, insulating and opacifier film glass to standing water. This can cause premature seal failure or delamination. Viracon requires either impervious weather seals or an adequate weep system to prevent this from occurring (see Figure 12). This is also true of lockstrip gasket glazing. The glazing system manufacturer or designer is ultimately responsible for the design of the weep system and its proper performance.

Structural Silicone Glazing

Structural silicone glazing uses silicone sealants with an interior backup mullion. It must be specified as a structural silicone glazing system due to compatibility limitations of silicone sealants with certain types of glass or insulating unit secondary seal designs. To obtain approval for any structural silicone glazing system, contact the appropriate silicone manufacturer or Viracon's Technical Services Department.

Glass Handling and Storage

Care needs to be taken during handling and glazing to ensure that glass damage does not occur. Do not allow glass edges to contact the frame or any hard surface during installation. Use rolling blocks if the insulating units are rotated or "cartwheeled" on their corners. To see an example of a rolling block, refer to the Glass Association of North America (GANA) glazing manual.

Improper glass storage techniques may result in damage to glass components, glass surfaces, coatings or glass breakage. Store glass crates properly to prevent them from tipping. Also, ensure proper blocking and protection from outside elements. Improper air circulation for spandrel glass may result in glass damage or staining. Refer to Viracon's Glass Staining Tech Talk for additional information on glass staining and storage.

Viracon recommends a 5-7° lean against two wide, sturdy uprights, which are capable of withstanding crate weight.

Once the glass is installed, the architect, general contractor or building owner should provide for glass protection and cleaning. Weathering metals, alkaline materials or abrasive cleaners may cause surface damage. Windblown objects, welding sparks or other material that contacts the glass surface during construction may cause irreversible damage.

Maintenance and Cleaning

To maintain aesthetics, it is important to clean the glass during and after construction. For routine cleaning, use a soft, clean, grit-free cloth and a mild soap, detergent, or window cleaning solution.

Rinse immediately with clean water and remove any excess water from the glass surface with a squeegee. Do not allow any metal or hard parts of the cleaning equipment to contact the glass surface.

Take special care cleaning coated reflective glass surfaces. Do not use abrasive cleaners, razor blades, putty knives, and metal parts of cleaning equipment, since these will scratch the reflective coating. Fingerprints, grease, smears, dirt, scum and sealant residue are more noticeable on reflective glass, requiring more frequent cleaning. Follow the same cleaning techniques used for nonreflective glass.

Glass Breakage

It is important to first determine appropriate loads for the glass. Viracon can supply architects with glass strength analyses on specified products. "Unexplained" glass breakage may still occur due to thermal stress, glazing system pressures, glazing damage, handling and storage conditions, excessive wind loads, objects and debris striking the glass, improper factory fabrication or damage by persons or objects at the construction site.

Framing Deflections

Refer to the GANA glazing manual for information on adequate framing systems. You are required to comply with industry standards for framing deflection. It must not exceed either the length of the span divided by 175 or 3/4" (19 mm), whichever is less.

Non-Rectangular Glass Shapes

Viracon's capabilities include cutting virtually any shape glass required for your project without full-size patterns. However, if you require a full-size pattern, it must be submitted to Viracon on mylar material. If not, Viracon will transfer the pattern to mylar at an additional charge. However, Viracon will not be responsible for size accuracy. For additional information, contact Viracon's Inside Sales Department.

Suggested Specifications

You can specify Viracon products, using the MASTERSPEC® Basic Section "Glass and Glazing" or the MASTERSPEC Supplemental Section "Decorative Glazing" software.

MASTERSPEC is a comprehensive and unbiased master specification system produced and distributed by the American Institute of Architects (AIA) on a licensed user basis. For further information, call 800-424-5080.

In addition, guideline specifications for Section 08810—Glass and additional Viracon product information is available through Sweets CD, McGraw Hill's electronic complement to Sweets Catalog Files.

Warranty Information

Viracon's architectural products carry limited warranties. Failure to adhere to the following guideline for spandrel glass will void its warranty:

- Viracon does not recommend or warrant applications in which insulation is applied directly to the opacifier film. The area behind the panel must be vented to prevent condensation from forming on cold interior surfaces. Insulation should be installed with a 1" air space between the glass and insulation (see Figure 13). Contact our Inside Sales Department for copies of our product warranties.

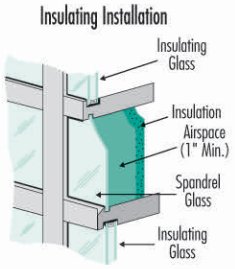


Figure 13

RECOMMENDED CLEARANCES

Glass Thickness	Edge Clearance	Face Clearance	Glass Bite	Dimensional Tolerance	Thickness Tolerance
		Monolithic Glass			
1/4" (6 mm)	1/4" (6 mm)	1/8" (3 mm)	3/8" (10 mm)	+/-1/16" (+/-1.6 mm)	Per ASTM C1036
		Laminated Glass			
1/4" (6 mm) Laminate with 1/8" (3 mm) Glass	1/4" (6 mm)	1/8" (3 mm)	3/8" (10 mm)	+3/16"/-1/16" (4.8 mm/-1.6 mm)	.259" - .300"* (6.6 mm - 7.6 mm)
1/2" (12 mm) Laminate with 1/4" (6 mm) Glass	1/4" (6 mm)	1/8" (3 mm)	1/2" (13 mm)	+3/16"/-1/16" (4.8 mm/-1.6 mm)	.467" - .520"* (11.9 mm - 13.2 mm)
		Insulating Glass			
1" (25 mm) Unit with 1/4" (6 mm) Glass	1/4" (6 mm)	3/16" (5 mm)	1/2" (13 mm)	+3/16"/-1/16" (4.8 mm/-1.6 mm)	.973" - 1.033" (24.7 mm - 26.2 mm)

*Thickness tolerances for laminated glass use a .030" (.76 mm) pvb interlayer.

PRODUCT STANDARDS

Monolithic Silk-screened Glass

The following applies to standard and custom patterns:

Minimum Size	Standard Maximum Size*
12" x 12"	84" x 144"
(305 mm x 305 mm)	(2134 mm x 3658 mm)

Premium over-sized maximum: 84" x 165" (2134 mm x 4191 mm). A technical review is required for all over-sized requests.

Silk-screened Insulating Glass

The following applies to standard and custom patterns:

Minimum Size	Standard Maximum Size*
12" x 12"	84" x 144"
(305 mm x 305 mm)	(2134 mm x 3658 mm)

Premium over-sized maximum: 84" x 165" (2134 mm x 4191 mm). A technical review is required for all over-sized requests.

Silk-screened Laminated Glass

The following applies to standard and custom patterns:

Minimum Size	Standard Maximum Size*
12" x 12"	84" x 144"
(305 mm x 305 mm)	(2134 mm x 3658 mm)

Premium over-sized maximum: 84" x 165" (2134 mm x 4191 mm). A technical review is required for all over-sized requests.

Viraspan Silk-screened Glass with Solarscreen High-Performance Reflective and Low-E Coatings

The following applies to Solarscreen coatings with standard and custom patterns:

Minimum Size	Standard Maximum Size*
12" x 36"	84" x 144"
(305 mm x 914 mm)	(2134 mm x 3658 mm)

Premium over-sized maximum: 84" x 165" (2134 mm x 4191 mm). A technical review is required for all over-sized requests.

Coated Glass Inspection Guidelines

Viracon's coated glass products comply with ASTM Standard C 1376.

- Pinholes—Inspect glass from a distance of 10 ft. (3 m) in transmission, at a viewing angle of 90 degrees to the specimen, against a bright, uniform background. If a pinhole is readily apparent, the following criteria apply: Pinholes larger than 1/16" (1.6 mm) in diameter are not allowed in 80 percent of the central glass area. Pinholes larger than 3/32" (2.4 mm) are not allowed in the outer 20 percent of the glass area. No more than two readily apparent blemishes are allowed in a 3-in. (75 mm) diameter circle and no more than five readily apparent blemishes are allowed in a 12-in. (300 mm) diameter circle.
- Uniformity—When viewing coated glass from a minimum distance of 10 ft. (3 m), color variation may occur from one unit to another. This can be caused by variations within the float glass substrate and normal production variations. This is not considered a defect. All Viracon commercial glass products conform to industry color standards.
- Distortion—Various factors involved in heat processing, insulating air spacers, and frame binding may distort reflected objects viewed on the glass surface. These are not considered defects of the coated glass or the final fabricated product.
- Scratches—Inspect glass from a distance of 10 ft. (3 m). Scratches up to 2" (50 mm) are allowed in the 80% central glass area and scratches up to 3" (75 mm) are allowed in the outer area. Concentrated scratches or abraded areas are not allowed.

Note: Monolithic, insulating, laminated and Solarscreen coated silk-screened glass products are available in glass thicknesses of 1/8" to 1/2".

Viraspan Uncoated Glass

1. Viracon designs its spandrel glass for glazing against a uniform, opaque background. We do not recommend its use in transoms, partitions or other areas where a uniform, opaque background is unavailable.
2. Viraspan Spandrel Glass Inspection Guidelines

- View spandrel glass from a distance of 15 ft. (4.6 m) under natural daylight conditions. Color and reflectance may vary when viewed under a uniform, opaque background. This is not considered a defect.
- When viewing spandrel glass under similar conditions, reflected pinholes and scratches are not considered defects if they are unobtrusive.

3. You can use Viraspan in structurally glazed applications; however, a clear edge may be visible. Contact Viracon's Inside Sales Department for more information.
4. Viracon reserves the right to change substrate glass suppliers. As a result, this may affect perceived colors of our Viraspan samples. Approval of all glass colors is based on 12" x 12" (305 mm x 305 mm) samples, which are ordered for each project.

Heat-Processed Glass (Heat Strengthened and Tempered)

1. Glass cutting and fabrication is completed prior to heat processing.
2. Viracon's two types of heat-processed glass comply with ASTM Standard C1048. Surface compression of heat-strengthened glass with thicknesses of 1/4" (6 mm) and less is 4,000-7,000 psi. Surface compression for 5/16" (8 mm) and 3/8" (10 mm) heat-strengthened glass is 5,000-8,000 psi.* For fully-tempered glass, the minimum surface compression is 10,000 psi. It also complies with ANSI Z97.1 and CPSC 16 CFR 1201 safety glazing standards.

*Because of reader repeatability and instrument tolerances, Viracon's tolerance for heat-strengthened glass surface compression is +/- 1,000 psi.

***Note: The maximum sizes listed are shown to illustrate production limits. These sizes are unavailable as finished products. Maximum size for heat-treated glass under any condition is 65 sq. ft. (6.04 m). Maximum unit weight is 750 pounds (340 kg). The premium over-weight maximum is 2000 pounds (907 kg) for Insulating Units only and subject to a Technical Review.**

Viraspan Decorative Silk-screened Glass Specifications

1. Applicable Base Glass Standards

- ASTM C1036 Standards Specification for Flat Glass
- ASTM C1048 Standard Specification for Heat-Treated Flat Glass

2. Silk-screened Ceramic Frit Inspection Guidelines

- View silk-screened glass from a distance of 10 ft. (3 m) under natural daylight conditions. Pinholes larger than 1/16" (1 .6 mm) are not allowed if noticeable from a distance of 10 ft. or greater. Color as well as opacity of the ceramic frit pattern may vary slightly due to paint thickness variations.

3. Pattern Orientation

- Patterns may be located up to 1/16" (1.6 mm) off parallel from the locating glass edge. Due to glass dimensions and squareness tolerances, patterns may be up to 1/8" (3 mm) off parallel from edges other than the locating glass edge.

4. Pattern Definition

- A print definition of 1/32" (.8 mm) indefinite border is acceptable.

5. Pattern Registry

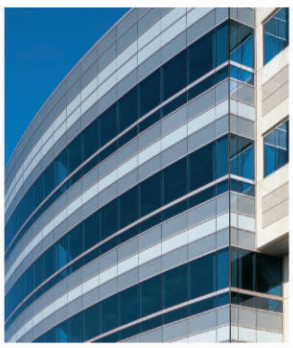
- Maximum variation of ±1/32" (.8 mm) in dot, line or hole location is acceptable.
- Viracon's silk-screened glass products may be used in structural glazed applications. Viracon has tested the compatibility using Dow Corning 982 and 795.

For more information on spandrel and silk-screened glass or additional literature, call 800-533-2080 (E-mail address: glass@viracon.com).

Viraspan™ colors

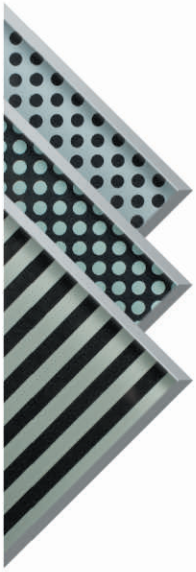
The above colors are for comparison purposes only. Actual samples should be viewed for final product selection.

Cape Coral Government Center
Cape Coral, Florida
Architect: Spillis Candela/DMJM Miami
Glazing Contractor: Trainor Glass
Glass Type: Green Laminated Glass with 52% Low-E Coating (VE2-52) and Evergreen (V-902) Dots on #2; Green Laminated Glass with 55% Low-E coating (VE2-55) and High Opacity White (V-175) Dots on #2; Clear Laminated Glass with Hue White PVB Interlayer
Photographer: Wes Thompson



Tellabs Corporate Headquarters
Naperville, Illinois
Architect: TMA Affinity Corp, Arlington Heights, Illinois.
Glazing Contractor: Enclos Corp.
Glass Type: Blue Insulating Glass with 52% Low-E Coating (VE5-52) on #2; Blue Insulating Glass with 42% Low-E Coating (VE5-42) on #2; Spandrel: Clear Monolithic Glass with Custom Color Silk-screen and Custom Color Flood Coat; Clear Monolithic Glass with Custom Color Spandrel and Medium Gray (V933) Flood Coat
Photographer: Wes Thompson

silk-screened standard patterns

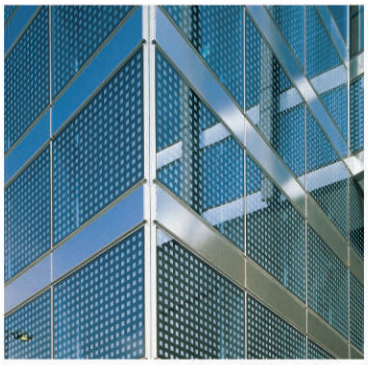


DOTS
40% COVERAGE

HOLES
60% COVERAGE

LINES
50% COVERAGE

Gannett/USA Today
McLean, Virginia
Architect: KPF (Kohn Pedersen Fox Associates PC)
Glazing Contractor: Enclos Corp.
Glass Type: Clear Insulating Superwindow with 20% Crystal Chrome Coating (VWY1-20) on #2 and 85% Low-E Coating (VE1-85) on #3; Clear Insulating Glass with Solarscreen 2000 Low-E Coating (VE1-2M) on #2 and Custom Color Line Silk-screen on #2; and Clear Insulating Glass with Solarscreen 2000 Low-E Coating (VE1-2M) on #2
Photographer: Wes Thompson



Blue Cross/Blue Shield
Chicago, Illinois
Architect: Lohan & Associates
Glazing Contractor: Antamex
Glass Type: Clear Insulating Glass with a 52% Low-E Coating (VE1-52) on #2 with a Metallic Ceramic Frit Silk-screen Pattern
Photographer: Wes Thompson

VIRACON

800 Park Drive, Owatonna, MN 55060
507.451.9555 800.533.2080 (Toll Free)
507.444.3555 FAX (Within U.S.A.) 507.451.2178 FAX (Outside U.S.A.)
E-Mail: glass@viracon.com Internet address: http://www.viracon.com

This publication describes Viracon's architectural decorative silk-screened and spandrel glass products to help you analyze possible design options and applications. To obtain warranty information, contact Viracon's Architectural Inside Sales or Technical Services Department.

The information contained in this publication is presented in good faith. It is believed to be accurate at the time of publication. Viracon reserves the right to change product specifications without notice and without incurring obligation.

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