VIRACON®

GLASS IS EVERYTHING™

2015

PRODUCT GUIDE

BRIDGEPOINT ACTIVE HEALTHCARE

LOCATION: TORONTO, ONTARIO, CANADA

GLASS TYPE: VRE15-38, VNE15-63 (PODIUM)

ARCHITECT: STANTEC ARCHITECTURE (PDC); KPMB ARCHITECTS (PDC); HDR ARCHITECTURE (DBFM); DIAMOND SCHMITT ARCHITECTS (DBFM)

GLAZING CONTRACTOR: SOTA GLAZING INC.; TAGG INDUSTRIES (PODIUM)

PHOTOGRAPHER: © TOM ARBAN

HAVE QUESTIONS? NEED ANSWERS FAST?

FOR ARCHITECTS / DESIGN PROFESSIONALS

Our Architectural Design Department can assist you with specific questions regarding architectural glass products, design considerations, and specification writing.

FOR GLAZING CONTRACTORS

Our Sales and Technical Services Departments will provide answers to your questions. Whether you need help with costing, achieving technical performance goals, or understanding lead times, we are here to help.

Please email or call:

glass@viracon.com // 800.533.2080

viracon.com

800 Park Drive, Owatonna, MN 55060
800.533.2080

Follow us on:

GATES HALL, CORNELL UNIVERSITY (COVER)

LOCATION: ITHACA, NEW YORK

GLASS TYPE: VRE24-38, VNE24-63, DIGITALDISTINCTIONS™

ARCHITECT: MORPHOSIS ARCHITECTS

GLAZING CONTRACTOR: W & W GLASS LLC

PHOTOGRAPHER: © MATTHEW CARBONE

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trulia

LETTER TO OUR VALUED PARTNERS

Thank you very much for your interest in Viracon's architectural glass products and services. We hope you find this product guide to be a helpful resource.

At Viracon, we strive to set the industry standard for finished product quality in the widest variety of customizable options that you can find in North America. We package our products with extremely deep technical expertise derived from our work on many of the world's most distinctive commercial buildings over the last several decades. Our unique position as both a glass coatings and glass fabrication leader reduces your risk, greatly increases your design flexibility, and allows glass products and services sourced from Viracon to be visibly better.

We would be very grateful for the opportunity to support you on your next project. Please call your local Viracon glass expert or contact one of our architectural design staff at 800.533.2080 to learn more.

Warm regards,

Kelly Schuller
President

◀ 535 MISSION

LOCATION: SAN FRANCISCO, CALIFORNIA

GLASS TYPE: VRE1-54

ARCHITECT: HOK

GLAZING CONTRACTOR: ARCHITECTURAL GLASS & ALUMINUM

PHOTOGRAPHER: © GREG WEST


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HOLLAND & HART
HOLLAND & HART

GREAT BUILDINGS DESERVE GREAT GLASS.

Architects and glazing contractors throughout the world turn to Viracon every day for innovative design solutions, proven products, professional services, and trusted advice. For more than 40 years we've built a reputation as a single source architectural glass fabricator you can rely on. From imaginative aesthetics to strict performance requirements and critical budget demands, Viracon can help you meet your project objectives. Our success is the direct result of our customers' success and is proudly reflected in the many great buildings Viracon has been part of.

The extraordinary vision you embrace for each of your projects deserves only the highest quality of architectural glass available. Our commitment to provide glass solutions within budget and on time ensures you will successfully meet and exceed your clients' needs.

MISSION STATEMENT

We deliver the highest quality, widest variety of customized architectural glass solutions for the creation of distinctive commercial buildings around the world.

ABOUT VIRACON

Viracon is based in Owatonna, Minnesota and has facilities in Statesboro, Georgia, St. George, Utah, and Nazaré Paulista, Brazil. All four facilities fabricate high-performance glass products as an international company of Apogee Enterprises, Inc. Apogee is a leading fabricator, distributor and installer of value-added glass products and systems. Headquartered in Minneapolis, the Apogee stock is traded on NASDAQ under the symbol APOG.

◂ EIGHTH AND MAIN

LOCATION: BOISE, IDAHO

GLASS TYPE: VE6-42, VE1-42

ARCHITECT: CTA ARCHITECTS ENGINEERS (ARCHITECT OF RECORD); BABCOCK DESIGN GROUP (DESIGN ARCHITECT)

GLAZING CONTRACTOR: D&A GLASS COMPANY, INC.; WAUSAU WINDOW AND WALL

PHOTOGRAPHER: © MARC WALTERS

COMPON
ENHANC

ENTS & EMENTS

HOW TO TURN ORDINARY GLASS INTO EXTRAORDINARY GLASS.

COMPONENTS & ENHANCEMENTS HIGHLIGHTS

THE RESIDENCES AT CITYCENTER

LOCATION: WASHINGTON, D.C.

GLASS TYPE: VE1-2M, VE3-2M

ARCHITECT: FOSTER + PARTNERS

GLAZING CONTRACTOR: HARMON, INC.

PHOTOGRAPHER: © ANNE GUMMERSON

CARPENTERS UNION INTERNATIONAL TRAINING CENTER (ITC) PHASE V (PREVIOUS)

LOCATION: LAS VEGAS, NEVADA

GLASS TYPE: VNE24-63

ARCHITECT: CARLILE COATSWORTH ARCHITECTS

GLAZING CONTRACTOR: QUANTUM GLASS & MIRROR

PHOTOGRAPHER: © COURTESY CARLILE COATSWORTH ARCHITECTS; RMA PHOTOGRAPHY

VIRACON NOMENCLATURE

Viracon utilizes an alphanumeric code for each coated glass product. The code designates the coating as well as the glass substrate the coating is applied to. This nomenclature is meant to aid in specifying our fabricated glass products however it is not enough on its own to clearly identify the full glass unit. In a specification, it is important to include the Viracon nomenclature along with an outline including each component of the glass unit.

The first portion of the code represents the coating family. Within each family, the coatings available have varying degrees of light transmittance. In our nomenclature, this is represented by the number following the dash.

Coating Type	Outboard Glass Substrate		Transmittance of Coating
VE	1	-	85

The number between the Viracon coating family and the nominal light transmittance of the coating is the outboard glass color that the coating is applied to. In this example, VE-85 is the coating and VE1-85 is the VE-85 coating applied to clear glass.

EXAMPLE SPECIFICATION

1. 1” VE1-85 Insulating Coated Glass as manufactured by Viracon.
    a. Exterior Glass Ply: 1/4” Clear Heat Strengthened
    b. Coating: VE-85 on #2 Surface
    c. Space: 1/2” aluminum, black, air filled
    d. Silicone: black
    e. Interior Glass Ply: 1/4” Clear Heat Strengthened
2. Performance Requirements
    a. Visible Light Transmittance: 76%
    b. Exterior (Vis-Out) Reflectance: 12%
    c. Winter U-Value: 0.31
    d. Summer U-Value: 0.29
    e. Shading Coefficient: 0.63
    f. Solar Heat Gain Coefficient: 0.54
    g. Light to Solar Gain Ratio: 1.41

Reference 08 80 00 Recommended Specification on pages 100-114.

GLASS SUBSTRATES

Glass substrates are the individual plies of glass used to fabricate glass units and may also be referred to as float glass, raw glass or glass lites. Glass substrate options include clear, tinted and low iron.

Clear is the most commonly specified glass substrate and has a slight green tint. In applications where designers wish to reduce the green tint, low iron glass is often specified in place of clear glass.

Low iron is a type of float glass manufactured with less iron than standard clear glass. With this reduction in iron content, the green hue is reduced.

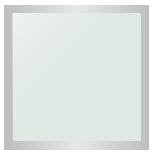
Tinted glass is available in an assortment of colors and light transmission levels. In addition to providing a specific appearance, tinted glass has the added benefit of improving performance.

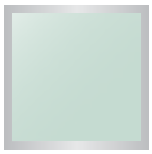
Viracon's glass substrate offering includes clear glass, two low iron glass substrates and a variety of tinted glass options. Each substrate is available in a variety of thicknesses and can have Viracon's reflective or Low-E coatings applied.

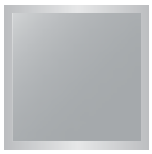
Viracon also offers a few specialty glass substrates which have been developed for limited use in specific applications. Due to their unique characteristics, specialty glass substrates cannot be combined with Viracon's reflective or Low-E coatings.

The specific glass substrate needed for a given project is typically dictated by a required solar performance or a desired appearance.

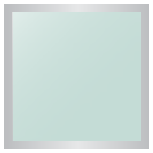
AVAILABLE COLORS

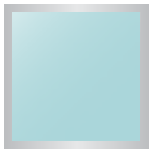

1=Clear

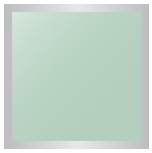

2=Green


3=Gray

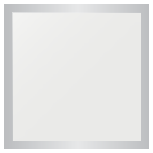

4=Bronze

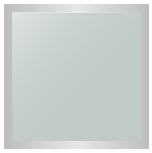

6=Blue Green

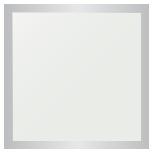

7=Azuria™

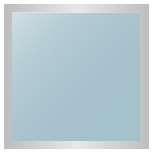

8=EverGreen™


11=Arctic Blue™

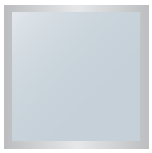

13=Starphire®
(low iron)


19=CrystalGray™


24=Optiwhite™
(low iron)


26=Solarblue™


27=Pacifica™


29=Graphite Blue™

GLASS SUBSTRATE THICKNESS

All glass substrates are available 1/4" (6mm) thick. Clear and each of the low iron substrates are also available in thicknesses of 3/16" (5mm), 5/16" (8mm) and 3/8" (10mm). For tinted substrates, specialty substrates or other thicknesses of clear or low iron glass substrates, please check with Viracon for availability.

GLASS SUBSTRATES

SPECIALTY GLASS SUBSTRATES

Viracon's specialty glass substrates are not available with a Viracon coating applied, so they are not given a numerical code. When specifying a specialty glass substrate, the full substrate name should be included in the specification. Contact Viracon for more information about these specialty glass substrates.

VELOUR ACID ETCHED GLASS

For a translucent appearance in an application where solar performance requirements are minimal, Viracon offers an acid etched glass substrate. This specialty substrate has a single acid etched surface which can be used for interior or exterior applications. Velour acid etched glass cannot be used in a glass unit with a coating. Viracon offers a simulated acid-etched glass for applications where a reflective or Low-E coating is desired.

OPTIVIEW ANTI-REFLECTIVE GLASS

This specialty glass substrate has 5% exterior reflectance. When compared to clear glass with 8% exterior reflectance, OptiView is a practical choice for retail storefronts or other applications where minimizing exterior reflectance is a necessity. OptiView can also be laminated with the anti-reflective surfaces facing outward to provide a glass unit with 2% exterior and 2% interior reflectance.

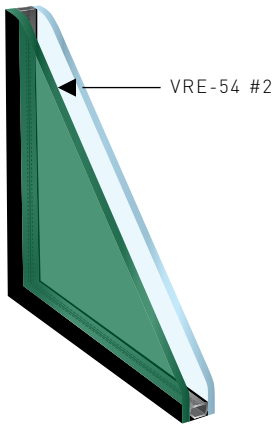
CONNEXTIONS

LOCATION: ORLANDO, FLORIDA // **GLASS TYPE:** VRE26-38 // **ARCHITECT:** LITTLE DIVERSIFIED ARCHITECTURAL CONSULTING
GLAZING CONTRACTOR: KELLEY & SON GLASS SERVICE // **PHOTOGRAPHER:** © BEN TANNER

GLASS SUBSTRATE LOCATION

1" VRE2-54 INSULATING

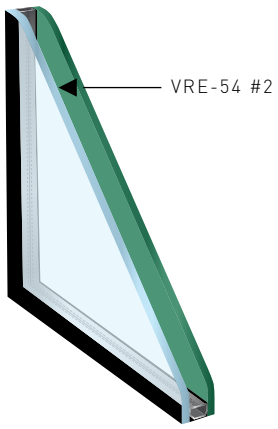
1/4" (6mm) green with VRE-54 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	40%
Winter u-value	0.30
Summer u-value	0.27
SHGC	0.24

1" VRE1-54/GREEN INSULATING

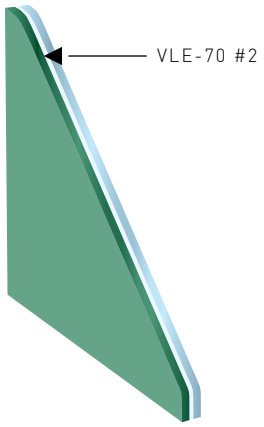
1/4" (6mm) clear with VRE-54 #2
1/2" (13.2mm) airspace
1/4" (6mm) green



VLT	40%
Winter u-value	0.30
Summer u-value	0.27
SHGC	0.29

9/16" VLE2-70 LAMINATED

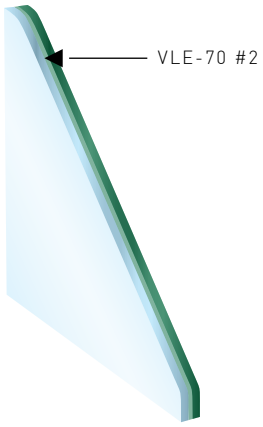
1/4" (6mm) green with VLE-70 #2
.060" clear PVB
1/4" (6mm) clear



VLT	57%
Winter u-value	0.96
Summer u-value	0.87
SHGC	0.44

9/16" VLE1-70/GREEN LAMINATED

1/4" (6mm) clear with VLE-70 #2
.060" clear PVB
1/4" (6mm) green



VLT	57%
Winter u-value	0.96
Summer u-value	0.87
SHGC	0.37

INSULATING GLASS

In units with multiple glass plies, it is important to specify the specific glass substrate for each ply. When a tinted glass substrate is selected, typically only one ply of the fabricated glass unit is tinted while the other ply remains clear. The tinted ply should be placed to the exterior to reduce solar heat gain.

LAMINATED GLASS

One exception is laminated glass. Since there is no airspace to keep the heat absorbed by the tinted exterior ply from re-radiating into the building, the solar heat gain can be improved by moving the tinted ply to the inboard. This improvement happens when the clear coated outboard with high solar reflectance is placed in front of the tinted glass.

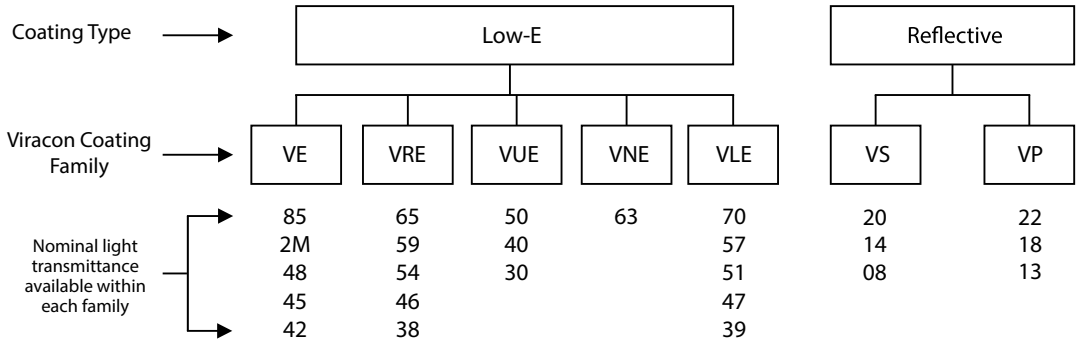
HIGH PERFORMANCE COATINGS

Coatings are thin layers of metal applied to glass to improve solar performance. The first coatings utilized on building facades were reflective coatings which provide a mirror-like appearance and reduce solar heat gain by reflecting the sun's energy away from the building.

Today, the most popular coatings applied to glass are low-emissivity (Low-E) coatings. Coatings with low-emissivity properties have low heat transfer properties and offer higher light transmission than traditional reflective coatings.

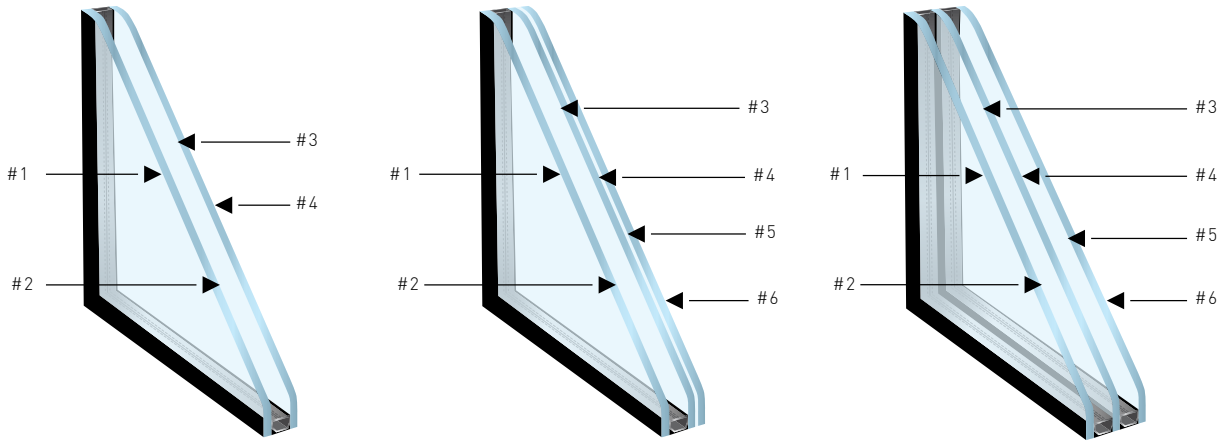
Viracon offers a broad selection of both reflective and Low-E coatings. Our coatings can be applied to clear or tinted glass substrates. In addition, a silk-screen pattern can be applied to the same surface as the coating for excellent solar performance and appearance.

The specific coating needed for a given project is typically dictated by a required solar performance or a desired appearance.



SURFACE DESIGNATION

When describing glass products there are industry standard recommended surface designations. Each ply of glass has two surfaces. The surface to the exterior of the building is referred to as surface #1, the back of this glass ply is surface #2. For glass units with multiple glass plies, there could be 6 or more surfaces.



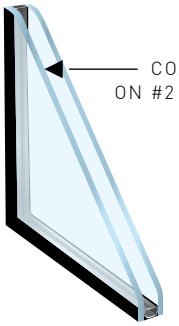
INSULATING

INSULATING LAMINATED

TRIPLE INSULATING

COATING LOCATION

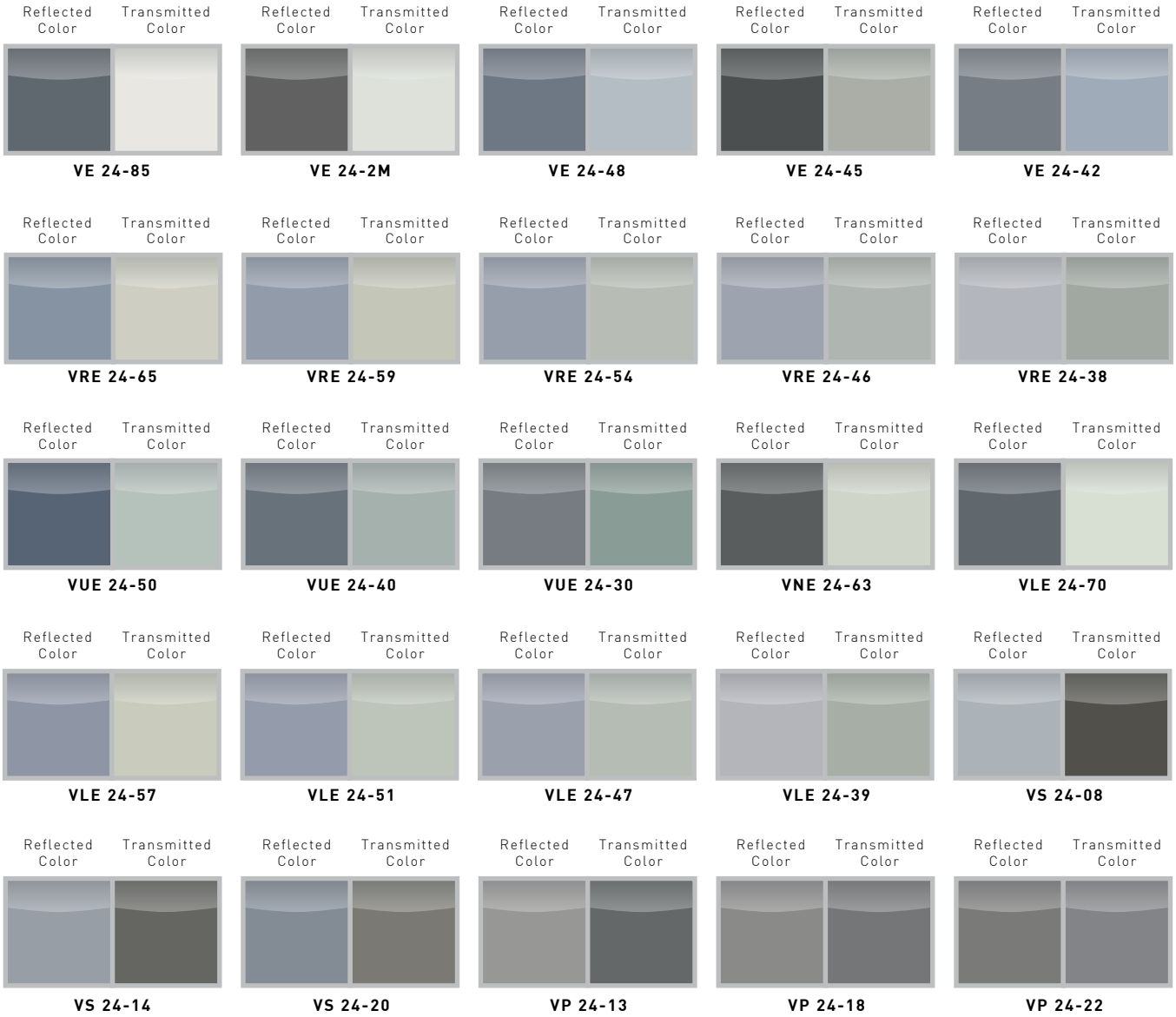
For cooling dominated buildings, the best solar performance is achieved when the coating is applied to the #2 surface, therefore Viracon coatings are located on the #2 surface.



VISUAL EXAMPLE OF VIRACON COATINGS ON LOW IRON GLASS

Reflected color: The color one experiences when looking at the glass from the exterior of the building.

Transmitted color: The color one sees looking through the glass when there is something behind the glass, such as blinds/shades.



COATING AVAILABILITY BY PRODUCT CONFIGURATION

	Configurations								
					1-5/16" Laminated Insulating			1-5/8" Double Laminated Insulating	
Coatings	1/4" Monolithic	9/16" Laminated	1" Insulating	1-5/16" Insulating Laminated	(Coating #2)	(Coating #4)	1-3/4" Triple Insulating	(Coating #2)	(Coating #4)
VE-42		YES	YES	YES	YES	YES	YES	YES	YES
VE-45			YES	YES			YES		
VE-48		YES	YES	YES	YES	YES	YES	YES	YES
VE-2M			YES	YES			YES		
VE-85		YES	YES	YES	YES	YES	YES	YES	YES
VLE-39		YES			YES			YES	
VLE-47		YES			YES			YES	
VLE-51		YES			YES			YES	
VLE-57		YES			YES			YES	
VLE-70		YES			YES			YES	
VNE-63			YES	YES			YES		
VRE-38			YES	YES		YES	YES		YES
VRE-46			YES	YES		YES	YES		YES
VRE-54			YES	YES		YES	YES		YES
VRE-59			YES	YES		YES	YES		YES
VRE-65			YES	YES		YES	YES		YES
VP-13	YES	YES	YES	YES	YES		YES	YES	
VP-18	YES	YES	YES	YES	YES		YES	YES	
VP-22	YES	YES	YES	YES	YES		YES	YES	
VS-08	YES	YES	YES	YES	YES	YES	YES	YES	YES
VS-14	YES	YES	YES	YES	YES	YES	YES	YES	YES
VS-20	YES	YES	YES	YES	YES	YES	YES	YES	YES
VUE-30			YES	YES		YES	YES		YES
VUE-40			YES	YES		YES	YES		YES
VUE-50			YES	YES		YES	YES		YES

All laminated glass shown here uses a PVB interlayer, see Coating Availability for Laminated Configuration for interlayers other than PVB. Refer to page 006 for Viracon Nomenclature information.

COATING AVAILABILITY FOR LAMINATED CONFIGURATION

Coating Availability for Laminated Configuration with an Interlayer other than PVB					
Coatings	Saflex® SilentGlass Acoustic	SentryGlas®	StormGuard®	Vanceva® Storm	Vanceva® Color*
VE-42		YES	YES	YES	YES
VE-45					
VE-48		YES	YES	YES	YES
VE-2M					
VE-85			YES	YES	YES
VLE-39			YES	YES	YES
VLE-47			YES	YES	YES
VLE-51			YES	YES	YES
VLE-57			YES	YES	YES
VLE-70			YES	YES	YES
VNE-63					
VRE-38					
VRE-46					
VRE-54					
VRE-59					
VRE-65					
VP-13		YES	YES	YES	YES
VP-18		YES	YES	YES	YES
VP-22		YES	YES	YES	YES
VS-08		YES	YES	YES	YES
VS-14		YES	YES	YES	YES
VS-20		YES	YES	YES	YES
VUE-30					
VUE-40					
VUE-50					

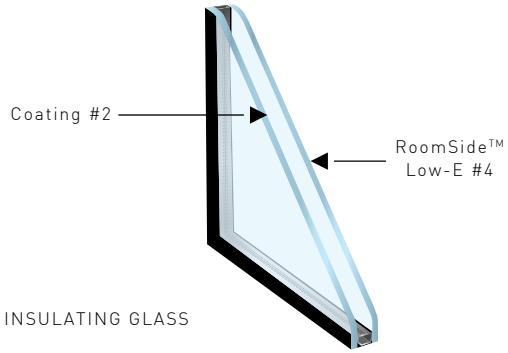
**Due to coating and Vanceva Color base interlayer properties, a clear PVB interlayer must be placed between the coating and the colored interlayer.*

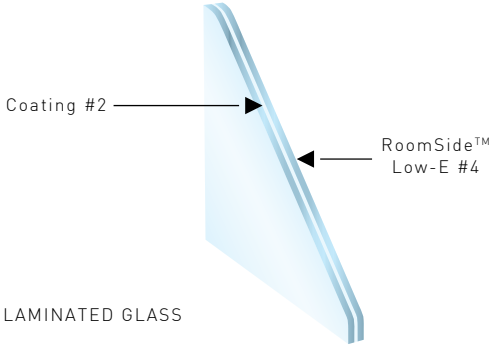
ROOMSIDE™ LOW-E

INTERIOR SURFACE COATING

Viracon's RoomSide™ Low-E is an interior surface coating designed to improve the u-value of an insulating or laminated glass unit. The coating works by reflecting indoor heat back into the room and improving thermal efficiency.

The RoomSide Low-E coating is supplied to the interior surface side of the glass unit; number 4 surface of an insulating or laminated glass unit and number 6 surface of an insulating laminated, laminated insulating or triple insulating glass unit.





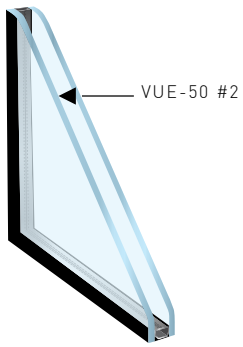
FAENA HOUSE
SAXONY HOTEL (RENOVATION)

LOCATION: MIAMI BEACH, FLORIDA // **GLASS TYPE:** VE1-42, ROOMSIDE™ LOW-E
ARCHITECT: FOSTER + PARTNERS; REVUELTA (COLLABORATING ARCHITECT); REM KOOLHAAS (SAXONY RENOVATION DESIGN ARCHITECT)
GLAZING CONTRACTOR: PERMASTEELISA NORTH AMERICA CORP. // **PHOTOGRAPHER:** © JOHN BRICE

An insulating glass unit consisting of a RoomSide Low-E coating on the number 4 surface in combination with a high performance coating on the number 2 surface and an argon fill can offer comparable u-value performance to a triple insulating unit without the additional expense.

1" VUE1-50 INSULATING

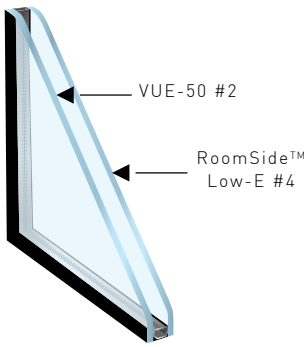
1/4" (6mm) clear with VUE-50 #2
1/2" (13.2mm) Argon filled space
1/4" (6mm) clear



VLT	48%
Winter u-value	0.25
Summer u-value	0.20
SHGC	0.25

1" VUE1-50 INSULATING WITH ROOMSIDE™ LOW-E

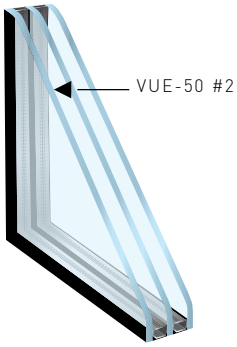
1/4" (6mm) clear with VUE-50 #2
1/2" (13.2mm) Argon filled space
1/4" (6mm) clear with RoomSide™ Low-E #4



VLT	48%
Winter u-value	0.20
Summer u-value	0.17
SHGC	0.24

1 3/4" VUE1-50 TRIPLE INSULATING

1/4" (6mm) clear with VUE-50 #2
1/2" (13.2mm) Argon filled space
1/4" (6mm) clear
1/2" (13.2mm) Argon filled space
1/4" (6mm) clear



VLT	43%
Winter u-value	0.18
Summer u-value	0.17
SHGC	0.22

SKYSONG3
ASU SCOTTSDALE
INNOVATION CENTER

LOCATION: SCOTTSDALE, ARIZONA
GLASS TYPE: VUE1-30, VUE1-50
ARCHITECT: BUTLER DESIGN GROUP
GLAZING CONTRACTOR: KOVACH INC.
PHOTOGRAPHER: © COURTESY ASU

SPANDREL GLASS

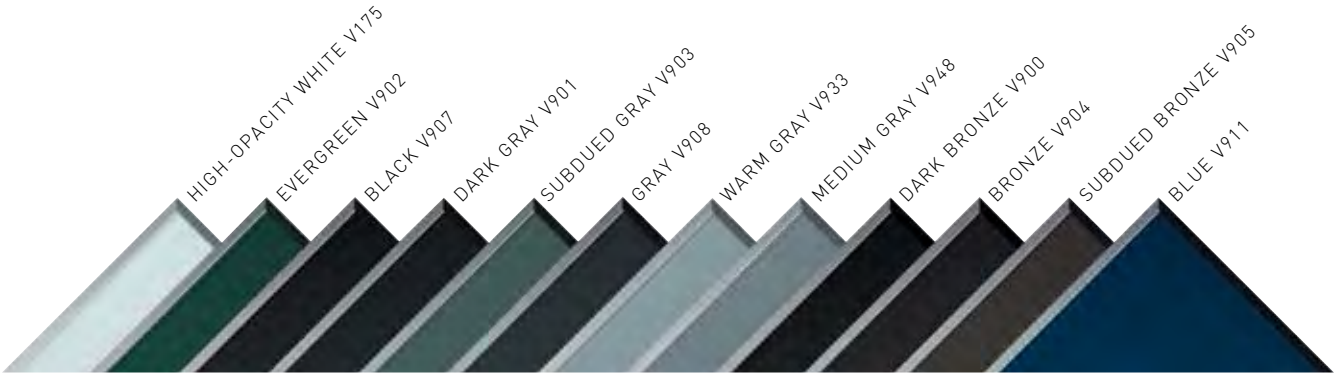
Spandrel is the panel(s) of a wall located between vision areas of windows, which conceal structural columns, floors and shear walls.

For spandrel applications Viracon offers Viraspan™, a factory-applied, fire-fused ceramic frit paint for use with monolithic or insulating glass and in some laminated glass configurations.

A high performance coating on the #2 surface of the laminate is required for units composed with full coverage Viraspan on the #4 surface.

Viracon uses only lead free ceramic frit paints, which are environmentally friendly. A proven performer, Viraspan ceramic frit paints are the product of choice for color consistency, durability, cost control and long life.

VIRASPAN™ OPAQUE CERAMIC FRIT COLORS AVAILABLE



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

HUB GROUP CORPORATE HEADQUARTERS

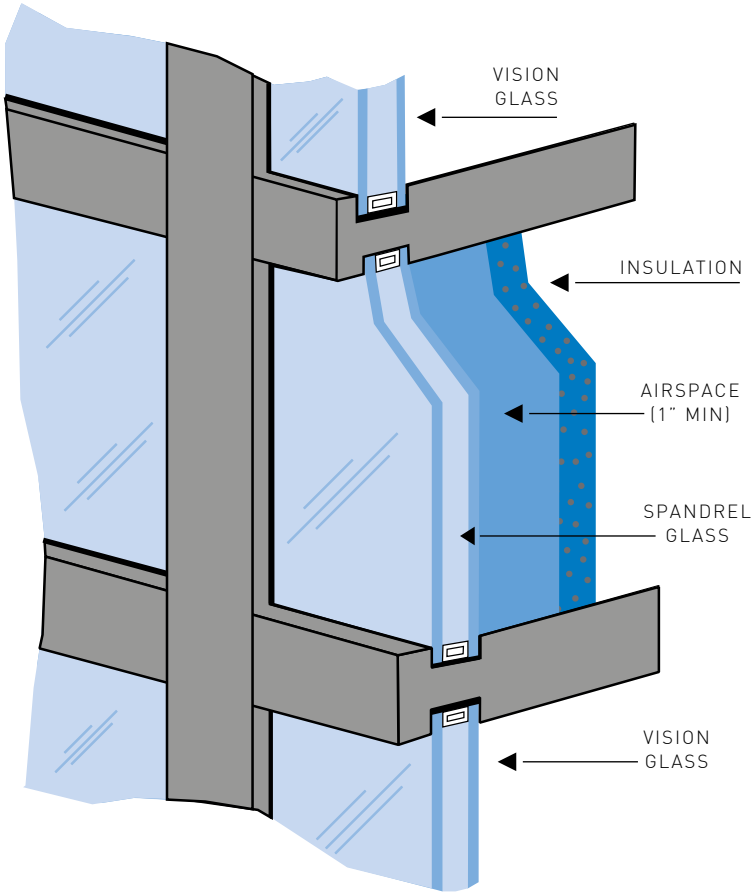
LOCATION: OAK BROOK, ILLINOIS

GLASS TYPE: VNE1-63, SPANDREL

ARCHITECT: SOLOMON CORDWELL BUENZ

GLAZING CONTRACTOR: HARMON, INC.

PHOTOGRAPHER: © HARMON, THYRA NELSON



SPANDREL GLASS APPLICATIONS

The proper application for ceramic fritted spandrel glass is to install it in an opening that has a uniformly colored insulation or back-pan that eliminates the possibility of read-through or viewing the glass in transmission. When done properly, the glass may only be viewed from the exterior of the building, with daylight reflecting from the glass surface.

Spandrel Glass is not for vision wall areas

Viracon's ceramic frit spandrel glass products are to be glazed against a uniform, opaque background. We do not recommend that they be used in any application where they can be viewed with daylight or artificial light on the opposite side such as interior partitions, mechanical rooms, screen walls or glazing in a parking garage.

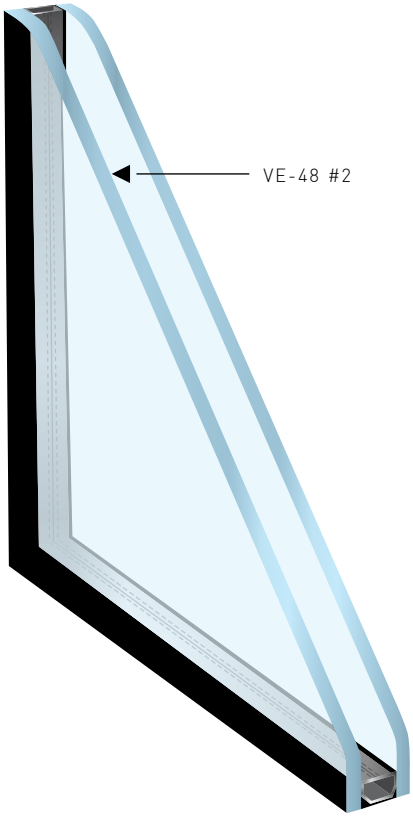
Glass by its nature is highly transparent and it is impossible to make it uniformly opaque. The application of the ceramic frit to the glass surface is achieved by conveying the glass under a rubber application roller. The application of the frit to the glass surface results in striations from the roll that are highly visible when viewing the glass in transmission (with light on the opposite side).

SPANDREL GLASS PERFORMANCE

Winter and summer u-values are the performance values available for spandrel glazing. The u-values for spandrel glazing are the same as the corresponding vision unit. Ceramic frit does not affect u-value performance.

1" VE1-48 INSULATING

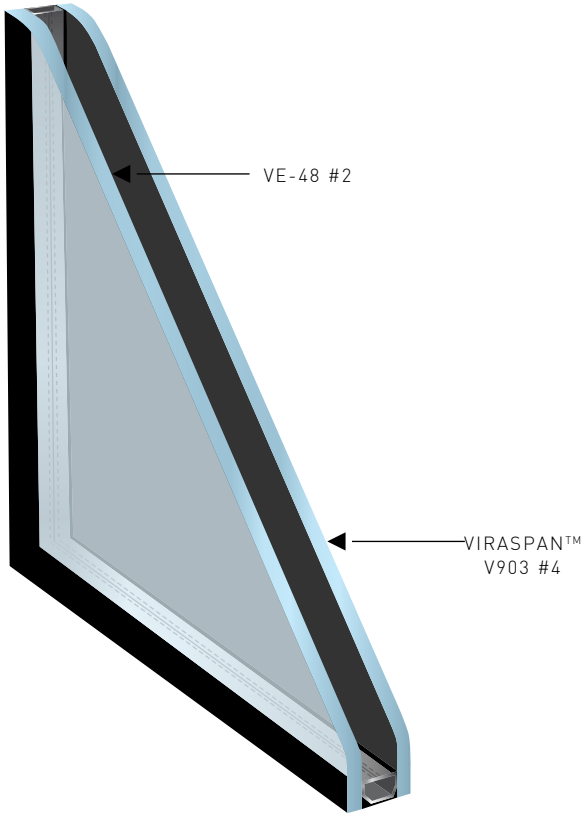
1/4" (6mm) clear with VE-48 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.31
Summer u-value	0.29
SHGC	0.37

1" VE1-48 INSULATING SPANDREL

1/4" (6mm) clear with VE-48 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear with Viraspan™ V903 #4



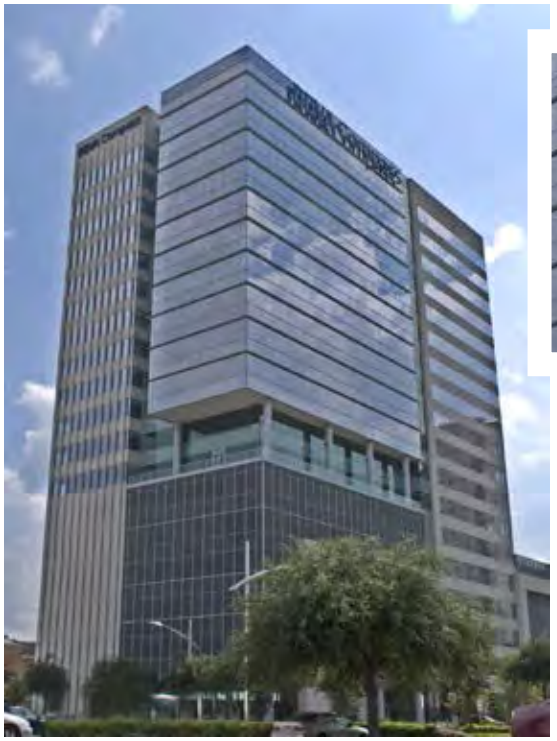
Winter u-value	0.31
Summer u-value	0.29

MATCHING SPANDREL AND 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. Low-light transmitting and high-reflective glass types provide the least contrast between vision and spandrel areas. Variable sky conditions can also influence our perception. 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 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. 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 fourth (#4) surface.

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.



◀ BBVA COMPASS PLAZA

LOCATION: HOUSTON, TEXAS

GLASS TYPE: VRE1-46, VNE24-63, VNE1-63, SPANDREL

ARCHITECT: HKS, INC.

GLAZING CONTRACTOR: JAMCO

PHOTOGRAPHER: © VIRACON, HANNAH HEMBY (PGP)

MOIRÉ PATTERN

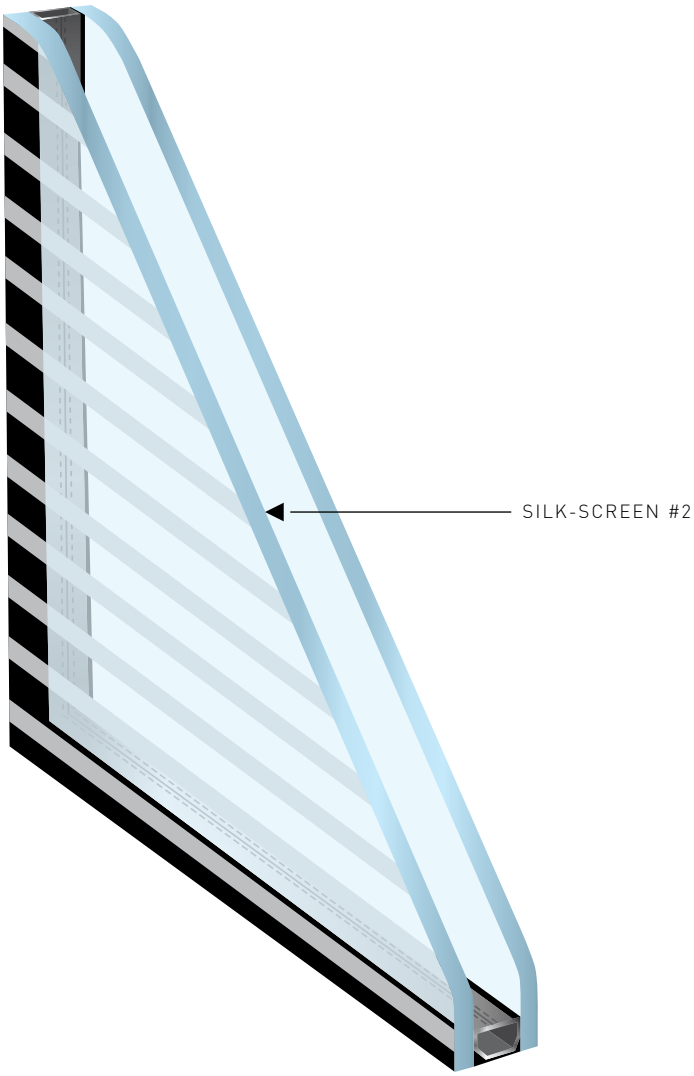
Moiré is an optical phenomenon that may present itself as a "wavy, rippled or circular" pattern under certain conditions. Moiré patterns can be created whenever one semi-transparent object with a repetitive pattern is placed over another. The moiré pattern is not a glass defect, but rather a pattern in the image formed by the eye. For additional information, please review Viracon's Moiré Pattern Tech Talk on our website at viracon.com.

SILK-SCREEN

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 improves solar control performance and can be combined with clear or tinted glass substrates, as well as with high-performance coatings to reduce glare and decrease solar transmission.

The first step in silk-screening involves washing the annealed glass. Then, the ceramic frit paint is applied to one side of the glass. Next, it is fired within a tempering furnace and the frit is permanently bonded to the glass. The glass must be heat strengthened or fully tempered to prevent glass breakage due to thermal stresses under sunlit applications.

When designing with silk-screen patterns, it is important to select the pattern (screen), select the color for the pattern and identify the pattern orientation.



AMAZON VULCAN BLOCK 26 & 32

LOCATION: SEATTLE, WASHINGTON // **GLASS TYPE:** VE1-2M, CUSTOM SILK-SCREEN // **ARCHITECT:** LMN ARCHITECTS

GLAZING CONTRACTOR: ALL NEW GLASS INC. // **PHOTOGRAPHER:** © DALE LANG

SILK-SCREEN PATTERNS

Viracon offers a variety of standard Viraspan™ Design patterns as well as the ability to customize a façade using your own Viraspan Design – Original.

VIRASPAN™ DESIGN

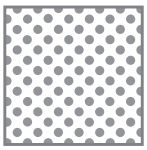
20% COVERAGE

SCREEN 2256
1/8" LINES - 1/2" SPACE

SCREEN 5065
1/8" DOTS

30% COVERAGE

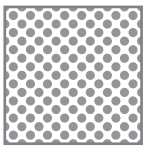
SCREEN 2973
1/8" LINES - 9/32" SPACE



SCREEN 5959
1/8" DOTS

40% COVERAGE

SCREEN 2030
1/8" LINES - 3/16" SPACE



SCREEN 5006
1/8" DOTS

SCREEN 6017

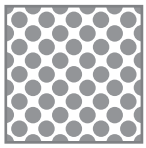
50% COVERAGE

SCREEN 2002
1/8" LINES - 1/8" SPACE

SCREEN 2013
1" LINES - 1" SPACE

SCREEN 2032
1/2" LINES - 1/2" SPACE

SCREEN 2050
1/4" LINES - 1/4" SPACE

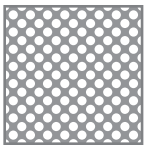


SCREEN 5960
1/4" DOTS

SCREEN 6002

60% COVERAGE

SCREEN 2604
1/8" LINES - 3/32" SPACE

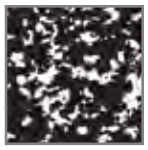


SCREEN 5023
1/8" HOLES

SCREEN 5961
7/16" DOTS

SCREEN 6019

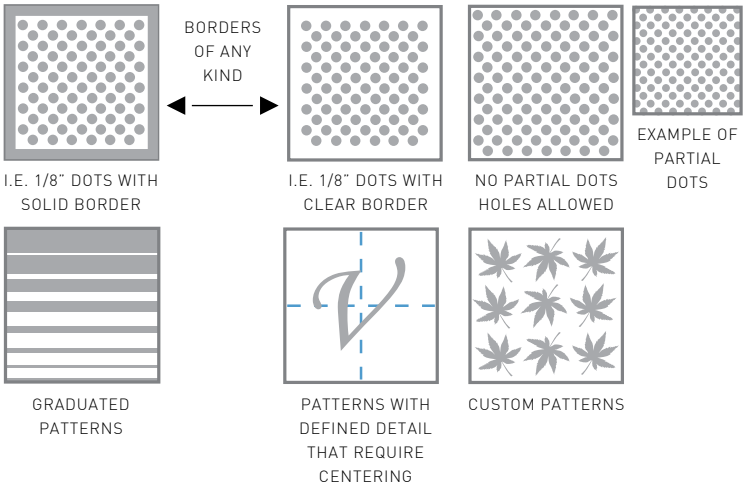
70% COVERAGE



SCREEN 6015

VIRASPAN™ DESIGN- ORIGINAL

Borders, graduations or custom patterns you design.



DNV GL TECHNOLOGY CENTRE

LOCATION: SINGAPORE // **GLASS TYPE:** VLE26-39, CUSTOM SILK-SCREEN // **ARCHITECT:** DCA ARCHITECTS PTE LTD

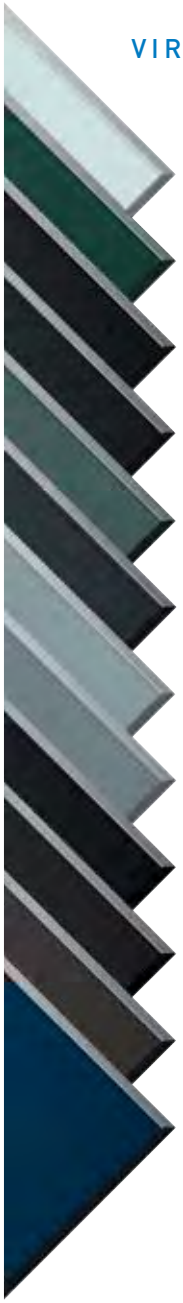
GLAZING CONTRACTOR: POSITIVE ENGINEERING PTE LTD // **PHOTOGRAPHER:** © VIRACON, JJ HAN

VIRASPAN™ COLOR OPTIONS

Viracon uses only lead free ceramic frit paints, which are environmentally friendly, to apply the silk-screen pattern onto the glass surface. A proven performer, Viraspan™ ceramic frit paints are the product of choice for color consistency, durability, cost control and long life. For silk-screen applications, Viracon offers translucent and opaque* ceramic frit color options.

**Opaque is defined as when the products are viewed in reflection with an opaque uniform background.*

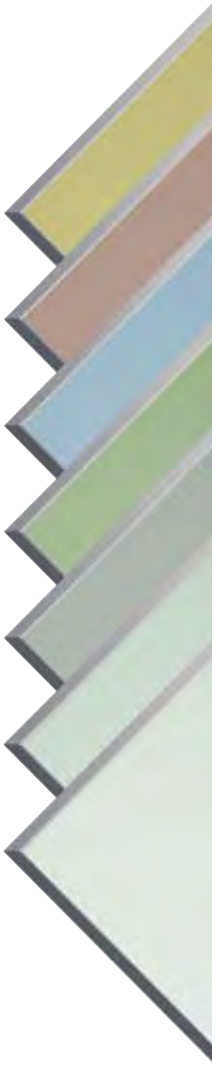
VIRASPAN™ OPAQUE FRIT



- HIGH-OPACITY WHITE V175
- EVERGREEN V902
- BLACK V907
- DARK GRAY V901
- SUBDUED GRAY V903
- GRAY V908
- WARM GRAY V933
- MEDIUM GRAY V948
- DARK BRONZE V900
- BRONZE V904
- SUBDUED BRONZE V905
- BLUE V911

VIRASPAN™ TRANSLUCENT FRIT

- YELLOW MOON V1091
- SPICE V1090
- BLUE FROST V1089
- SAGE GREEN V1088
- FOG GRAY V1087
- SIMULATED SANDBLAST V1086
- SIMULATED ACID-ETCH V1085



WITHOUT VIRASPAN™

V1085 V1086

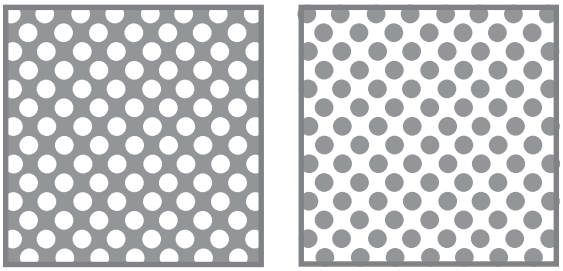
SILK-SCREEN ORIENTATION

Pattern placement, aka orientation, must also be considered when specifying silk-screened glass and should be included in the drawings if you are using a line pattern or for all other patterns if a specific orientation is required.

STANDARD ORIENTATION

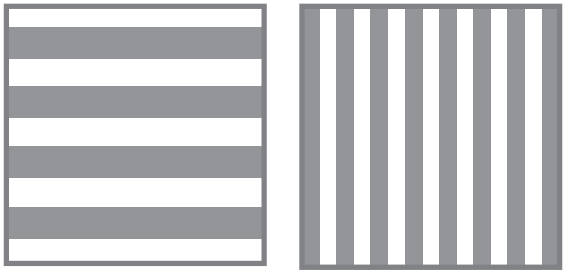
DOT PATTERNS

The dot pattern starts at the base dimension and runs off the edges of the glass. Partial dots/holes are acceptable with standard dot pattern orientation.



LINE PATTERNS

The dot pattern is vertical or horizontal and starts with either a line or space.

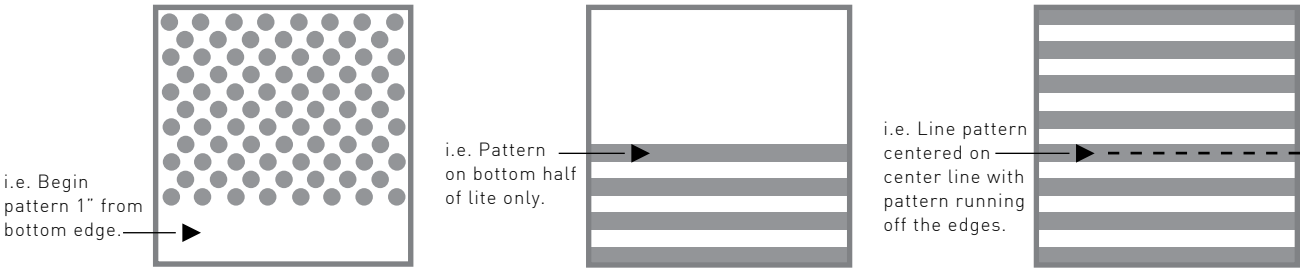


- *When a line pattern is specified, answers to the following questions should be included in the specifications:*

  1. *Will the lines be vertical or horizontal?*
  2. *Which edge will the pattern start on?*
  3. *Will the pattern start with a line or space?*

DESIGN - PLUS ORIENTATION

A Viraspan Design pattern with requirements beyond standard orientation.

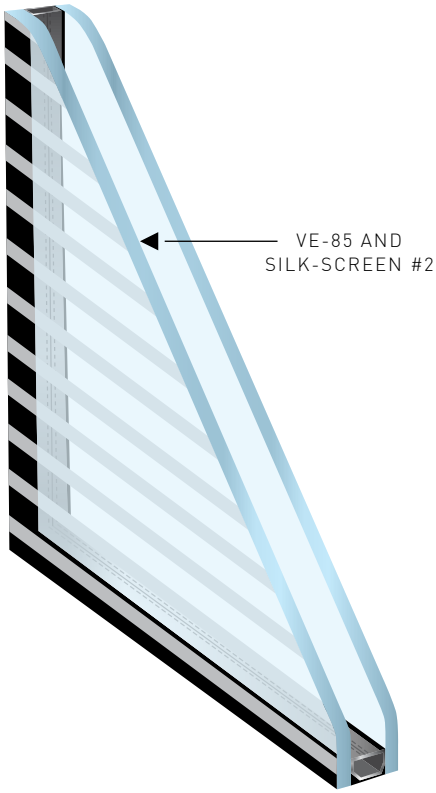


SILK-SCREEN PERFORMANCE

Viracon recommends applying the silk-screen pattern to the second (#2) surface for optimum solar performance. The Low-E or reflective coating can be applied to the same surface as the silk-screen pattern.

1" VE1-85 INSULATING SILK-SCREEN

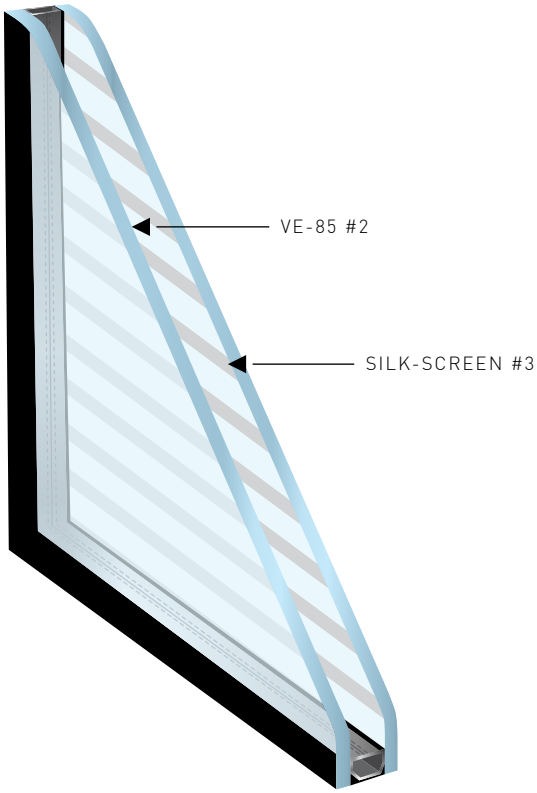
1/4" (6mm) clear with VE-85 and 50% coverage, V175 White #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.31
Summer u-value	0.29
SHGC	0.37

1" VE1-85 INSULATING SILK-SCREEN

1/4" (6mm) clear with VE-85 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear with 50% coverage, V175 White #3



VLT	47%
Winter u-value	0.31
Summer u-value	0.29
SHGC	0.42

SPECIFYING SILK-SCREEN GLASS

When specifying silk-screened glass, include the pattern, color and orientation in the overall glass composition. If it is not practical to describe the orientation in the specification, a drawing should be referenced to clearly identify orientation.

EXAMPLE SPECIFICATION

1. 1" VRE1-59 INSULATING COATED SILK-SCREENED GLASS AS MANUFACTURED BY VIRACON

a. Exterior Glass Ply: 1/4" Clear HS

b. Ceramic Frit: V933 Warm Gray on #2 Surface

c. Pattern: Viraspan Design Screen 5959 – lines

d. Orientation: Horizontal lines, starting at the top with a line

e. Coating: VRE-59 on #2 Surface

f. Airspace: 1/2" aluminum, black painted

g. Silicone: black

h. Interior Glass Ply: 1/4" Clear HS

2. PERFORMANCE REQUIREMENTS

a. Visible Light Transmittance: 39%

b. Exterior (Vis-Out) Reflectance: 25%

c. Winter U-Value: 0.30

d. Summer U-Value: 0.27

e. Shading Coefficient: 0.31

f. Solar Heat Gain Coefficient: 0.27

g. Light to Solar Gain Ratio: 1.44

◀ ORCHARD TRIMBLE

LOCATION: SANTA CLARA, CALIFORNIA

GLASS TYPE: VNE1-63, CUSTOM SILK-SCREEN

ARCHITECT: STUDIO G ARCHITECTS

GLAZING CONTRACTOR: USA ALL GLASS INC.

PHOTOGRAPHER: © VIRACON, RYAN HOFFMAN

SILK-SCREEN DESIGN GUIDELINES

Silk-screen patterns may be applied to any surface except the exterior (#1) surface. Viracon recommends applying the silk-screen pattern to the #2 surface for optimal performance. See silk-screen performance for additional information.

PATTERNS

1/16" minimum dot, pixel or space

COVERAGE

For coverage options, refer to ceramic frit coverage rules on the following page.

DUAL SURFACE PATTERNS

Due to moiré pattern potential and manufacturing tolerances, dual surface silk-screen patterns (typically requested as #2 and #3 surface) are not recommended.

Viracon's Dual Surface Silk-screen Pattern Disclaimer must be signed before Viracon is able to provide any dual surface pattern samples.

A full size mock-up or signed waiver is required before glass is ordered.

Any other requests for a dual surface pattern must be reviewed by Viracon's Technical Services and Manufacturing Departments.

▶ *For information regarding design restrictions, please visit viracon.com.*

TIDEWATER COMMUNITY COLLEGE LEARNING RESOURCE CENTER, JOINT USE LIBRARY

LOCATION: VIRGINIA BEACH, VIRGINIA // **GLASS TYPE:** VNE1-63, VE1-2M, VE1-85, CUSTOM SILK-SCREEN // **ARCHITECT:** RRMM ARCHITECTS
GLAZING CONTRACTOR: WALKER & LABERGE CO. INC. // **PHOTOGRAPHER:** © COURTESY WALKER & LABERGE CO. INC.

CERAMIC FRIT COVERAGE RULES

All maximums listed are for any one square foot area of a glass unit.

Type	Color	Coverage
Silk-screen pattern	Opaque, except V175 White	60% Maximum
Silk-screen pattern	V175 High Opacity White	80% Maximum
Silk-screen pattern	Translucent	80% Maximum
Full coverage translucent frit** (Frosted, non-pattern)	Translucent	100%
Spandrel	Opaque	100%

***Not available for interior applications and not available with coatings on the same surface. Also, when translucent frit is used as full coverage, inherent characteristics may make this product unsuitable for vision areas. These characteristics include slight variations in color and uniformity, pinholes or streaks.*

When considering translucent frits for spandrel applications note that these areas may be prone to condensation formation on interior glass surfaces. Over time, this may result in a visible film formation. Therefore, consideration must be given to the suitability of these products in spandrel applications. For these applications, the translucent frit may only be applied to non-exposed surfaces.

See silk-screen inspection guidelines and manufacturing tolerances on page 117 for additional information.

MOIRÉ PATTERN

Moiré is an optical phenomenon that may present itself as a "wavy, rippled or circular" pattern under certain conditions. Moiré patterns can be created whenever one semi-transparent object with a repetitive pattern is placed over another. The moiré pattern is not a glass defect, but created when the images do not align. For additional information, please review Viracon's Moiré Pattern Tech Talk on our website viracon.com.

DIGITALDISTINCTIONS™

The great possibilities of architectural design are now even more possible. DigitalDistinctions™ by Viracon combines the durability of ceramic inks with the versatility of digital printing into one proven solution for all glass-printing applications. A stunning technology that's as beautiful and imaginative as it is functional.

DESIGN WITHOUT LIMITS

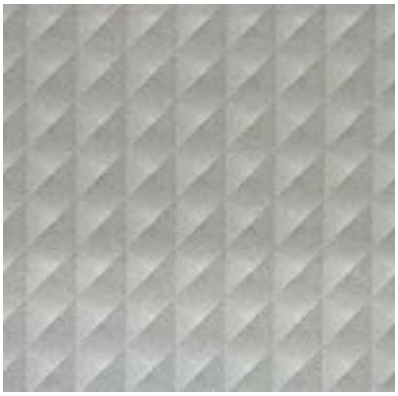
DigitalDistinctions™ by Viracon finally removes the limitations of screen-printing. Now, you can print a vast number of colors on glass with complete predictability, repeatability and ceramic ink durability. Plus, you'll enjoy the benefits of greater UV resistance, transparency, and scratch resistance, while applying Viracon's solar control coatings directly over the digital image.

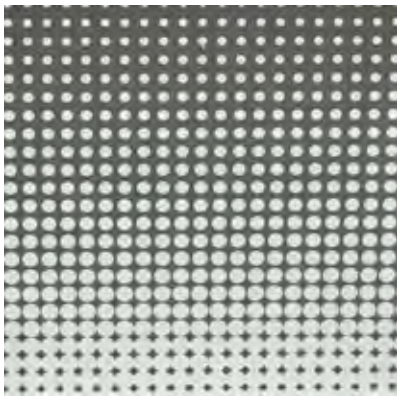
The artistic possibilities of DigitalDistinctions™ would mean nothing if it didn't also meet or exceed functionality requirements. In fact, digital in-glass printing enhances the functionality of glass and the energy performance of your building by optimizing light diffusion and transmission, energy efficiency, solar control and the support of carbon emission reduction. Functionality has never looked this good.

MULTI-COLOR IMAGES

CUSTOM DESIGNS

MULTI-COLOR PATTERNS





GRADUATING PATTERNS

SEPIA IMAGES

WHY ARCHITECTS CHOOSE DIGITALDISTINCTIONS™ BY VIRACON:

- *Virtually unlimited design possibilities.*
- *Low-E coatings can be applied over the ceramic ink.*
- *Optimized energy performance.*
- *Enhanced durability and beauty of ceramic ink.*

DIGITALDISTINCTIONS™ DUAL IMAGE

Dual image printing consists of a printed image or pattern on one side of the glass that is a different color or image than the other side of the glass. For example, red dot on white dot (as shown below).

RED DOTS - AS VIEWED FROM INTERIOR

WHITE DOTS - AS VIEWED FROM EXTERIOR

DIGITALDISTINCTIONS™ SIMULATED ETCH INK

Simulated Etch ink can be used alone or in combination with other ink colors to simulate the look of acid etched or colored etch glass.

ETCH INK

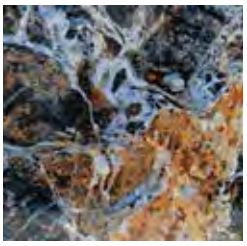
ETCH INK WITH COLOR

DIGITALDISTINCTIONS™ ADDITIONAL DESIGN OPTIONS

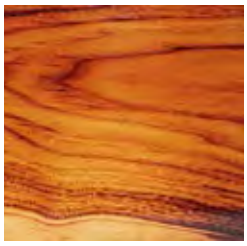
DigitalDistinctions can also be used as a cost effective solution to simulate building materials.

BRICK

STONE



STONE



WOOD GRAIN

Standard and custom patterns can be printed in a vast array of colors by mixing the six basic ink colors: black, white, green, blue, red and orange-yellow.

Note: Images on pages 030-031 are sample images intended to highlight the aesthetic possibilities available with DigitalDistinctions. Please contact Viracon at 800.533.2080 to discuss further design possibilities.

DIGITALDISTINCTIONS™ TECHNICAL REQUIREMENTS

- Maximum dimensions (Insulated and Monolithic Products): 84" x 157" (2134mm x 3988mm) or 96" x 144" (2438mm x 3658mm)
- Maximum dimensions (Laminated Products): 84" x 157" (2134mm x 3988mm)
- Maximum size: 70 sq. ft.
- Minimum dimensions: 12" x 12" (305 mm x 305 mm)

ALL DIGITAL PRINTS MUST BE APPROVED BY THE ARCHITECT OR BY THE BUILDING OWNER AFTER VIEWING A FULL SIZE MOCK-UP. A WAIVER LETTER MUST BE SIGNED IF NO MOCK-UP IS APPROVED.

DIGITALDISTINCTIONS™ ADDITIONAL INFORMATION

- Digitally printed glass is to be viewed from a distance of 15 feet under natural daylight conditions. Color and reflectance may vary when viewed under a uniform, opaque background. This is not considered a defect.
- Variations in perceived color may occur with any ceramic ink. Those variations will be more apparent with white or light colors than darker colors because of unavoidable light transmission. Furthermore, due to the inherent variations in ceramic ink thickness, light colors are more readily influenced by the colors of the materials installed behind the glass.
- While Viracon will take every precaution to control color uniformity, Viracon takes no responsibility for variations in color or thickness that are within quality standards.
- Pinholes, fisheyes, color concentrations, streaks from the printing process, and paint particles are allowed, undetectable from 15 feet.
- An indefinite border of up to 1/32" (0.8mm) is acceptable. An indefinite border refers to the sharpness of the print pattern and is dependent on the image printed. An indefinite border is characterized as 'ghosting', halo or saw-tooth print.
- A maximum of 1/32" (0.8mm) variation in dot, hole or line location is allowed.
- There will be a 2mm nominal clear edge (paint free) around all edges.
- There will be a 3/8" (9.525mm) clear edge (paint free) border required around all edges where coating deletion is required. Additional restrictions may apply.
- Images or patterns may be located up to 1/16" (1.6mm) off parallel from locating glass edge. Images or patterns may be located up to 1/8" (3mm) off parallel from edges other than locating glass edge due to glass tolerances.
- All fabrication, such as cutting to overall dimensions, edgework, drilled holes, notching, and grinding shall be performed prior to applying the digital print.

DIGITALDISTINCTIONS™ IMAGES/FILES

A signed document declaring that the Buyer has rights to any images or patterns that will be printed will be required. High resolution electronic design files must be supplied by the Buyer. Vector based files are highly preferred. Acceptable file types are EPS, PDF, JPEG, TIFF, AI, CDR, PSD, DWG, and DXF. Original file format preferred.

Design files should be:

- Drawn to scale
- Show glass sizes or depict glass edges
- "As viewed from exterior."

Buyer shall be responsible for the accuracy of all documents, data, glass takeoffs, shop drawings, specifications, architectural drawings, and electronic design files furnished by Buyer to Viracon. Viracon shall not be liable for any errors or omissions in documents, data, glass takeoffs, shop drawings, specifications, architectural drawings, and electronic design files furnished by Buyer, including but not limited to drawings not drawn to scale, not accurately depicted glass sizes, not depicting glass edges, or that do not depict proper orientation of the glass.

EL PASO CLOCK TOWER, SOUTHWEST UNIVERSITY PARK

LOCATION: EL PASO, TEXAS // **GLASS TYPE:** MONOLITHIC, LAMINATED, DIGITALDISTINCTIONS™

ARCHITECT: POPULOUS // **GLAZING CONTRACTOR:** SIGNATURE ARCHITECTURAL ELEMENTS

PHOTOGRAPHER: © BRIAN WANCHO // **PRINTED IMAGE ARTIST:** ROBERTO DAVIDOFF; DAVID KUNZELMAN

HEAT TREATMENT

Heat-treated glass is a term used to describe glass that has been processed through a tempering furnace to alter its strength characteristics. The process is done in order to provide greater resistance to thermal and mechanical stresses and achieve specific break patterns for safety glazing applications as compared to annealed glass.

The process of heat-treating glass is taking annealed glass, cutting it to its desired size, transferring the glass to a furnace and heating it to approximately 1,150° F. Once at this temperature, the glass exits the furnace and is then rapidly cooled, or quenched. Air is blown onto the glass surface on both sides simultaneously. This cooling process creates a state of high compression at the glass surfaces while the central core of the glass is in a compensating tension. The only physical characteristics of the glass that change are the improved strength and resistance to thermal stress and shock.

There are two kinds of heat-treated glass, heat-strengthened (HS) and fully tempered (FT). Fabrication requirements, tolerances, and testing procedures for heat-treated glass are defined in the ASTM International document C 1048.

Due to the process of heat-treating glass, the original flatness of the annealed substrate is slightly modified. This inherent condition of heat-treated glass results in roller wave distortion and glass bow and warp.

Viracon's tolerance for roller wave is a maximum of 0.003" (0.076mm) from peak to valley in the center of lites, and a maximum of 0.008" (0.20mm) within 10.5" (267mm) of the leading or trailing edge. There is no industry standard for heat-treated glass roller wave, however a tolerance of 0.005" is frequently specified.

Viracon's tolerance for localized warp for rectangular glass is 1/32" (0.8mm) over any 12" (305mm), or half of the ASTM C 1048 Standard Specification for Heat-Treated Flat Glass standard of 1/16" (1.6mm) over any 12" (305mm) span.

Strain patterns are a characteristic of heat-treated glass. To learn more about this subject see Viracon's Tech Talk on "Quench Patterns" on our website at viracon.com.

MARITIME AND SEAFOOD INDUSTRY MUSEUM

LOCATION: BILOXI, MISSISSIPPI

GLASS TYPE: VUE1-50

ARCHITECT: H3 HARDY COLLABORATION ARCHITECTURE LLC

GLAZING CONTRACTOR: A-1 GLASS SERVICE, INC.

PHOTOGRAPHER: © RON BUSKIRK

ANNEALED (AN)

Raw glass that has not been heat treated is annealed glass.
In a specification, the designation for annealed glass is AN.

HEAT STRENGTHENED (HS)

Heat-strengthened glass is twice as strong as annealed glass of the same thickness, size and type. If broken, heat-strengthened glass will break into large shards similar to annealed glass.

The surface compression of heat-strengthened glass with thicknesses of 1/4" (6mm) and less is 4,000 - 7,000 psi. Surface compression for 5/16" (8mm) and 3/8" (10mm) heat-strengthened glass is 5,000 - 8,000 psi. (Because of reader repeatability and instrument tolerances, Viracon's tolerance for heat-strengthened glass surface compression is +/- 1,000 psi.)

While improving the strength and resistance to thermal shock and stress, heat-strengthened glass does not meet safety glazing requirements as outlined by the American National Standards Institute (ANSI) Z97.1 or the federal safety standard Consumer Products Safety Commission (CPSC) 16 CFR 1201, and therefore should not be used in these situations.

In a specification, the designation for heat strengthened glass is HS.

FULLY TEMPERED (FT)

Glass with fully tempered surfaces is typically four times stronger than annealed glass and two times as strong as heat-strengthened glass of the same thickness, size and type. In the event that fully tempered glass is broken, it will break into fairly small pieces, reducing the chance for injury. In doing so, the small glass shards make it more likely that the glass will become separated from the opening. The minimum surface compression for fully-tempered glass is 10,000 psi. In addition, it complies with the safety glazing requirements as outlined by the American National Standards Institute (ANSI) Z97.1 and the federal safety standard Consumer Products Safety Commission (CPSC) 16 CFR 1201.

In a specification, the designation for fully tempered glass is commonly abbreviated as FT.

HEAT SOAKING

Fully tempered glass may break without warning due to the expansion of nickel sulfide inclusions (NiS) present within float glass. To avoid the risk of spontaneous breakage in fully tempered glass, a common practice is to avoid the use of tempered glass whenever possible. Although the incidence of tempered glass breakage due to these inclusions is rare, greater publicity of their occurrence has resulted in an increased awareness of this phenomenon. In fact, limiting the use of tempered glass in commercial building applications has become the recommendation of a number of glass suppliers, including Viracon. In some situations however, tempered glass is required to meet safety glazing requirements or for added strength. In these cases, Viracon can perform a heat soak test to provide the added assurance that significant spontaneous breakage will not occur. For more information, refer to our technical document Heat Soak Testing on our website viracon.com.

HOLES

Viracon offers hole drilling capabilities starting at 1/4 inch. Our Z. Bavelloini vertical two-sided hole drilling equipment offers precision accuracy.

MAXIMUM NUMBER OF HOLES

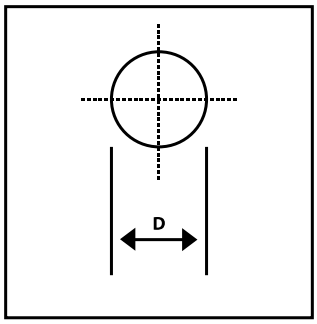
The maximum number of holes allowed in any lite of glass is ten (10.)

GUIDELINE FOR HOLE DIMENSION

Circular holes must have a diameter at least 1/16" greater than the thickness of the glass, with 1/4" (6mm) being the smallest hole allowed. The maximum size of a hole can not be more than 1/3 the narrowest dimension of the glass.

For holes that have a straight edge, or are non-circular, fillets are required in the corners. A fillet is a rounded corner from which the straight edge emerges. The radius of the fillet must be equal to or greater than the thickness of the glass, but not less than 1/2".

Inches	
Glass Thickness	**D=Minimum Diameter**
1/8	3/16
5/32	7/32
3/16	1/4
1/4	5/16
5/16	3/8
3/8	7/16
1/2	9/16
5/8	11/16
3/4	13/16



Millimeters	
Glass Thickness	**D=Minimum Diameter**
3	5
4	6
5	6
6	8
8	10
10	11
12	14
16	17
19	21

GUIDELINE FOR MINIMUM GLASS WIDTH WITH HOLES

The minimum width of glass containing holes that can be satisfactorily tempered is an 8" width. All other requirements of hole location, spacing of holes, and dimensions of holes must also be met.

Inches	
Glass Thickness	**Minimum Width**
1/8	8
5/32	8
3/16	8
1/4	8
5/16	8
3/8	8
1/2	8
5/8	8
3/4	8

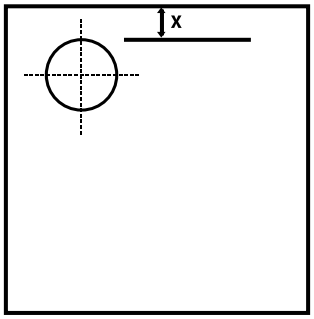
Millimeters	
Glass Thickness	**Minimum Width**
3	203
4	203
5	203
6	203
8	203
10	203
12	203
16	203
19	203

GUIDELINE FOR HOLE SPACING

The distance from any edge of glass to the nearest point on the rim of the hole (x) must be at least 6mm (1/4") or 2 times the thickness of the glass, whichever is greater.

The distance between holes must be 10mm (3/8") or two (2) times the thickness of the glass, whichever is greater.

Inches	
Glass Thickness	**X=Minimum Distance**
1/8	1/4
5/32	5/16
3/16	3/8
1/4	1/2
5/16	5/8
3/8	3/4
1/2	1
5/8	1-1/4
3/4	1-1/2

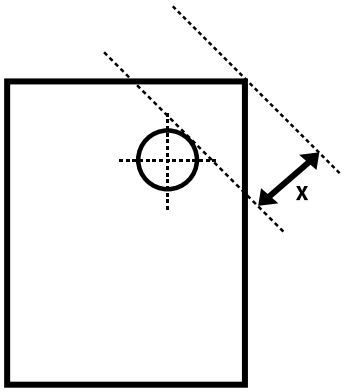


Millimeters	
Glass Thickness	**X=Minimum Distance**
3	6
4	8
5	10
6	12
8	16
10	19
12	25
16	32
19	38

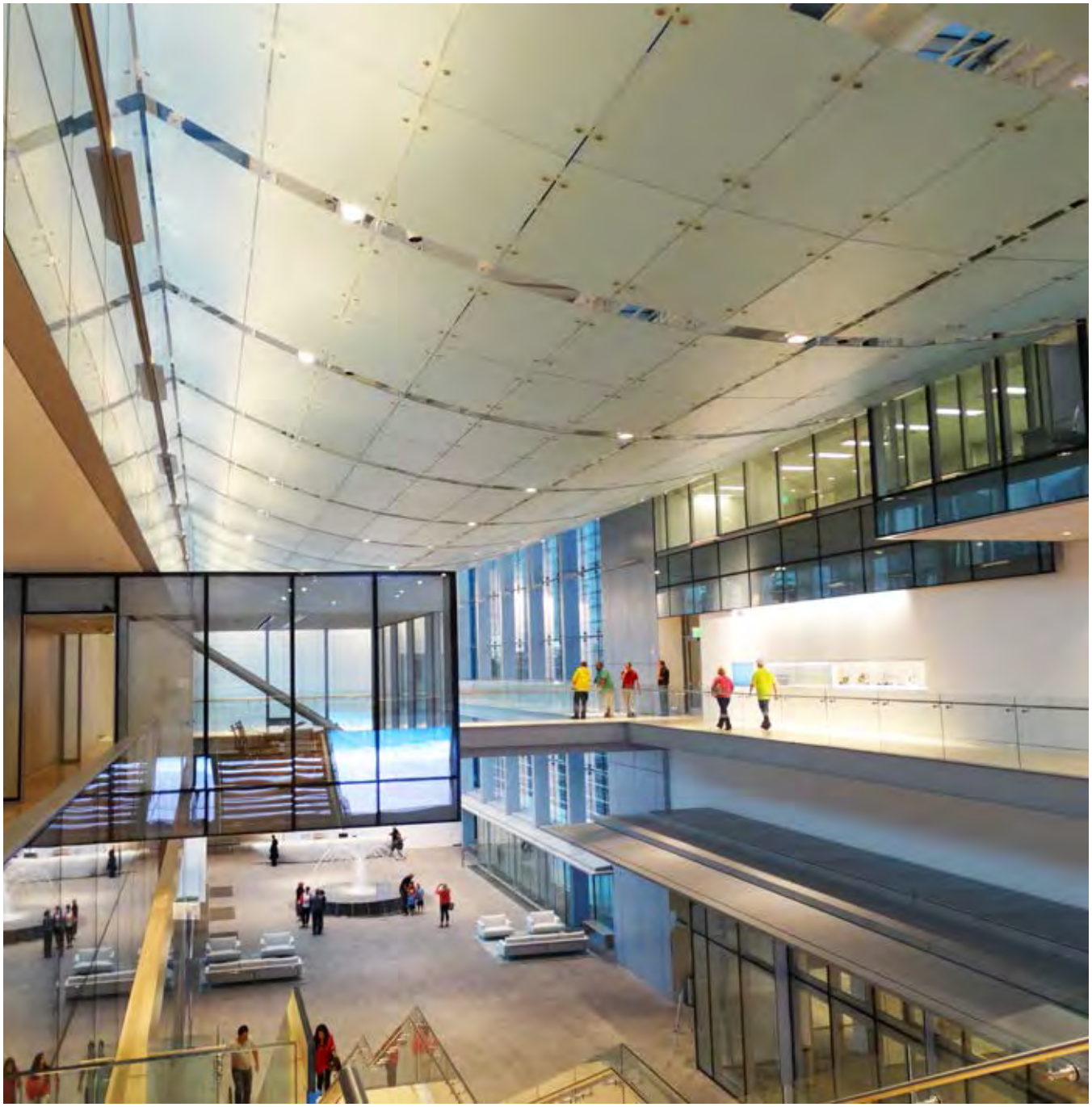
GUIDELINE FOR HOLES PLACEMENT NEAR THE GLASS CORNERS

Holes near corners must be located so that the nearest edge of the hole is at least 6.5 times the thickness of the glass from the tip of the corner when the corner is 90° or more.

Inches	
Glass Thickness	**X=Minimum Distance**
1/8	3/16
5/32	1-1/64
3/16	1-7/32
1/4	1-5/8
5/16	2-1/32
3/8	2-7/16
1/2	3-1/4
5/8	4-1/16
3/4	4-7/8



Millimeters	
Glass Thickness	**X=Minimum Distance**
3	21
4	26
5	31
6	41
8	52
10	62
12	82
16	103
19	124



NU SKIN INNOVATION CENTER (EXPANSION)

LOCATION: PROVO, UTAH // **GLASS TYPE:** LAMINATED, POINT-SUPPORTED (CEILING INTERIOR); VRE1-59 (EXTERIOR)

ARCHITECT: BOHLIN CYWINSKI JACKSON // **GLAZING CONTRACTOR:** STEEL ENCOUNTERS

PHOTOGRAPHER: © COURTESY STEEL ENCOUNTERS

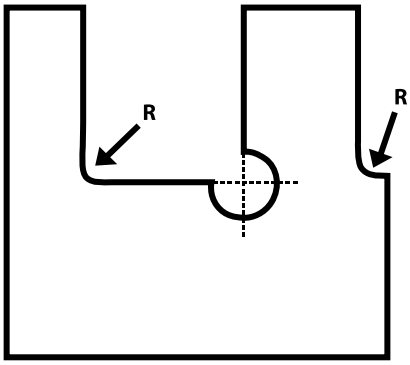
NOTCHES

Fabricated on our Z. Bavelloni CNC Machine, Viracon can supply you with more options for custom enhancements of monolithic glass. Please refer to the following guidelines when requesting your specially fabricated glass products.

GUIDELINES FOR NOTCHES AND CUTOUTS

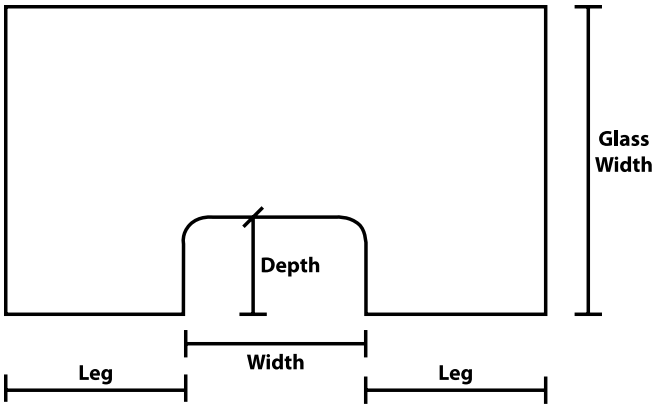
To provide you with notches and cutouts, the corners must have fillets. A fillet is a rounded corner of which the straight edge emerges. The radius of the fillet must be equal to or greater than the thickness of the glass, but not less than 1/2".

Inches	
Glass Thickness	**Minimum Radius**
1/8	1/2
5/32	1/2
3/16	1/2
1/4	1/2
5/16	1/2
3/8	1/2
1/2	1/2
5/8	5/8
3/4	3/4



Millimeters	
Glass Thickness	**Minimum Radius**
3	12
4	12
5	12
6	12
8	12
10	12
12	12
16	16
19	19

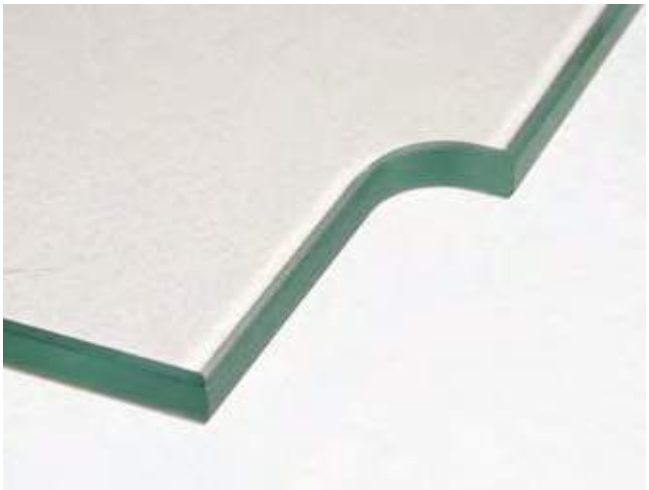
All fabricated glass products with holes, notches and cutouts must incorporate fully tempered or heat-strengthened glass. Due to stresses created in the glass with these cutouts, annealed glass products are not appropriate. In addition, the guidelines below also apply for notch and cutout requirements.



FABRICATION LIMITATIONS

1. The depth or width of the notch or cutout can not have a dimension larger than 1/3 of the narrowest dimension of the lite.
2. The leg length must be more than the depth of the notch.
3. The leg length must be at least 3".
4. The depth of the notch must be less than the width.
5. The inside corner(s) must have a radius equal to, or greater than the thickness of the glass, but not less then 1/2".

EDGEWORK



Viracon gives you options when it comes to glass edgework. Our Busetti two-sided horizontal edger specializes in ground and polished edges. Our Z.Bavelloini vertical edgers are dedicated to miter and beveled edge treatments. Choose from: Seamed, Flat Belt Ground or Flat Belt Seamed, Flat Ground, Flat Polished or Mitered Edges.

LAMINATED GLASS EDGEWORK

1. Ground, polished and mitered edges are available to 2" thickness for laminated annealed glass.

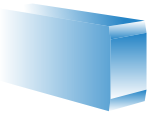
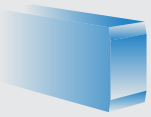
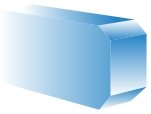
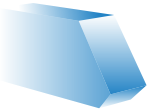
2. Viracon recommends the aesthetics of ground, polished or mitered edges of heat treated laminated glass be evaluated because of the offset edges (edge work must be done prior to heat treating). The potential for mismatched edges exists to a maximum of 1/8".

PATRIOT PLAZA, SARASOTA NATIONAL CEMETERY

LOCATION: SARASOTA, FLORIDA // **GLASS TYPE:** LAMINATED // **ARCHITECT:** HOYT ARCHITECTS

GLAZING CONTRACTOR: NOVUM STRUCTURES LLC // **PHOTOGRAPHER:** © THE PATTERSON FOUNDATION, DALE SMITH PHOTOGRAPHER

EDGEWORK OPTIONS

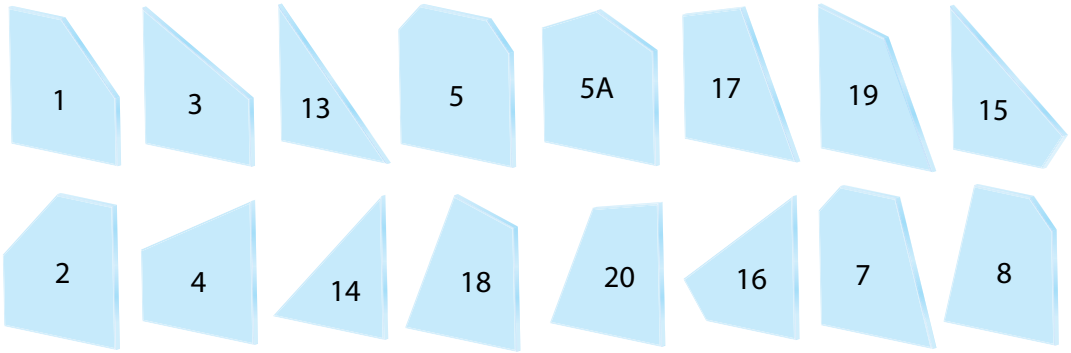
Type	Description	Glass Thickness	Recommended Application	Finish
Seamed	This is the simplest type of edge work whereby the sharp edges from an "as cut" glass are removed on a belt seamer.	Available in all thickness' up to 3/4"	Concealed or Structurally glazed edges FT & HS only	Seamed Finish as Cut 
Flat Belt Ground & Seamed	The sharp edges from an "as cut" glass are removed as well as flares, etc. by manual process.	Available in all thickness' up to 3/4"	Structurally glazed FT & HS only	Seamed Finish Belt Ground 
Flat Ground with Arris	This is a machined edge of flat form with a satin finish.	1/8" to 3/4"	Butt jointed edges with silicone seal or exposed edges FT & HS only	Ground Finish 
Flat Polish with Arris	This is a machined edge of flat form with arrised edges which has been polished.	1/8" to 3/4"	Exposed edges	Polished Finish 
Mitered Edges**	This is a flat machined edge from a 1° to a 45° angle to the cut edge of the panel. The thickness of glass remaining at the edge is 1/16" (nominal).	3/16" to 3/4"	Butt jointed edges with silicone seal - Ground or exposed edge (polished) Ground FT & HS only	Polished or Ground Finish 

***For mitered edges a customer sketch is required to identify the angle size and orientation.*
Requests incorporating a mitered edge and a silk-screened pattern must be approved.

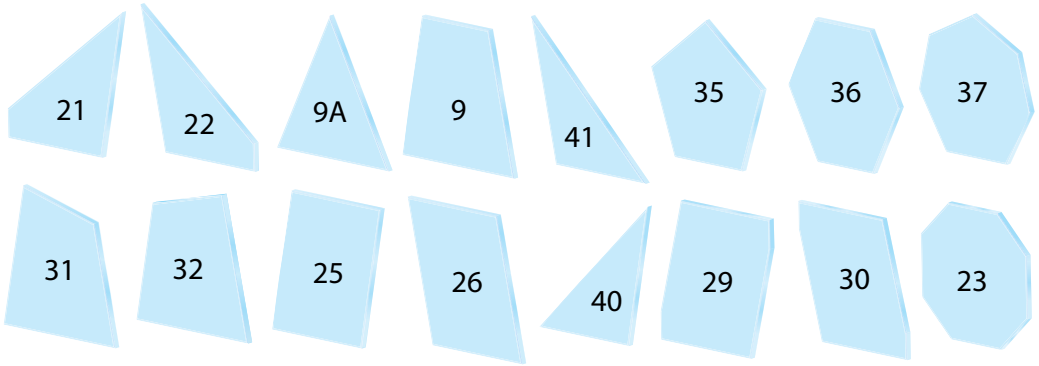
SHAPES & PATTERN CUTS

Viracon has the capability to cut glass lites to a specific pattern or shape; below is a reference for the type of pattern cuts available. Please contact Viracon to discuss the capability of incorporating pattern glass lites into the final glass unit you desire; special approval may be required. Customer drawings (including pattern dimensions) are required to adequately evaluate pattern availability.

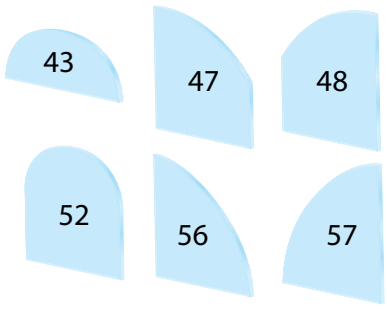
NON-RADIUS PATTERNS W/ A 90˚ CORNER



NON-RADIUS PATTERNS W/ **NO** 90˚ CORNER



RADIUS PATTERNS



MISC / OTHER PATTERNS

*Special approval may be required --
Please contact your Viracon Representative.

FIONA STANLEY HOSPITAL

LOCATION: PERTH, WESTERN AUSTRALIA

GLASS TYPE: VNE1-63, VNE19-63

ARCHITECT: SILVER THOMAS HANLEY; HAMES SHARLEY; HASSELL

GLAZING CONTRACTOR: SHENYANG YUANDA ALUMINUM IND

PHOTOGRAPHER: © WIKIMEDIA COMMONS

EDITH GREEN-WENDELL WYATT FEDERAL BUILDING (RENOVATION)

LOCATION: PORTLAND, OREGON // **GLASS TYPE:** VE2-2M // **ARCHITECT:** SERA ARCHITECTS; CUTLER ANDERSON ARCHITECTS

GLAZING CONTRACTOR: BENSON INDUSTRIES LLC // **PHOTOGRAPHER:** © WIKIMEDIA COMMONS

FEDERAL OFFICE BUILDING

LOCATION: MIRAMAR, FLORIDA // **GLASS TYPE:** VLE13-57, VRE13-59, CYBERSHIELD™

ARCHITECT: GENSLER (PROJECT ARCHITECT); KRUECK + SEXTON ARCHITECTS (DESIGN ARCHITECT)

GLAZING CONTRACTOR: ENCLOS CORP.; BAKER METAL PRODUCTS // **PHOTOGRAPHER:** © COURTESY HENSEL PHELPS

LIFE SCIENCE LABORATORIES, UNIVERSITY OF MASSACHUSETTS

LOCATION: AMHERST, MASSACHUSETTS // **GLASS TYPE:** VE1-2M // **ARCHITECT:** WILSON ARCHITECTS (DESIGN ARCHITECT); RDK ENGINEERS

GLAZING CONTRACTOR: R & R WINDOW CONTRACTORS // **PHOTOGRAPHER:** © COURTESY R & R WINDOW CONTRACTORS

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INSULATING GLASS HIGHLIGHTS

LIBERTY PARKWAY TOWER

LOCATION: PHILADELPHIA, PENNSYLVANIA

GLASS TYPE: VRE1-54, VE19-2M, VE1-2M

ARCHITECT: BALLINGER

GLAZING CONTRACTOR: NATIONAL GLASS & METAL CO.; DECISION DISTRIBUTION

PHOTOGRAPHER: © JEFFREY TOTARO

MARRIOTT MARQUIS (PREVIOUS)

LOCATION: WASHINGTON, DC

GLASS TYPE: VRE1-59, VRE1-38, VE1-2M, LAMINATED POINT-SUPPORTED (CANOPY)

ARCHITECT: COOPER CARRY

GLAZING CONTRACTOR: TSI EXTERIOR WALL SYSTEMS; NOVUM STRUCTURES (CANOPY)

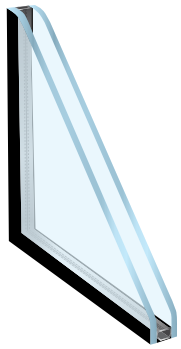
PHOTOGRAPHER: © HALKIN | MASON | PHOTOGRAPHY

PRODUCT OVERVIEW

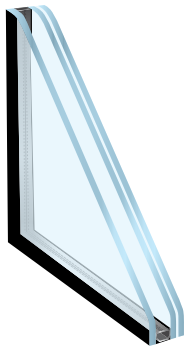
Insulating glass is two or more plies of glass enclosing a hermetically sealed air space. Inherently, insulating glass increases a window's thermal performance by reducing the heat gain or loss.

At Viracon, insulating glass units are double sealed with a primary seal of polyisobutylene and a secondary seal of silicone. To provide a hermetically sealed and dehydrated space, the glass plies are separated by a desiccant-filled spacer with three bent corners and one keyed-soldered corner or four bent corners and one butyl injected zinc plated steel straight key joint. The desiccant absorbs the insulating glass unit's internal moisture.

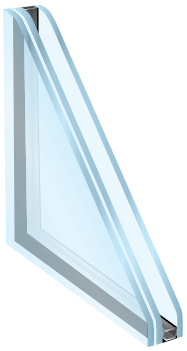
INSULATING GLASS CONFIGURATIONS



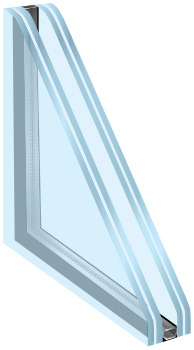
INSULATING



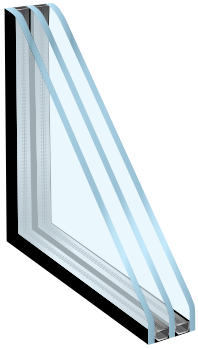
INSULATING LAMINATED



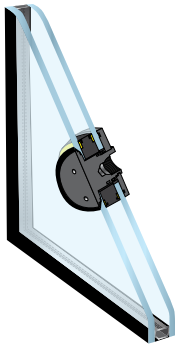
LAMINATED INSULATING



DOUBLE LAMINATED INSULATING



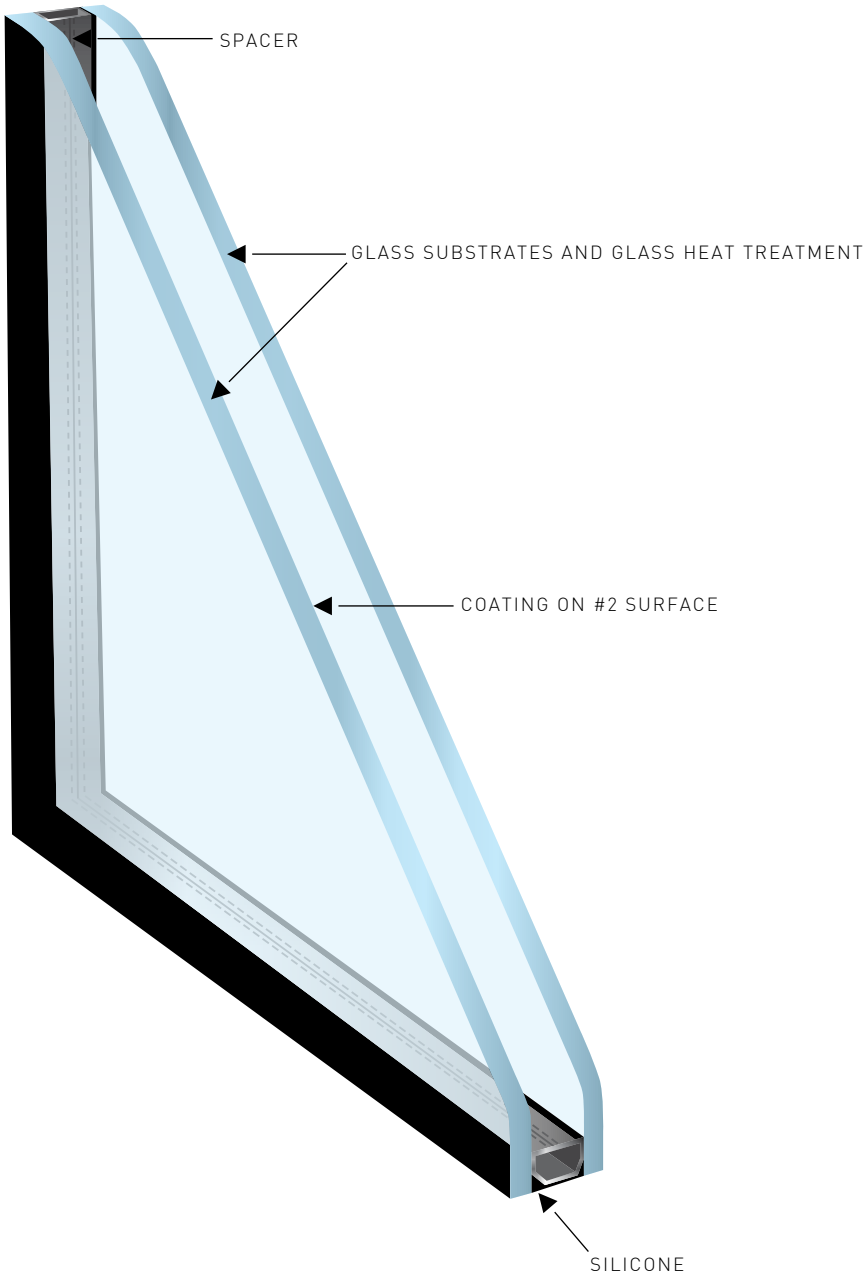
TRIPLE INSULATING



CLEARPOINT™

PRODUCT COMPONENTS

When specifying insulating glass, it is important to select and clearly outline the configuration as well as each individual component of the insulating glass unit.



Reference pages 005 - 042 for Viracon product enhancements such as: coatings, silk-screens, DigitalDistinctions™ and more; that can be combined with insulating units to obtain improved thermal performance and aesthetic design.

STANDARD INSULATING GLASS

The most common insulating glass unit is constructed with two plies of glass and one sealed air space. This configuration is a dual pane or double pane insulating glass unit, however is commonly shortened to insulating glass. Insulating glass is used due to the improvement in solar performance it provides. The most significant improvement is thermal performance (u-value) which improves by approximately 50% when compared to a monolithic glass ply. This improvement occurs whether the glass is coated or uncoated.

In addition to the improved solar performance, insulating glass offers a greater availability of coatings.

Low-E coatings which cannot be exposed, and therefore cannot be used with monolithic glass, can be used inside the insulating unit where they are protected by the hermetically sealed space. Insulating units also have more aesthetic possibilities than monolithic glass.

The Low-E coating and silk-screen pattern, if desired, are applied to the exterior ply of glass leaving the interior ply available for additional treatment.

For a spandrel location, a full coverage opaque ceramic frit can be applied to the inner face (surface #4). For vision areas where daylight is desired but view through needs to be minimized, a translucent ceramic frit can be applied to the surface facing the airspace (surface #3).

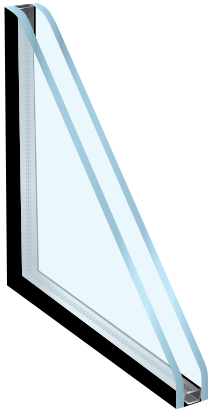
1/4" CLEAR MONOLITHIC

1/4" (6mm) clear

VLT	88%
Winter u-value	1.02
Summer u-value	0.92
SHGC	0.82

1" CLEAR INSULATING

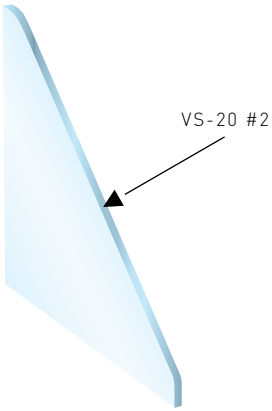
1/4" (6mm) clear
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	79%
Winter u-value	0.47
Summer u-value	0.49
SHGC	0.70

1/4" VS1-20 MONOLITHIC

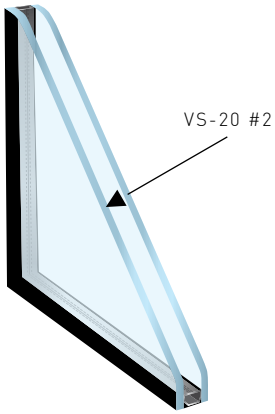
1/4" (6mm) clear with VS-20 #2



VLT	20%
Winter u-value	0.86
Summer u-value	0.75
SHGC	0.31

1" VS1-20 INSULATING

1/4" (6mm) clear with VS-20 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



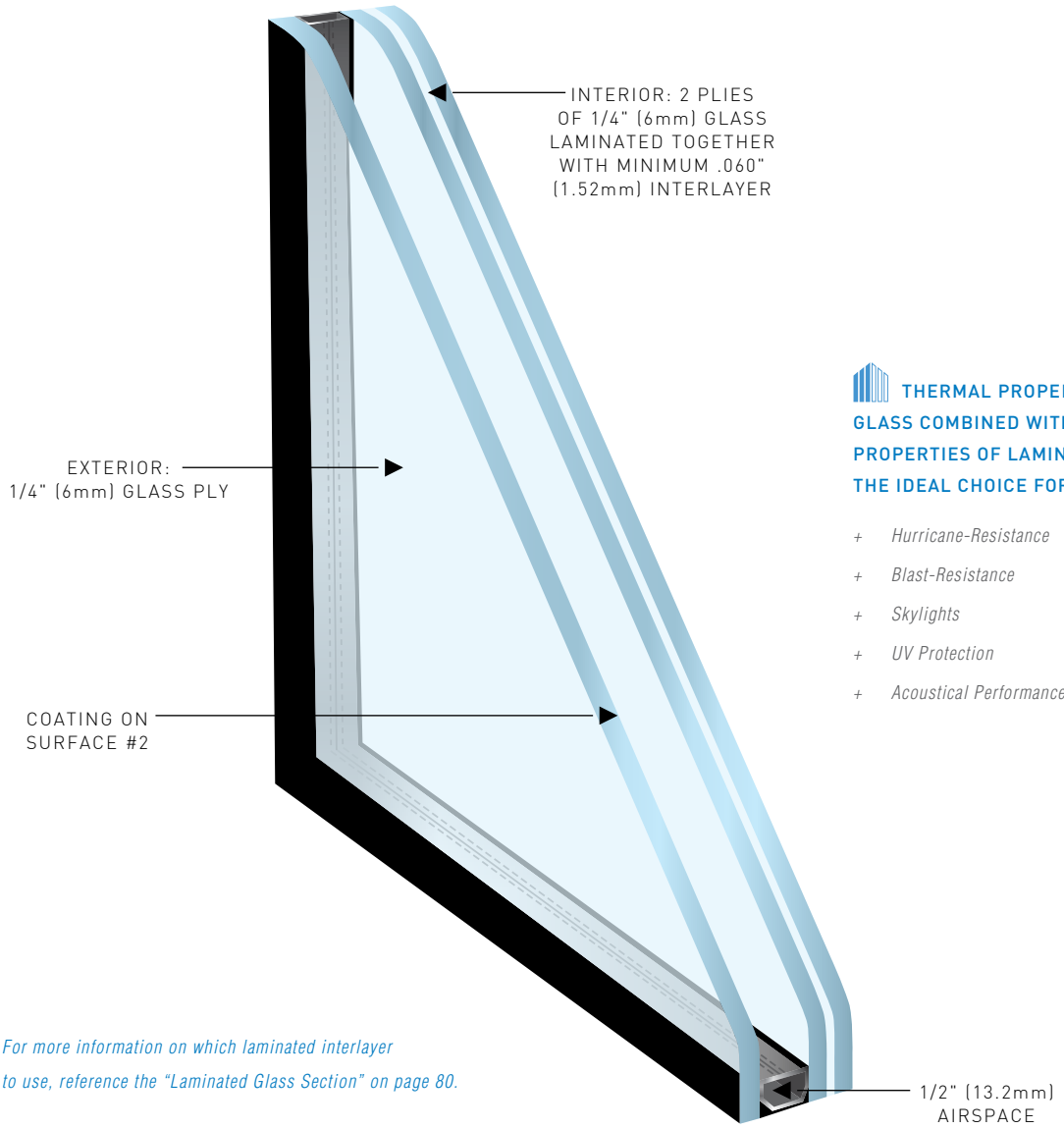
VLT	18%
Winter u-value	0.42
Summer u-value	0.43
SHGC	0.23

INSULATING LAMINATED

Viracon Insulating Laminated Glass provides the solar controlling properties of an insulating unit along with the safety features of the laminated inboard component. This allows the flexibility to design with hundreds of combinations of tinted glass, high-performance coatings, silk-screen patterns and pigmented interlayers, together or alone. In addition, Insulating Laminated Glass enhances acoustical performance, ultraviolet light protection, and the laminated component is designed to remain integral in the opening should glass damage occur. For this reason, insulating laminated glass is utilized for skylights or other overhead glazing applications.

Often the laminated inboard component is required to provide protection against man-made threats or natural disasters such as hurricanes, bomb blasts or forcible-entry.

A typical insulating laminated glass configuration is 1-5/16" thick overall constructed as follows:



THERMAL PROPERTIES OF INSULATING GLASS COMBINED WITH THE SAFETY GLAZING PROPERTIES OF LAMINATED GLASS MAKE IT THE IDEAL CHOICE FOR:

- *Hurricane-Resistance*
- *Blast-Resistance*
- *Skylights*
- *UV Protection*
- *Acoustical Performance*

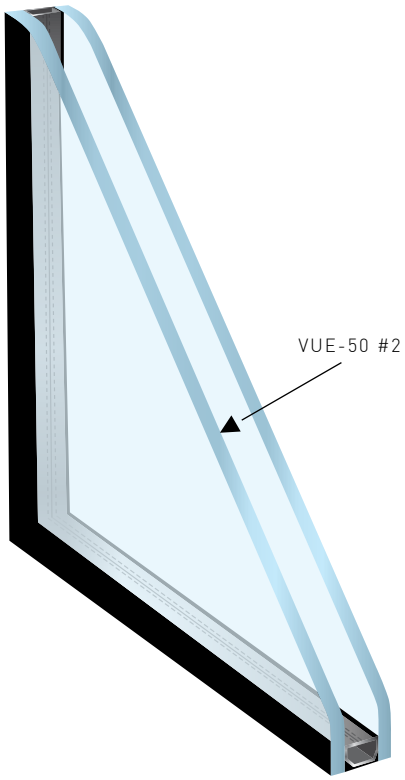
For more information on which laminated interlayer to use, reference the "Laminated Glass Section" on page 80.

INSULATING LAMINATED PERFORMANCE

While insulating laminated glass provides numerous benefits from protection to safety to acoustic improvements, the solar performance between an insulating unit and the insulating laminated counterpart is nominal.

1" VUE1-50 INSULATING

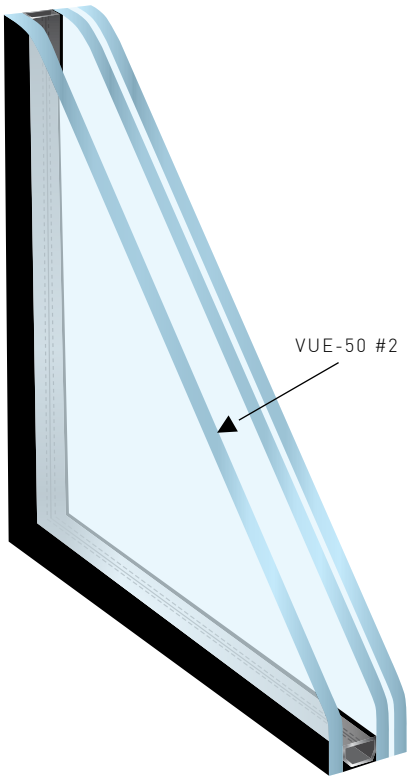
1/4" (6mm) clear with VUE-50 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



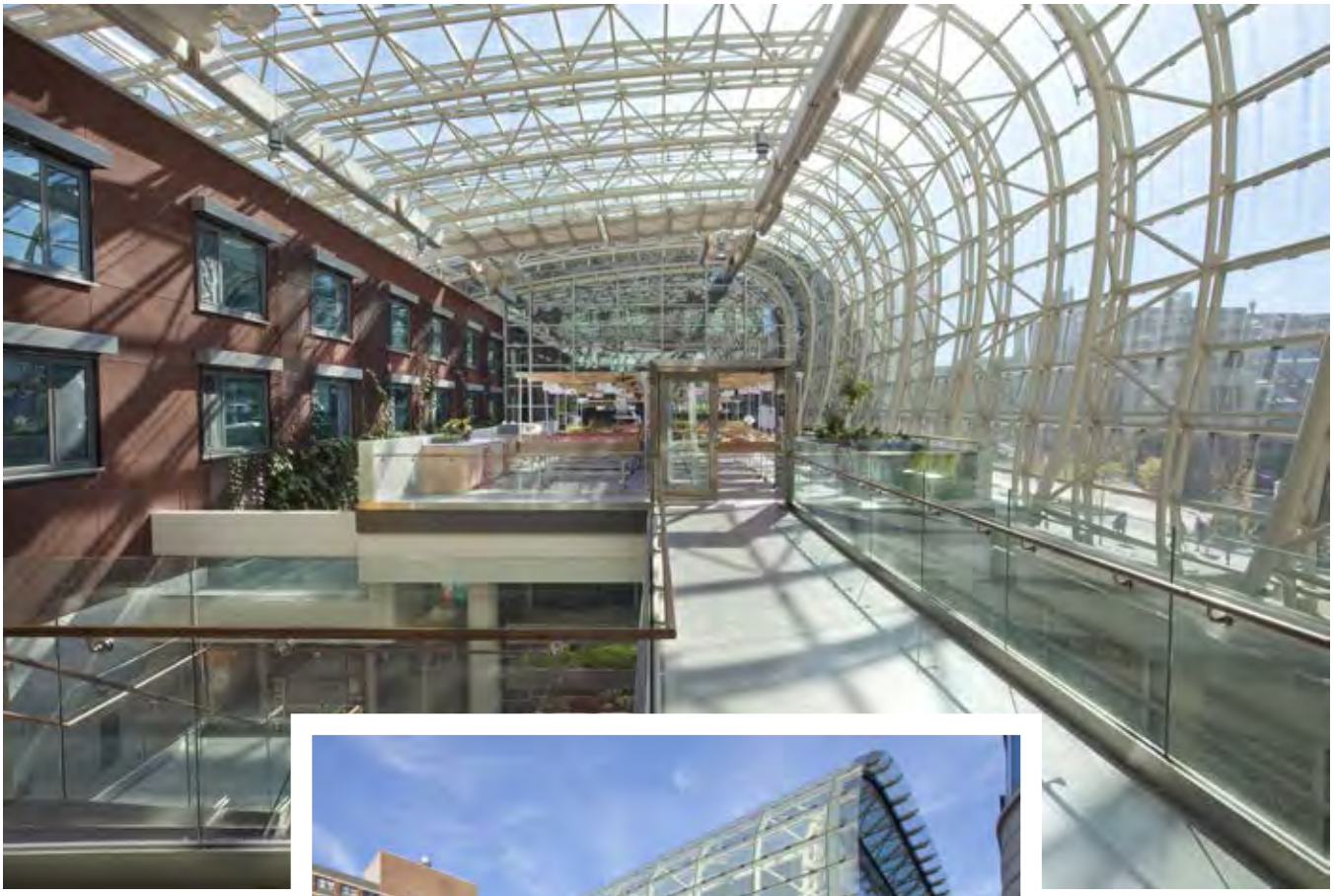
VLT	48%
Winter u-value	0.29
Summer u-value	0.26
SHGC	0.25

1-5/16" VUE1-50 INSULATING LAMINATED

1/4" (6mm) clear with VUE-50 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear
.060" (1.52mm) clear PVB
1/4" (6mm) clear



VLT	46%
Winter u-value	0.29
Summer u-value	0.25
SHGC	0.25



CENTER FOR SUSTAINABLE URBAN LIVING, LOYOLA UNIVERSITY

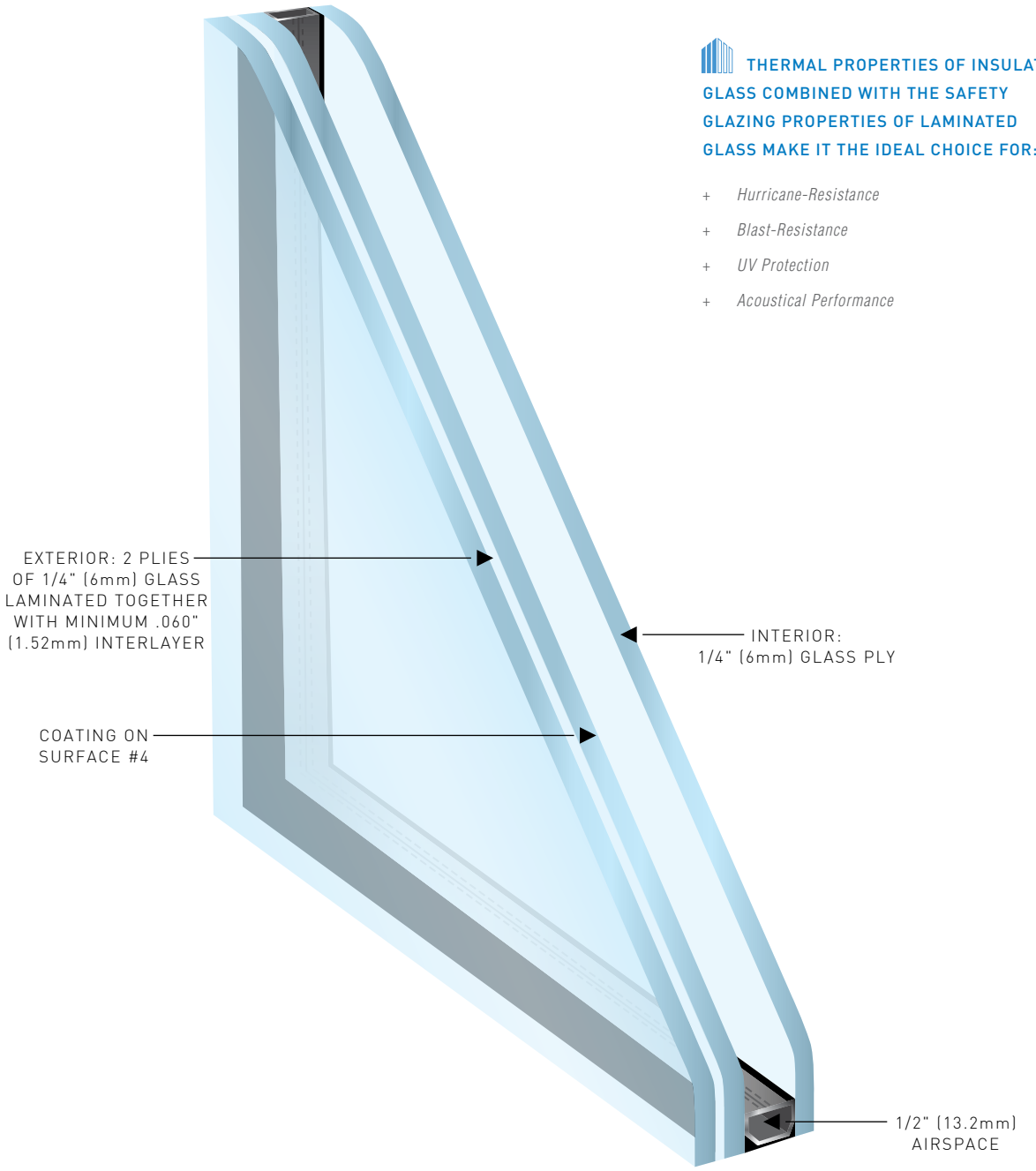
LOCATION: CHICAGO, ILLINOIS // **GLASS TYPE:** VE1-85, VE1-2M // **ARCHITECT:** SOLOMON CORDWELL BUENZ

GLAZING CONTRACTOR: SUPER SKY PRODUCTS // **PHOTOGRAPHER:** © WILLIAM LEMKE

LAMINATED INSULATING

Laminated insulating glass is an insulating glass unit with a laminated outboard. This configuration can be used in applications where the exterior is overhead glazing or in specific hurricane zones where safety glazing is required for the exterior.

A typical laminated insulating glass configuration is 1-5/16” thick overall constructed as follows:



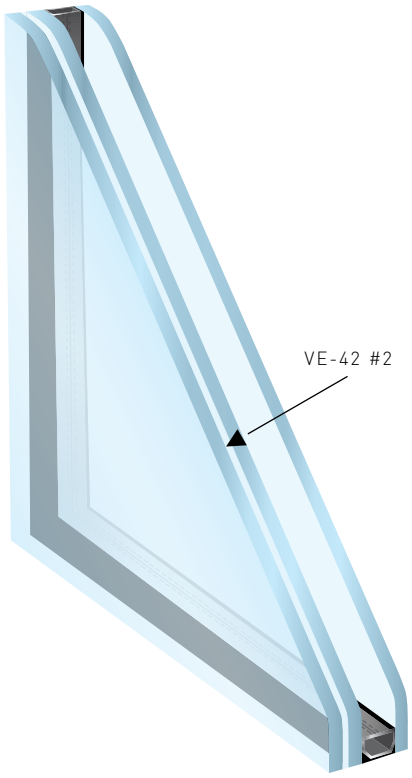
THERMAL PROPERTIES OF INSULATING GLASS COMBINED WITH THE SAFETY GLAZING PROPERTIES OF LAMINATED GLASS MAKE IT THE IDEAL CHOICE FOR:

+ *Hurricane-Resistance*
+ *Blast-Resistance*
+ *UV Protection*
+ *Acoustical Performance*

It is important to note, with laminated insulating glass there are two primary options for Low-E or Reflective coating placement within the unit. Coatings can be placed on the #2 surface, however superior solar performance can be achieved by placing the coating on the #4 surface, touching the air space. For additional information regarding Viracon coatings, see page 010 within components and enhancements.

1-5/16" VE1-42 LAMINATED INSULATING

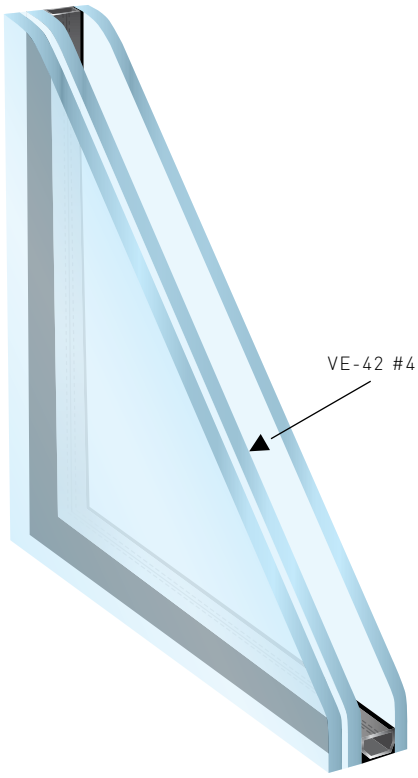
1/4" (6mm) clear with VE-42 #2
.060" (1.52mm) clear PVB
1/4" (6mm) clear
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	36%
Winter u-value	0.46
Summer u-value	0.48
SHGC	0.31

1-5/16" LAMINATED INSULATING

1/4" (6mm) clear
.060" (1.52mm) clear PVB
1/4" (6mm) clear with VE-42 #4
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	36%
Winter u-value	0.30
Summer u-value	0.28
SHGC	0.29

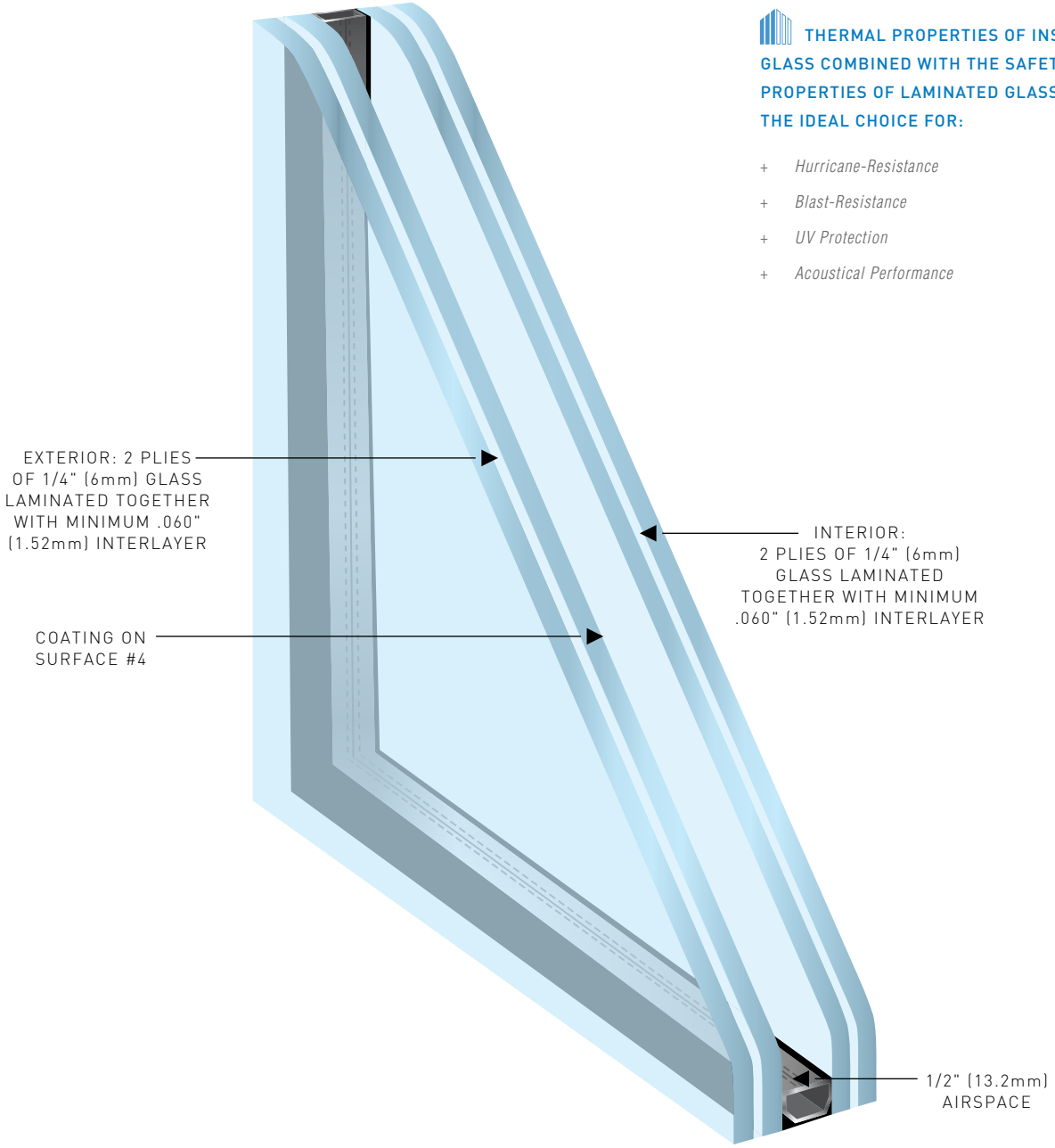
DOUBLE LAMINATED INSULATING

Double laminated insulating glass units have both a laminated inboard and laminated outboard with a space in between. This configuration is often selected when improved OITC acoustic performance is desired such as in schools. In addition, double laminated insulating units can meet protective glazing requirements.

A typical double laminated insulating glass configuration is 1-5/8" thick overall constructed as follows:

THERMAL PROPERTIES OF INSULATING GLASS COMBINED WITH THE SAFETY GLAZING PROPERTIES OF LAMINATED GLASS MAKE IT THE IDEAL CHOICE FOR:

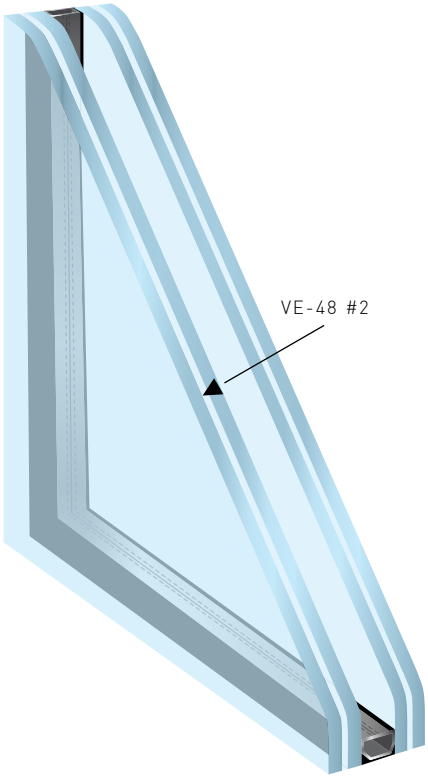
+ *Hurricane-Resistance*
+ *Blast-Resistance*
+ *UV Protection*
+ *Acoustical Performance*



There are eight surfaces in a double laminated insulating glass unit and two primary options for Low-E or Reflective coating placement within the unit. Coatings placed on the #2 surface decrease solar heat gain. However, superior solar performance, including an improved u-value, is achieved by placing the coating on the #4 surface touching the air space. For additional information regarding Viracon coatings, see page 010 within components and enhancements.

1-5/8" VE1-48 DOUBLE LAMINATED INSULATING

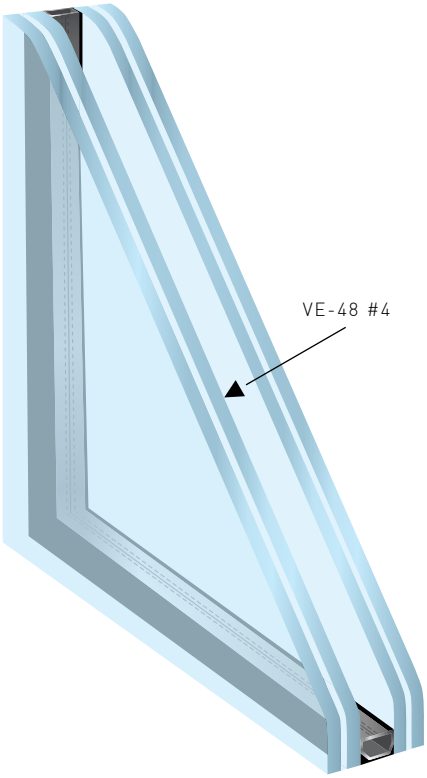
1/4" (6mm) clear with VE-48 #2
.060" (1.52mm) clear PVB
1/4" (6mm) clear
1/2" (13.2mm) airspace
1/4" (6mm) clear
.060" (1.52mm) clear PVB
1/4" (6mm) clear



VLT	43%
Winter u-value	0.44
Summer u-value	0.46
SHGC	0.34

1-5/8" VE1-48 DOUBLE LAMINATED INSULATING

1/4" (6mm) clear
.060" (1.52mm) clear PVB
1/4" (6mm) clear with VE-48 #4
1/2" (13.2mm) airspace
1/4" (6mm) clear
.060" (1.52mm) clear PVB
1/4" (6mm) clear



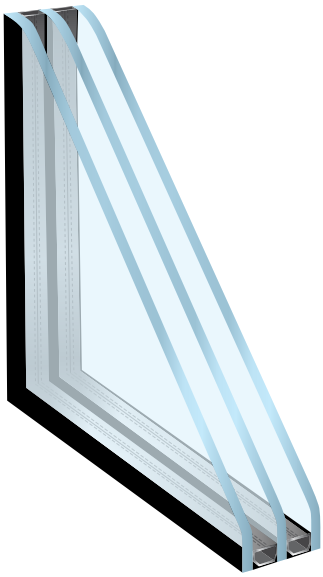
VLT	43%
Winter u-value	0.29
Summer u-value	0.27
SHGC	0.33

TRIPLE INSULATING

The most common triple insulating glass units are constructed with three plies of glass separated by two hermetically sealed and dehydrated spaces. This construction increases the insulating value of the glass unit, thus reducing the u-value. A triple insulating glass unit is especially useful in applications where a low u-value is necessary.

While it is possible to specify a 1" triple insulating unit to coincide with a 1" dual pane insulating unit, it is not always practical. A 1" triple insulating unit is constructed with 1/8" glass plies rather than 1/4" plies as used in a 1" dual pane insulating unit. The reduced glass thickness increases the potential for distortion and since the 1/8" plies are not as strong as 1/4" plies, the width and height of the glass units must also be decreased. In addition, the solar performance improvement is minimal.

More commonly, triple insulating glass units are constructed with three plies of 1/4" glass and two 1/2" spaces. Viracon's triple insulating glass units are available with the same Low-E coatings offered with dual pane insulating glass and the Low-E coating is placed on the #2 surface.

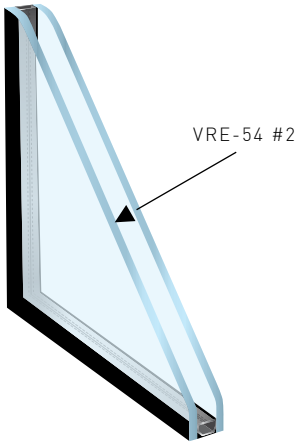


TRIPLE INSULATING KEY BENEFITS:

+ *Two spacers provide superior insulating performance*
+ *Reduces the center of glass u-value*

1" VRE1-54 INSULATING

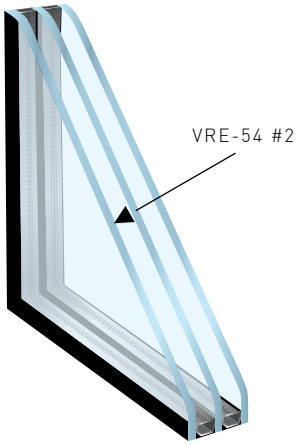
1/4" (6mm) clear with VRE-54 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.30
Summer u-value	0.27
SHGC	0.31

1" VRE1-54 TRIPLE INSULATING

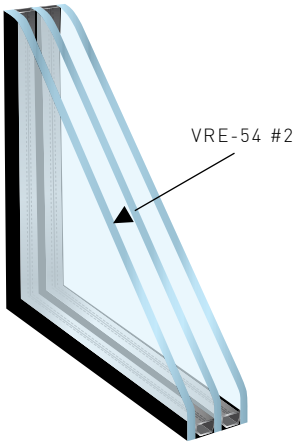
1/8" (3mm) clear with VRE-54 #2
5/16" (7.5mm) airspace
1/8" (3mm) clear
5/16" (7.5mm) airspace
1/8" (3mm) clear



VLT	44%
Winter u-value	0.27
Summer u-value	0.29
SHGC	0.29

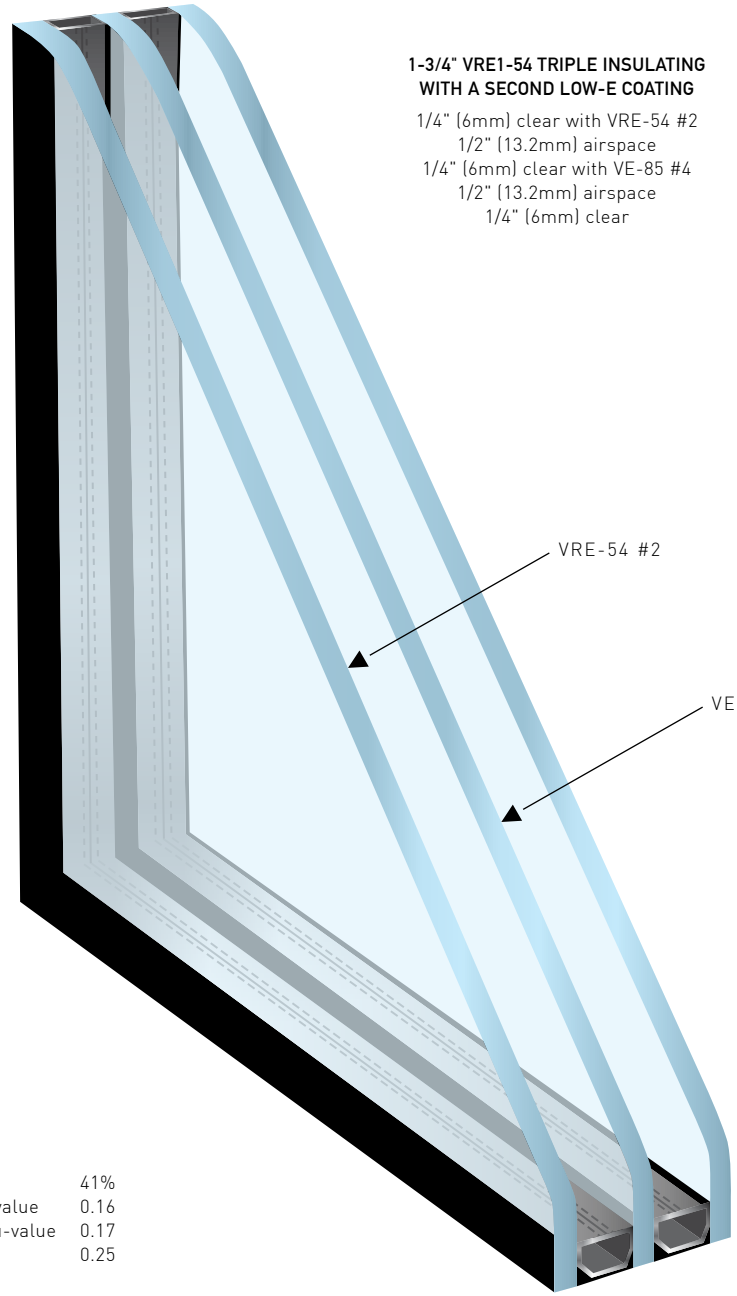
1-3/4" VRE1-54 TRIPLE INSULATING

1/4" (6mm) clear with VRE-54 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	42%
Winter u-value	0.22
Summer u-value	0.22
SHGC	0.28

The third ply of glass in a triple insulating unit also offers the option to add a second Low-E coating within the glass unit. The second coating is Viracon's VE-85, a highly transparent coating added to the #4 surface to further improve the solar performance without adversely affecting the appearance.



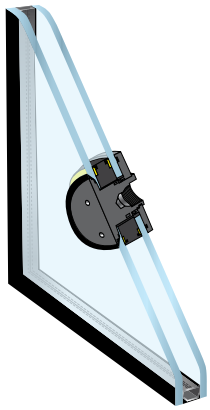
1-3/4" VRE1-54 TRIPLE INSULATING WITH A SECOND LOW-E COATING

1/4" (6mm) clear with VRE-54 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear with VE-85 #4
1/2" (13.2mm) airspace
1/4" (6mm) clear

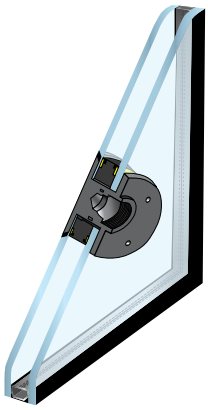
VLT	41%
Winter u-value	0.16
Summer u-value	0.17
SHGC	0.25

CLEARPOINT™

POINT-SUPPORTED INSULATING GLASS

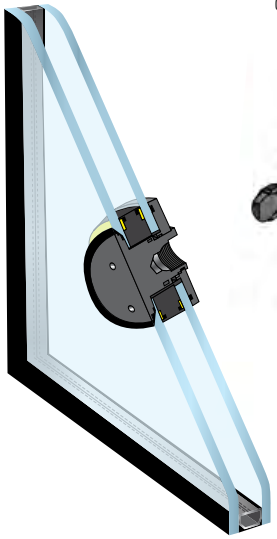


EXTERIOR



INTERIOR

CLEARPOINT



Viracon offers a raised glass fitting with a button design; ProudMount by NuPress.

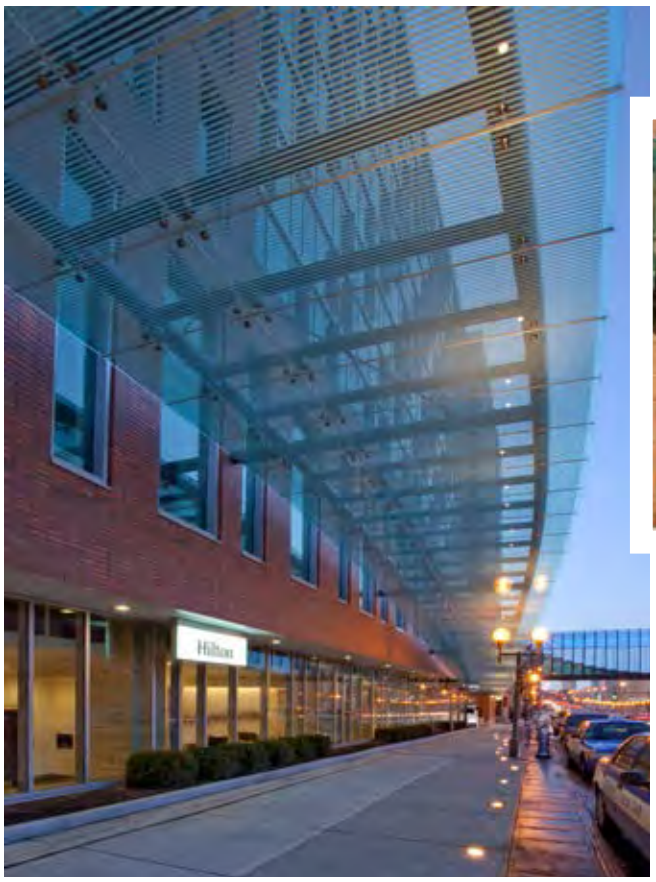
Reference the Components and Enhancements section on page 005 for Viracon product enhancements such as: coatings, DigitalDistinctions™, silk-screens, heat soaking and more; that can be combined with ClearPoint™ units to obtain thermal performance, safety glazing and aesthetic design.

ClearPoint™ by Viracon is a point-supported insulating glass system that increases the transparency of glass façades. Specifically engineered to provide building designers with greater flexibility, ClearPoint™ allows architects to maximize clear openings and enhance aesthetics, delivering a clean, contemporary look both inside and out.

The hardware solution offered by Viracon is made from 316 stainless steel and has a Number 4 finish. The interior base spacer that rests between the exterior and interior glass of the insulating glass unit is comprised of a proprietary material that has passed testing for out-gassing, ultraviolet light, caulking and discoloration. A countersunk system is available for applications requiring exterior tempered glass solutions. Nupress can supply a variety of stems that connect the insulating glass unit fitting to the client's connection point.

CLEARPOINT™ KEY BENEFITS:

- *Increases the transparency of glass facades*
- *Maximizes natural daylight into the building*
- *Low-E coating, silk-screen and DigitalDistinctions™ capabilities to optimize aesthetics and performance.*
- *Backed by Viracon heat soaked tempered glass and insulating glass Standard limited Warranties for peace of mind.*
- *Approved with Argon gas filled spacer - Viracon is the only glass fabricator in North America to offer an IGCC-certified insulating point-supported system with an argon gas filled spacer.*



HILTON COLUMBUS DOWNTOWN

LOCATION: COLUMBUS, OHIO
GLASS TYPE: LAMINATED, SILK-SCREEN, CLEARPOINT™ (CANOPY); VE1-2M
ARCHITECT: HOK; MOODY NOLAN
GLAZING CONTRACTOR: SUPER SKY PRODUCTS (CANOPY); UNITED SKYS INC.
PHOTOGRAPHER: © WILLIAM LEMKE

JAMCO TEXAS HEADQUARTERS

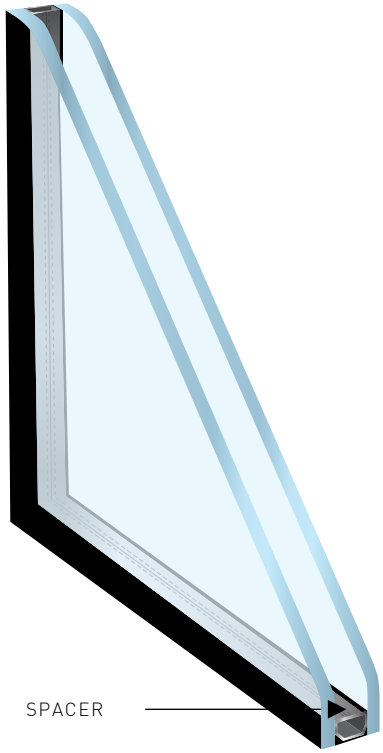
LOCATION: BASTROP, TEXAS // **GLASS TYPE:** VRE29-38, VRE29-54, CLEARPOINT™, DIGITALDISTINCTIONS™
ARCHITECT: HUSMANN ARCHITECTURE // **GLAZING CONTRACTOR:** JAMCO // **PHOTOGRAPHER:** © VIRACON, MIKE WINKLER

SPACERS

An insulating glass spacer is placed within the unit to separate the two or more plies of glass. Viracon's insulating glass spacers are available in two colors, three materials and a variety of thicknesses. When specifying an insulating glass unit, it is necessary to specify all three; color, material and thickness.

APPEARANCE

Color choices include a black painted finish or a mill finish which has a silver appearance. Mill finish spacers can be seen in the majority of existing buildings as they were the standard in the glass industry for many years. The trend is moving to black painted spacers as designers see the clean look this option provides. Black spacers tend to blend with the gaskets and framing which minimizes the overall visual impact by leading occupants to look through the glass rather than at the framing or spacer. The color of the spacer does not affect the solar performance of the insulating glass.

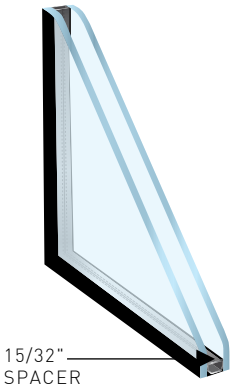


THICKNESS

The thickness of the spacer will determine the distance, or space, between the two glass plies in an insulating unit. Viracon's typical 1" insulating units are constructed using a 1/2" (13.2 mm) nominal thickness spacer, however a wide variety of alternate thickness spacers is available. Even a minimal change in the thickness of the spacer can affect solar performance so it is important to include the thickness in a specification.

7/8" VE1-48 INSULATING

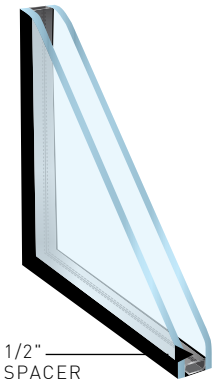
1/4" (6mm) clear with VUE-40 #2
15/32" (12mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.31
Summer u-value	0.30
SHGC	0.38

1" VE1-48 INSULATING

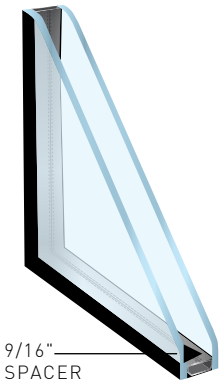
1/4" (6mm) clear with VUE-40 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.31
Summer u-value	0.28
SHGC	0.37

1-1/16" VE1-48 INSULATING

1/4" (6mm) clear with VUE-40 #2
9/16" (14mm) airspace
1/4" (6mm) clear



VLT	47%
Winter u-value	0.31
Summer u-value	0.28
SHGC	0.37

MATERIAL

Aluminum, Stainless Steel and ExtremEdge™ are the three spacer material options available from Viracon. Although aluminum is the most specified, increasing energy performance requirements are escalating the demand for alternate spacer options to improve edge of glass (EOG) u-value.

ALUMINUM

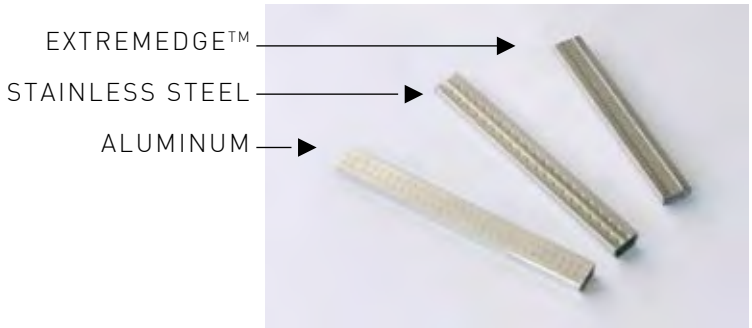
Historically has been the most-used spacer because of its malleability and availability.

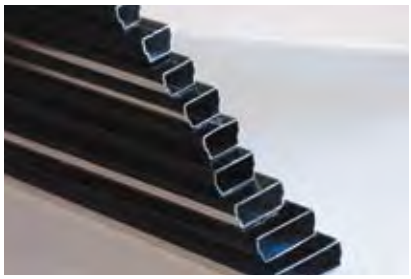
STAINLESS STEEL

A warm edge spacer option offered by Viracon. Stainless steel has one-tenth the thermal conductivity of aluminum.

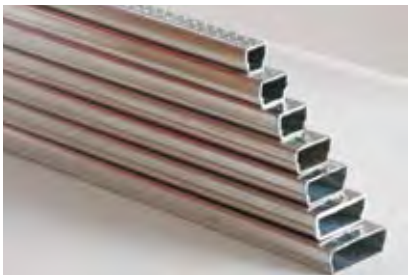
EXTREMEDGE™

Viracon's newest warm edge spacer offering. The ExtremEdge™ spacer consists of a biopolymer in the cross section area which is encapsulated in stainless steel. This combination further reduces the edge conductivity and thus reduces heat transfer into the building.





BLACK



MILL FINISH

SPACER AVAILABILITY

Please use this chart as a guideline when selecting spacer color, material and thickness.

		Aluminum		Stainless Steel		ExtremEdge™	
Nominal	**Thickness**	Black	Mill Finish	Black	Mill Finish	Black	Mill Finish
5/16"	7.5mm	YES					
3/8"	9.0mm	YES	YES		YES		
7/16"	11mm	YES					
15/32"	12mm	YES	YES		YES		
1/2"	13.2mm	YES	YES	YES	YES		
17/32"	13.5mm					YES	YES
9/16"	14mm	YES					
5/8"	15.5mm	YES	YES		YES		
3/4"	18.5mm	YES	YES		YES		
7/8"	22mm	YES	YES				
1"	25.4mm	YES	YES		YES		

Black painted and black anodized finishes are interchangeable.

ExtremEdge™ cannot be used in spandrel applications.

IBC BANK PLAZA

LOCATION: AUSTIN, TEXAS

GLASS TYPE: VE1-42, VE1-2M

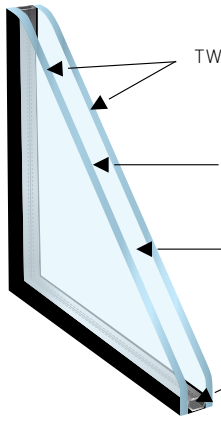
ARCHITECT: HKS, INC.

GLAZING CONTRACTOR: HARMON, INC.

PHOTOGRAPHER: © JONATHAN JACKSON

SPACER PERFORMANCE

Spacer materials that improve the u-value beyond the performance offered by aluminum are commonly grouped together under the category of warm edge spacers or warm edge technology. Below is an example of the improvement in thermal performance that can be obtained by using Viracon's warm edge spacers; ExtremEdge™ and Stainless Steel.



		Aluminum Spacer ½" (13.2 mm)	Stainless Steel Spacer ½" (13.2 mm)	ExtemEdge™ Spacer 17/32" (13.5 mm)
1" VE1-2M Insulating	Center of Glass U-Value[1]	Rough Opening U-Value[2]		
Conventionally Glazed Framing System	.25	.39	.38	.37
		CR[3] 48	*CR[3] 52*	*CR[3] 56*
2-Sided Structurally Glazed Framing System	.25	.35	.33	.32
		CR[3] 53	*CR[3] 57*	*CR[3] 64*
4-Sided Structurally Glazed Framing System	.25	.34	.31	.30
		CR[3] 56	*CR[3] 60*	*CR[3] 63*

1. Center of glass u-value is calculated using WINDOW 6.3.
2. Rough opening u-value is generated by an NFRC certified simulator using THERM 6.3 and WINDOW 6.3 based on NFRC Standard 100-2010 in a thermally enhanced framing system.
3. Condensation Resistance (CR): A relative indicator of a fenestration product's ability to resist the formation of condensation at a specific set of environmental conditions. The higher the Condensation Resistance value the greater the resistance to the formation of condensation.

UBIQUOSS

LOCATION: PANGYO, KOREA
GLASS TYPE: VNE1-63
ARCHITECT: HAEAHN ARCHITECTURE
GLAZING CONTRACTOR: WALLINK INTERNATIONAL LTD.
PHOTOGRAPHER: © ANNEWS, WWW.ANNEWS.CO.KR

COLLABORATIVE LIFE SCIENCES BUILDING, OHSU/OSU

LOCATION: PORTLAND, OREGON // **GLASS TYPE:** VE1-2M, VNE1-63 // **ARCHITECT:** CO ARCHITECTS (DESIGN); SERA ARCHITECTS (EXECUTIVE)
GLAZING CONTRACTOR: HARMON, INC. // **PHOTOGRAPHER:** © DALE LANG

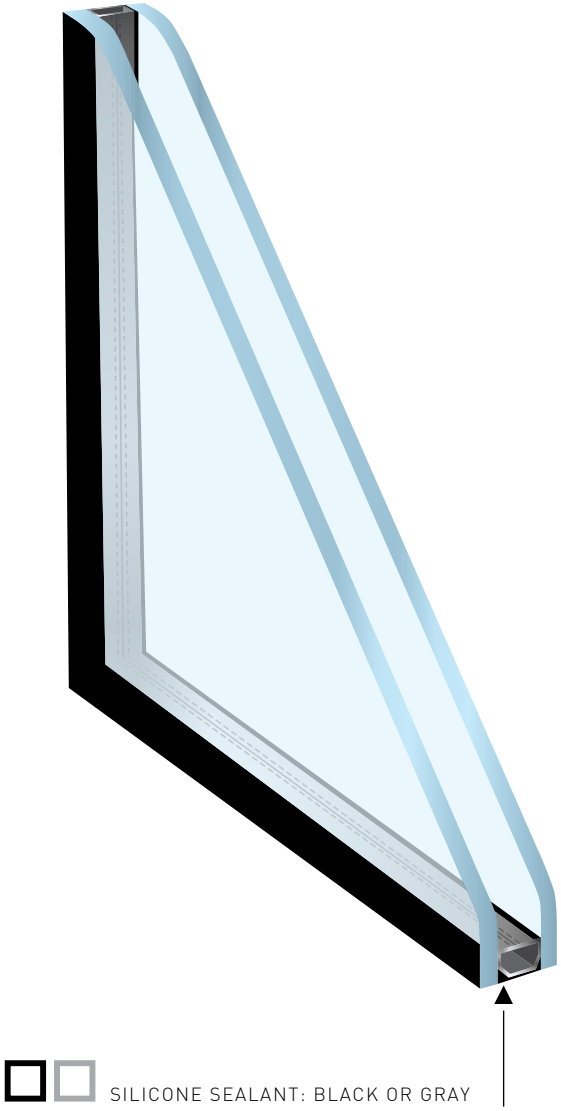
SILICONE

Viracon's insulating glass units are constructed with a dual seal configuration where polyisobutylene (PIB) is the primary seal and structural silicone is the secondary seal.

The PIB is the moisture barrier seal of the insulating glass unit preventing moisture vapor transmission into the unit's air space. It must also adhere well to the glass and spacer during the life of the insulating glass unit.

The secondary seal of silicone acts as the adhesive that holds the unit together in both conventional and structurally glazed systems. It must maintain its adhesion to the glass and air spacer throughout the life of the unit.

Silicone is uniquely resistant to ultraviolet light and is the only sealant capable of being exposed long term to UV, temperature extremes and harsh atmospheric conditions. The high strength of silicone makes it ideal for structurally glazed applications.

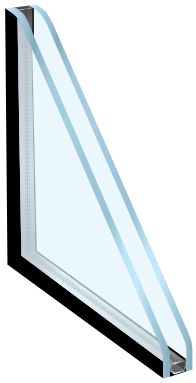


SPACER FILL

When specifying insulating glass with argon, it is important to also consider the thickness of the space. Increasing the thickness does not necessarily improve the thermal performance. There is an optimal thickness where each gas achieves the best performance. The optimal thickness for argon is 1/2".

7/8" VUE1-40 INSULATING

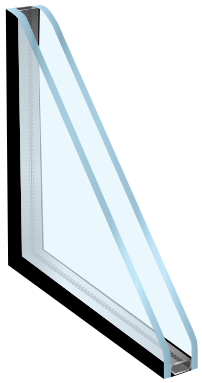
1/4" (6mm) clear with VUE-40 #2
3/8" (11mm) argon filled space
1/4" (6mm) clear



VLT	40%
Winter u-value	0.26
Summer u-value	0.26
SHGC	0.22

1" VUE1-40 INSULATING

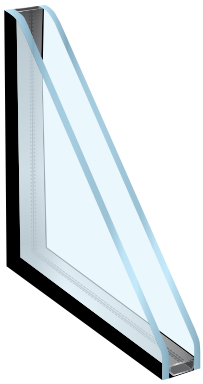
1/4" (6mm) clear with VUE-40 #2
1/2" (13.2mm) argon filled space
1/4" (6mm) clear



VLT	40%
Winter u-value	0.24
Summer u-value	0.20
SHGC	0.21

1-1/8" VUE1-40 INSULATING

1/4" (6mm) clear with VUE-40 #2
5/8" (15.5mm) argon filled space
1/4" (6mm) clear



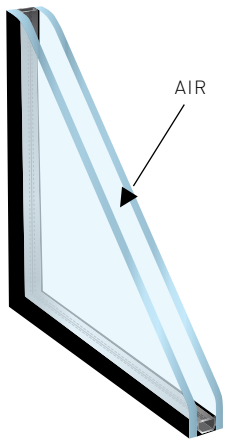
VLT	40%
Winter u-value	0.25
Summer u-value	0.19
SHGC	0.21

MSC INDUSTRIAL SUPPLY CO-HEADQUARTERS

LOCATION: DAVIDSON, NORTH CAROLINA
GLASS TYPE: VUE1-50
ARCHITECT: RULE JOY TRAMMELL + RUBIO
GLAZING CONTRACTOR: CABARRUS GLASS CO. INC.
PHOTOGRAPHER: © COURTESY RULE JOY TRAMMELL + RUBIO

1" CLEAR INSULATING

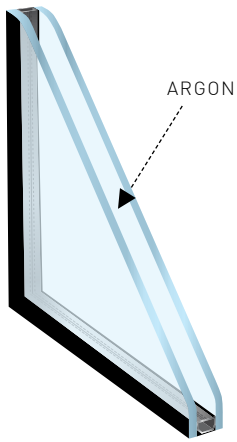
1/4" (6mm) clear
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	79%
Winter u-value	0.47
Summer u-value	0.49
SHGC	0.70

1" CLEAR INSULATING

1/4" (6mm) clear
1/2" (13.2mm) argon filled space
1/4" (6mm) clear



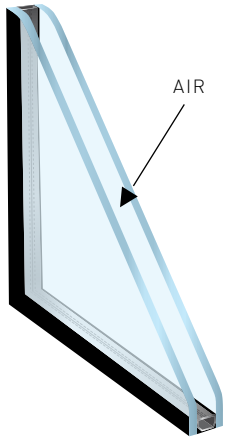
VLT	79%
Winter u-value	0.45
Summer u-value	0.47
SHGC	0.70

The standard fill option for insulating glass unit is air.

Argon is an invisible, non toxic gas with lower thermal conductivity than air. It can be used in place of air within an insulating unit to improve thermal performance (u-value).

1" VUE1-40 INSULATING

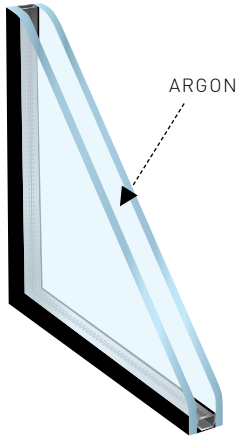
1/4" (6mm) clear with VUE-40 #2
1/2" (13.2mm) airspace
1/4" (6mm) clear



VLT	40%
Winter u-value	0.29
Summer u-value	0.26
SHGC	0.22

1" VUE1-40 INSULATING

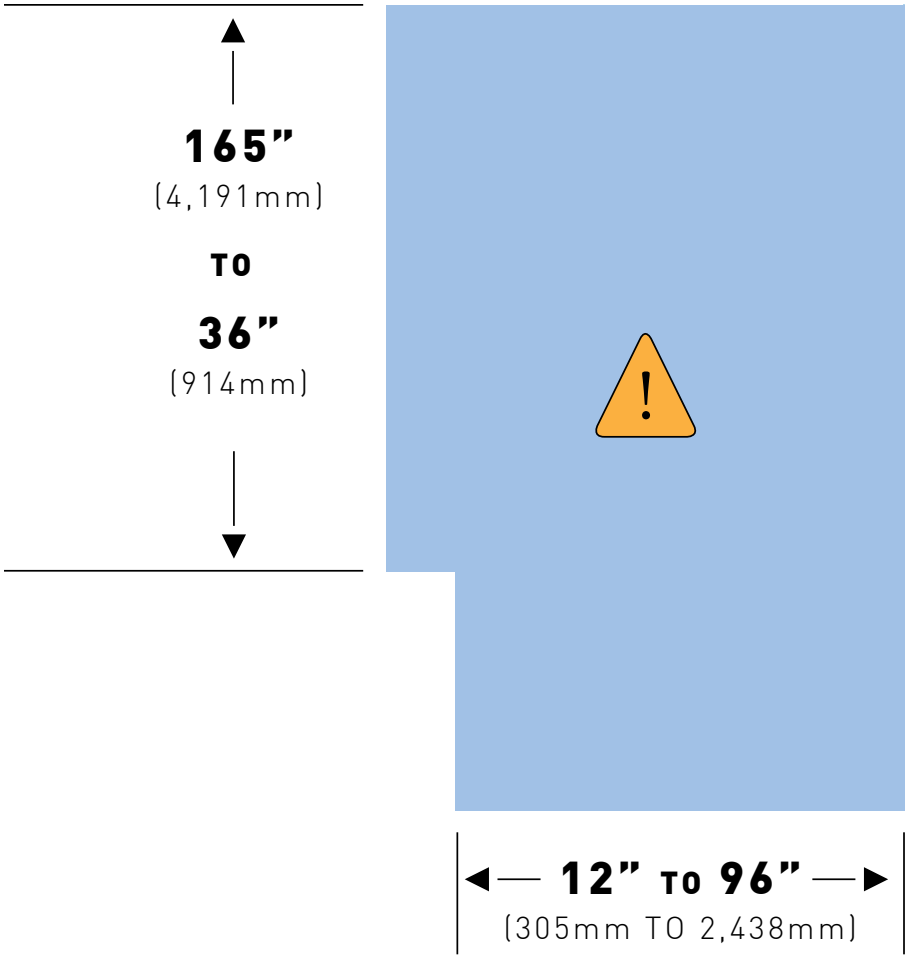
1/4" (6mm) clear with VUE-40 #2
1/2" (13.2mm) argon filled space
1/4" (6mm) clear



VLT	40%
Winter u-value	0.24
Summer u-value	0.20
SHGC	0.21

Argon gas alone is not enough to meet energy requirements. It should be specified in conjunction with a Low-E coating in order to provide optimal thermal performance.

INSULATING GLASS SIZES



Glass sizing is based on 1/4” (6mm) to 3/8” (10mm) thickness for both interior and exterior lites in vertical applications.

Insulating units > 70 square feet must be reviewed and approved by Viracon prior to receiving a quote.
Triple Insulating units cannot exceed 70 square feet.
Double laminated insulating units cannot exceed 40 square feet.

Configurations:

- *> 50 square foot units must be heat treated*
- *Laminated insulating units with a coating on the #4 surface cannot exceed an 84" width or 144" height.*
- *Triple insulating units cannot exceed a 72" width or 165" height*

Components & Enhancements:

- *Ceramic frit silk-screen or spandrel units cannot exceed an 84" width*
- *VE-45 coating cannot exceed an 84" width*
- *RoomSide™ Low-E coating cannot exceed 60" wide x 142" high or 72" wide x 120" high*
- *ClearPoint™ units must be reviewed and approved by Viracon prior to receiving a quote*
  - *Requires a minimum 24" width*
  - *Cannot exceed a 72" width or 120" height when using a SentryGlas® interlayer*
  - *Cannot exceed an 84" width or 144" height when using a PVB interlayer*

TORRE SOFIA

LOCATION: MONTERREY, MEXICO // **GLASS TYPE:** VRE1-38, VNE1-63 // **ARCHITECT:** PELLI CLARKE PELLI ARCHITECTS
GLAZING CONTRACTOR: GRUPO ALUVISA // **PHOTOGRAPHER:** © VIRACON, JUAN SCHNITZLER

DELTA HOTEL (LEFT), SOUTHCORE FINANCIAL CENTRE

LOCATION: TORONTO, ONTARIO, CANADA

GLASS TYPE: VRE1-46, VE1-42, VE24-2M

ARCHITECT: PAGE + STEELE / IBI GROUP ARCHITECTS

GLAZING CONTRACTOR: SOTA GLAZING INC.; TAGG INDUSTRIES

PHOTOGRAPHER: © ELIZABETH JONES, LENSCAPE INC.

BREMNER TOWER (RIGHT), SOUTHCORE FINANCIAL CENTRE

LOCATION: TORONTO, ONTARIO, CANADA

GLASS TYPE: VRE19-59, VLE19-57, VE1-2M

ARCHITECT: KPMB ARCHITECTS

GLAZING CONTRACTOR: OLDCASTLE BUILDING ENVELOPE

PHOTOGRAPHER: © ELIZABETH JONES, LENSCAPE INC.

GRAN TORRE COSTANERA

LOCATION: SANTIAGO, CHILE // **GLASS TYPE:** VRE1-54

ARCHITECT: PELLI CLARKE PELLI ARCHITECTS (DESIGN); ALEMPARTE BARREDA ARQUITECTOS ASOCIADOS (ARCHITECT OF RECORD)

GLAZING CONTRACTOR: FAR EAST ALUMINUM WORKS // **PHOTOGRAPHER:** © VIRACON, PEDRO DE LA FUENTE

LAMINAT

ED GLASS

ADD STRENGTH WITHOUT SUBTRACTING BEAUTY.

COLORADO TOWER

LOCATION: AUSTIN, TEXAS

GLASS TYPE: VRE1-46, VRE19-38, VS1-14

ARCHITECT: DUDA | PAINE ARCHITECTS, LLP; KENDALL/HEATON ASSOCIATES

GLAZING CONTRACTOR: JAMCO

PHOTOGRAPHER: © JONATHAN JACKSON

NORTH PATIENT TOWER, ORLANDO REGIONAL MEDICAL CENTER (PREVIOUS)

LOCATION: ORLANDO, FLORIDA

GLASS TYPE: VS1-20, VLE1-57, VLE1-39 (CANOPY)

ARCHITECT: HKS, INC.

GLAZING CONTRACTOR: HARMON, INC.; SUPER SKY PRODUCTS (CANOPY)

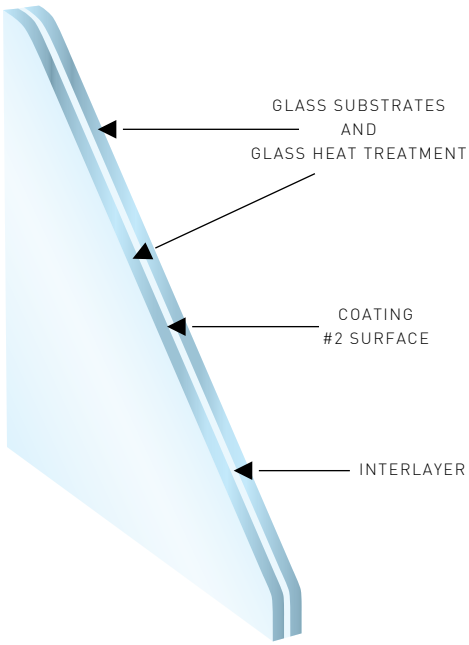
PHOTOGRAPHER: © BEN TANNER

PRODUCT OVERVIEW

The most common laminated glass units are constructed with two plies of glass permanently bonded together with one or more interlayers. The most important characteristics of laminated glass are fall-out protection due to the ability of the interlayer to support and hold the glass when broken as well as the reduced ability to penetrate the opening. The ability to resist various kinds of penetration is dependent upon a number of factors including thickness of the glass and the type of interlayer selected. For additional information regarding the interlayers, please refer to page 082.

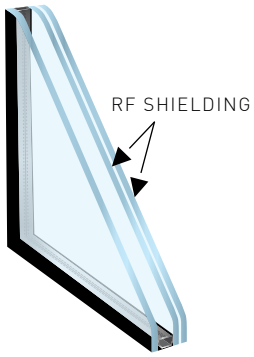
Laminated glass also offers a greater availability of coatings than monolithic glass. Low-E coatings which cannot be exposed, and therefore cannot be used with monolithic glass, can be used inside a laminated unit where they are protected.

Laminated glass units also have more aesthetic possibilities than monolithic glass. The interlayers used in laminated glass are available in a variety of colors and opacities. In addition, the Low-E coating and DigitalDistinctions™ or silk-screen pattern, if desired, are applied to the exterior ply of glass leaving the interior ply available for additional treatment. For a spandrel location, a full coverage opaque ceramic frit can be applied to surface #4. For vision areas where daylight is desired but view through needs to be minimized, a translucent ceramic frit can be applied to surface #3.

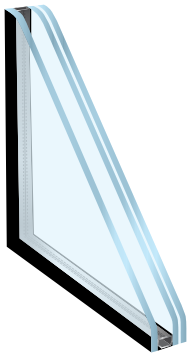


LAMINATED GLASS IDEAL FOR:

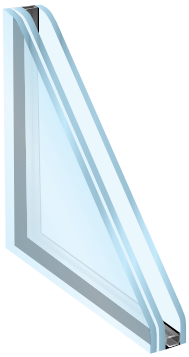
+ *Acoustic*
+ *Aesthetic*
+ *Blast-Mitigating*
+ *Hurricane-Resistant*
+ *Safety*
+ *Ultraviolet Protection*



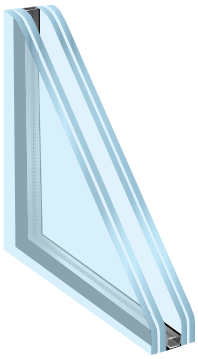
CYBERSHIELD™



INSULATING LAMINATED



LAMINATED INSULATING



DOUBLE LAMINATED INSULATING

CYBERSHIELD™

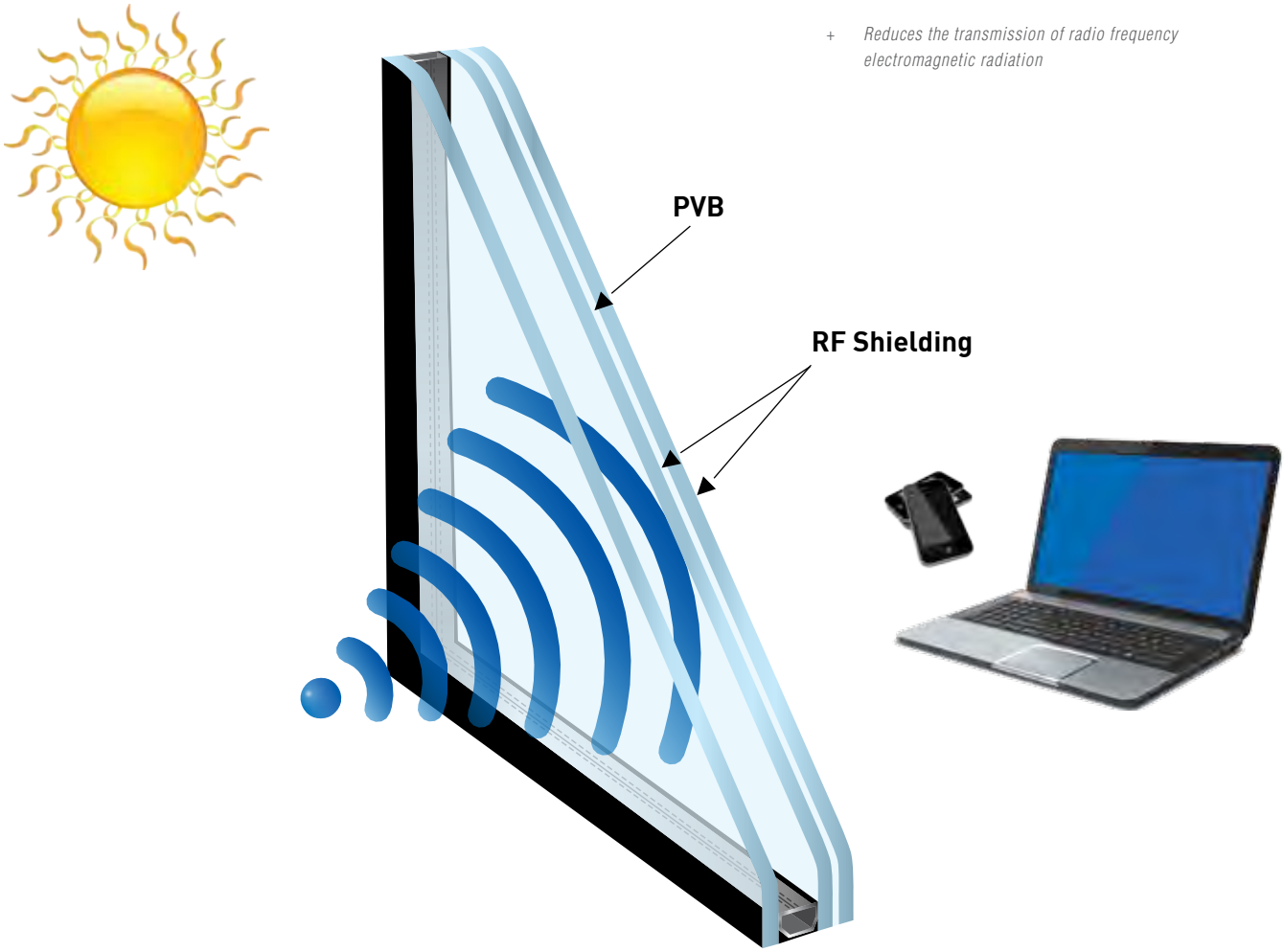
WITH PILKINGTON DATASTOP™

With more data being transmitted and shared electronically, it is becoming necessary to protect private conversations, boardroom discussions and trade secret documents from electronic eavesdropping. This is especially true for government organizations, businesses, architects and building owners looking for ways to design secure buildings. CyberShield™ by Viracon with Pilkington DATASTOP™ has been specifically engineered to reduce the transmission of radio frequency (RF) electromagnetic radiation, also known as RF Shielding.

CyberShield offers electrical attenuation with an average of 45 dB across a frequency range from 35 MHz to 18 GHz, while optimizing visible light transmission with a neutral glass color. Additionally, glass performance can be enhanced with a Low-E coating and/or silk-screen or DigitalDistinctions™.

CYBERSHIELD™ KEY BENEFITS:

+ *Reduces the transmission of radio frequency electromagnetic radiation*



INTERLAYERS

Interlayers are used to permanently bond two plies of glass in a laminated configuration. Laminated glass is a great choice for many applications to meet a variety of requirements. Viracon offers a vast selection of interlayer options to meet your specific requirements.

INTERLAYER OPTIONS

POLYVINYL BUTYRAL (pvb) is a standard architectural interlayer available in three thicknesses:

a. .030”

b. .060”

c. .090”

SAFLEX® SILENTGLASS ACOUSTIC is a three layer system designed to decouple and disseminate sound waves for superior sound damping performance. Interlayer available in .030" thickness

SENTRYGLAS® is an ionoplast interlayer bonded directly between two layers of glass for superior protection. The rigid interlayer minimizes deflection. Available interlayer thicknesses:

a. .060”

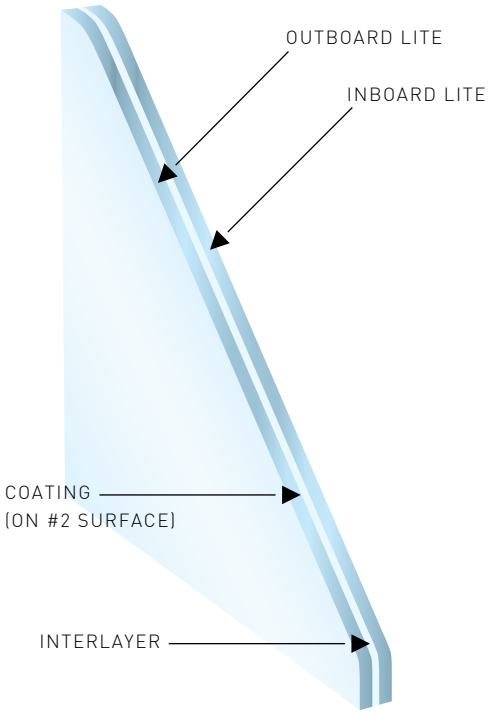
b. .090”

c. .100”

STORMGUARD® is an enhanced polyvinyl butyral (pvb) interlayer which provides excellent adhesion to glass and optimum performance for large missile hurricane-resistant applications. StormGuard has less deflection and better tear resistance than standard pvb interlayers. It is also available in combination with Vanceva® Color interlayers. Interlayer available in .100" thickness.

VANCEVA® STORM is a pvb / pet film / pvb composite laminated between two panes of glass. The composition provides the impact resistance of pvb and the tear resistance of a polyethylene terephthalate (pet) film. Interlayer available in .077" thickness

VANCEVA® COLOR is an interlayer system made up of base colors and a range of white interlayers that can be combined to achieve varying layers of translucency and color.



SOLAR PERFORMANCE

The solar performance of a glass unit results from the configuration of the unit along with the thickness of the glass used. Altering the thickness of an interlayer in a laminated glass unit, will have an insignificant effect on performance data.

INTERLAYERS AND COATINGS

Each interlayer has different availability with each of Viracon’s coatings. For additional information regarding coating and interlayer compatibility, see the Coatings section on pages 012-013.

VANCEVA® COLOR

Vanceva® Color is an interlayer system made up of base colors and a range of white interlayers that can be combined to achieve varying layers of translucency and color.

Here is how the system works:
1) Each Vanceva® base interlayer is designated by a number or letter.

2) A single color can be selected or the base interlayers can be stacked to provide the specific color and opacity desired. Up to four interlayers* can be stacked between two plies of glass within a laminated glass unit.

Each Vanceva® Color combination is given a four digit code. The specific layers and order of the layers determines the four digit code. This code can then be used in your laminated glass specification.

If the desired color is achieved with less than four base interlayers, a clear pvb is typically added to achieve .060" thickness and is represented with a zero.

MICHAEL A. EVANS CENTER FOR HEALTH SCIENCES, MARIAN UNIVERSITY

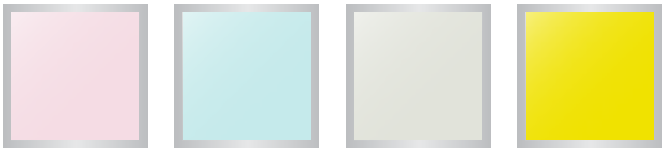
LOCATION: INDIANAPOLIS, INDIANA

GLASS TYPE: VUE1-50, VE1-2M, VE1-85, OPTIWHITE™/VE1-85, VANCEVA COLOR SYSTEM

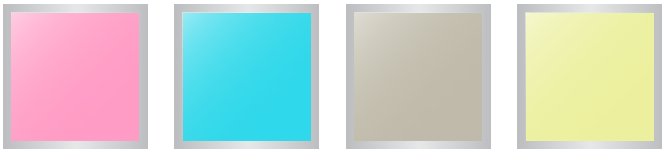
ARCHITECT: SCHMIDT ASSOCIATES; BSA LIFESTRUCTURES

GLAZING CONTRACTOR: HOOSIER GLASS CO. INC.

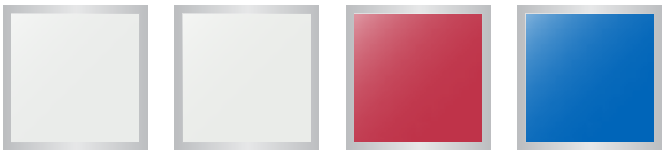
PHOTOGRAPHER: © COURTESY SCHMIDT ASSOCIATES



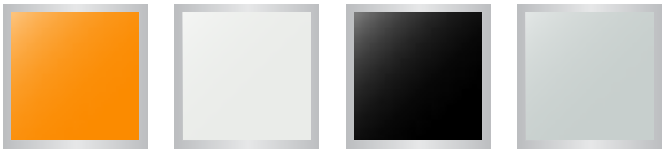
1=Coral Rose | 2=Aquamarine | 3=Smoke Gray | 4=Sahara Sun



5=Ruby Red | 6=Sapphire | 7=Evening Shadow | 8=Golden Light

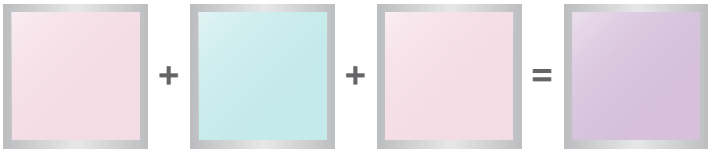


9=Arctic Snow (translucent) | A=Cool White (translucent) | C=Deep Red | D=True Blue



E=Tangerine | F=Polar White | G=Absolute Black | H=Ocean Gray

2=Aquamarine + 4=Sahara Sun = Vanceva 0024



1=Coral Rose + 2=Aquamarine + 1=Coral Rose = Vanceva 0121

**Vanceva® Color base interlayers are limited to three interlayers when used in combination with a coating. Due to coating and Vanceva Color base interlayer properties, a clear pvb interlayer must be placed between the coating and interlayer.*

LAMINATED GLASS

LAMINATED GLASS APPLICATIONS

	Primary Application							
Interlayer Material	Blast Mitigating (low-medium)	Blast Mitigating (medium-high)	Hurricane Resistant (small missile)	Hurricane Resistant (large missile)	Ultraviolet Protection	Aesthetic	Acoustic	Safety
Polyvinyl butyral (pvb) .030"	X				X		X	X
Polyvinyl butyral (pvb) .060"	X		X		X		X	X
Polyvinyl butyral (pvb) .090"	X			X	X		X	X
Saflex® SilentGlass Acoustic .030					X		X	X
SentryGlas® .060"	X			X	X			X
SentryGlas® .090"	X			X	X			X
SentryGlas® .100"	X			X	X			X
StormGuard® .100"		X		X	X			X
Vanceva® Storm .077"		X		X	X			X
Vanceva® Color					X	X		X

**This chart is a general reference to represent the primary use for each type of interlayer. It does not indicate compliance for a specific application. Laminated glass is a component of the overall glazing system therefore the performance in a specific application is dependent upon being installed into an adequately designed frame which is then installed appropriately for the specific application.*

PRIMARY APPLICATIONS:

ACOUSTIC

Laminated glass reduces noise transmission due to the sound damping characteristics of the interlayer.

AESTHETIC

Laminated glass interlayers offer a selection of color and opacity not achievable with other glass products such as coatings, glass substrates, silk-screen or spandrel glass. This is especially true with bright, vivid colors as well as opaque or translucent / frosted aesthetic requirements.

BLAST MITIGATING

Viracon provides a variety of laminated glass options that help mitigate the effects of air-blast attacks. Important note: Laminated glass is considered a component of the overall glazing system, therefore; the blast mitigating performance is also dependent upon being installed into an adequately designed frame which is then anchored appropriately to the wall structure. Viracon recommends the involvement of a blast consultant to verify the performance of the glass and framing system combination.

HURRICANE RESISTANT

Hurricane resistant laminates offered by Viracon meet or exceed stringent building code requirements of Florida and other coastal regions. The laminated glass is a component of the overall glazing system and every Viracon hurricane resistant glass product has passed the impact and cyclic wind pressure test as part of a complete glazing system. When choosing the right hurricane resistant glass for your application, the following points must be evaluated:

1. Determine the applicable building code and test method
2. Determine the required design pressure/wind load
3. Qualify the missile requirement - large and/or small missile

4. Identify the largest glass size
5. If using a tested or certified framing system, confirm the laminated glass qualified with the particular manufacturer's product
6. If not using a tested or certified frame, evaluate system design details, such as:
    a. Glazing method - conventional or structurally glazed
    b. Glass bite - Often large missile applications require a minimum edge engagement of 5/8" to augment performance.
    c. Anchorage and hardware requirements - typically large missile applications require an enhanced design.

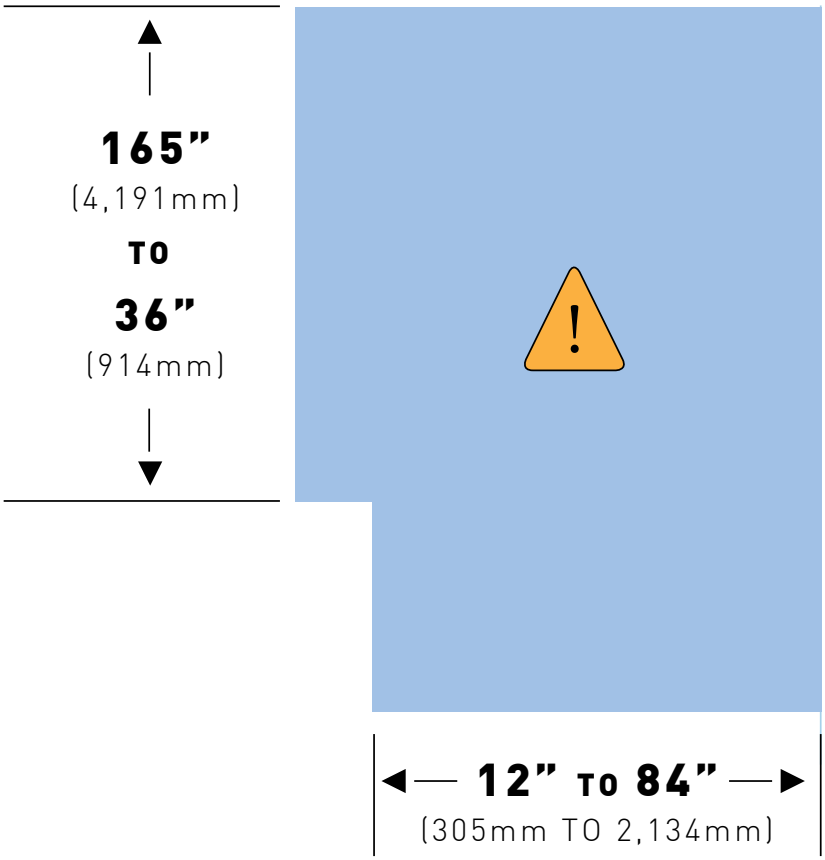
Hurricane resistant laminates offered by Viracon are Dade County approved and carry a component NOA.
For information on the current code requirements and test methods for a specific application and project location, please reference the applicable standard or the International Building Code (Impact Provision).

1. Safety - Viracon's architectural laminated glass products with a minimum .030" pvb interlayer comply with ANSI Z97.1-1984 and CPSC 16 CFR 1201, which are the industry safety standards for glazing materials.
2. Ultraviolet Protection – Laminated glass provides 99% UV light blockage at the wavelength range of ~300 - 380 nanometers

GENERAL FUNDING OFFICE BUILDING

LOCATION: MIAMI, FLORIDA // **GLASS TYPE:** VLE19-39, VLE26-39 // **ARCHITECT:** NICHOLS BROSCH WURST WOLFE & ASSOCIATES
GLAZING CONTRACTOR: GLASSWALL, LLC // **PHOTOGRAPHER:** © MIAMI IN FOCUS, INC.

LAMINATED GLASS SIZES



Glass sizing is based on 1/4” (6mm) to 3/8” (10mm) thickness for both interior and exterior lites in vertical applications.

Insulating Laminated and Laminated Insulating units > 70 square feet must be reviewed and approved by Viracon prior to receiving a quote.
Double laminated insulating units cannot exceed 40 square feet.
CyberShield™ units cannot exceed 60 square feet.

Configurations:

- *> 50 square foot units must be heat treated*
- *Laminated insulating units with a coating on the #4 surface cannot exceed a 144" height.*
- *Specialty laminates for hurricane applications have the following limitations:*
  - *Vanceva® Storm cannot exceed a 60" width or 144" height*
  - *StormGuard® cannot exceed a 72" width or 144" height*
  - *SentryGlas® cannot exceed a 72" width or 120" height*

Components & Enhancements:

- *Ceramic frit silk-screen or spandrel units cannot exceed an 84" width*
- *RoomSide™ Low-E coating cannot exceed 60" wide x 142" high or 72" wide x 120" high*
- *ClearPoint™ units must be reviewed and approved by Viracon prior to receiving a quote*
  - *Requires a minimum 24" width*
  - *Cannot exceed a 72" width or 120" height when using a SentryGlas® interlayer*
  - *Cannot exceed an 84" width or 144" height when using a PVB interlayer*
- *CyberShield™ units must be reviewed and approved by Viracon prior to receiving a quote*
  - *Requires a minimum 24" width*
  - *Cannot exceed 60" wide x 144" high or 72" wide x 120" high*

COLLEGE OF ARTS AND SCIENCES, EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

LOCATION: DAYTONA BEACH, FLORIDA // **GLASS TYPE:** VLE1-70/PACIFICA // **ARCHITECT:** LEO A DALY
GLAZING CONTRACTOR: WEST TAMPA GLASS // **PHOTOGRAPHER:** © COURTESY WEST TAMPA GLASS, ROGER CAMPLA

THE MOTHER BABY CENTER

LOCATION: MINNEAPOLIS, MINNESOTA // **GLASS TYPE:** VE19-2M, VANCEVA COLOR SYSTEM
ARCHITECT: HDR INC. // **GLAZING CONTRACTOR:** EMPIREHOUSE INC. // **PHOTOGRAPHER:** © BALLOGGPHOTO.COM

MONOLITH

IC GLASS

STANDS UP TO VIRTUALLY EVERYTHING.

INCLUDING THE DISCERNING EYES OF ARCHITECTS.

185 POST STREET

LOCATION: SAN FRANCISCO, CALIFORNIA

GLASS TYPE: MONOLITHIC WITH CUSTOM SILK-SCREEN

ARCHITECT: BRAND + ALLEN ARCHITECTS

GLAZING CONTRACTOR: C S ERECTORS INC.

PHOTOGRAPHER: © VIRACON, DAVID MADRID

HOWARD HUGHES CENTER (PREVIOUS)

LOCATION: LOS ANGELES, CALIFORNIA

GLASS TYPE: VT1-20, VS1-08, VA1-18, VA1-35

ARCHITECT: DMJM ARCHITECTS

GLAZING CONTRACTOR: WALTERS & WOLF

PHOTOGRAPHER: © FLICKR

PRODUCT OVERVIEW

Monolithic Glass is a single lite of glass that is typically used in the construction of the final Viracon fabricated product.

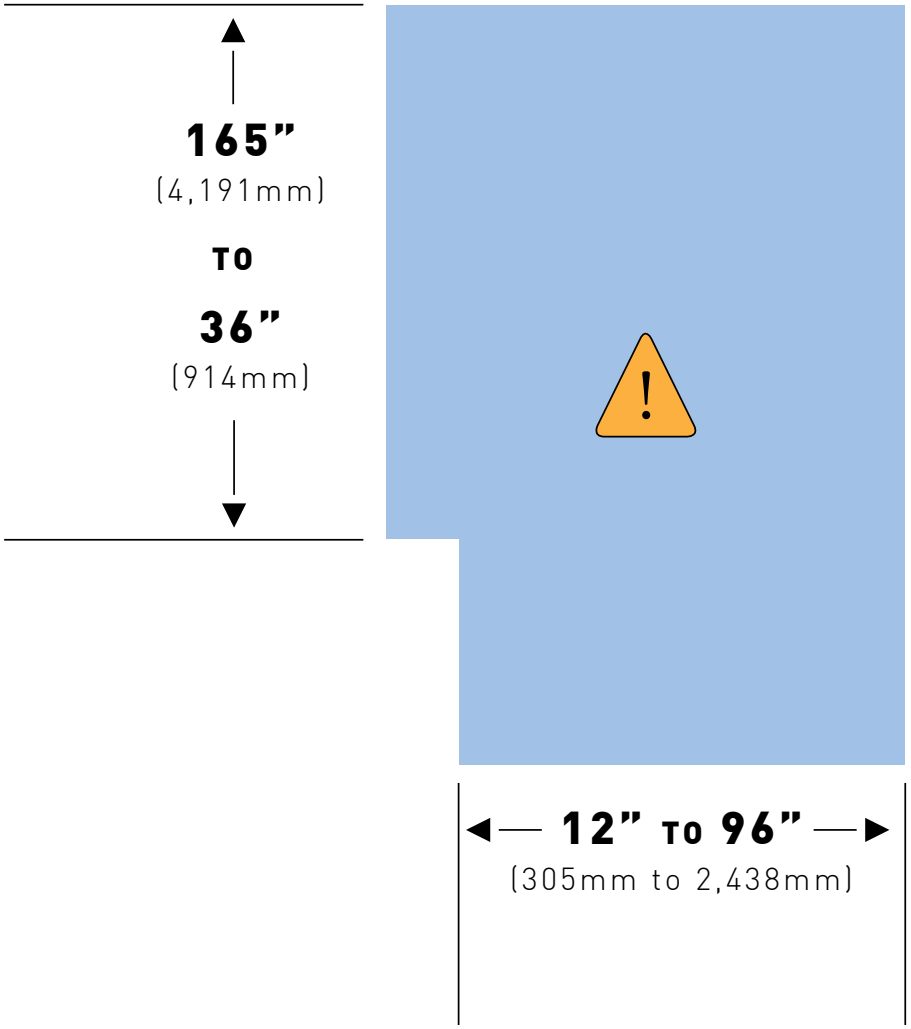
Viracon uses clear and tinted float glass substrates from all the major U.S. float glass manufacturing companies. Please note that the only Viracon coatings that can be supplied on monolithic glass are Stainless Steel (VS) and Pewter (VP).

A monolithic glass product is enhanced for strength (see heat treatment), design (see silk-screen, spandrel and DigitalDistinctions™) and aesthetics (see substrates and coatings). Additionally, monolithic glass is used to fabricate Viracon insulating and laminated glass products (see insulating and laminated).

Single lite of glass that can be used alone or incorporated within Viracon fabricated insulating and laminated products.

MONOLITHIC GLASS SIZES

Glass sizing is based on 1/4” (6mm) to 3/8” (10mm) thickness in vertical applications.



Monolithic glass units > 70 square feet must be reviewed and approved by Viracon prior to receiving a quote.

Configurations:

- *> 50 square foot units must be heat treated*

Components & Enhancements:

- *Ceramic frit silk-screen or spandrel units cannot exceed an 84” width*

RESO

URCES

THE BEAUTIFUL, UNIFORM FOUNDATION ON WHICH LANDMARK GLASS PROJECTS ARE BUILT.

ONE57

LOCATION: NEW YORK, NEW YORK

GLASS TYPE: VRE13-59, VRE19-59

ARCHITECT: ATELIER CHRISTIAN DE PORTZAMPARC (DESIGN); SLCE ARCHITECTS (ARCHITECT OF RECORD)

GLAZING CONTRACTOR: PERMASTEELISA NORTH AMERICA CORP.

PHOTOGRAPHER: © GREG WEST

MICHAEL A. EVANS CENTER FOR HEALTH SCIENCES, MARIAN UNIVERSITY (PREVIOUS)

LOCATION: INDIANAPOLIS, INDIANA

GLASS TYPE: VUE1-50, VE1-2M, VE1-85, OPTIWHITE™/VE1-85, VANCEVA COLOR SYSTEM

ARCHITECT: SCHMIDT ASSOCIATES; BSA LIFESTRUCTURES

GLAZING CONTRACTOR: HOOSIER GLASS CO. INC.

PHOTOGRAPHER: © COURTESY SCHMIDT ASSOCIATES

RESOURCES HIGHLIGHTS

GLASS SAMPLES

Glass samples are available for visual representation of Viracon products. To request samples, contact Viracon at 800.533.2080 or visit viracon.com.

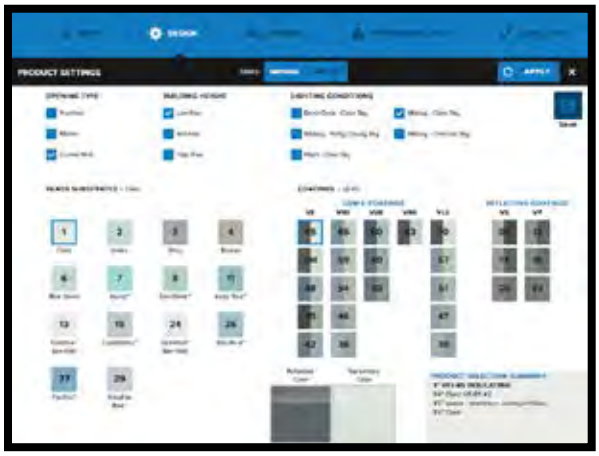
SAMPLES AVAILABLE:

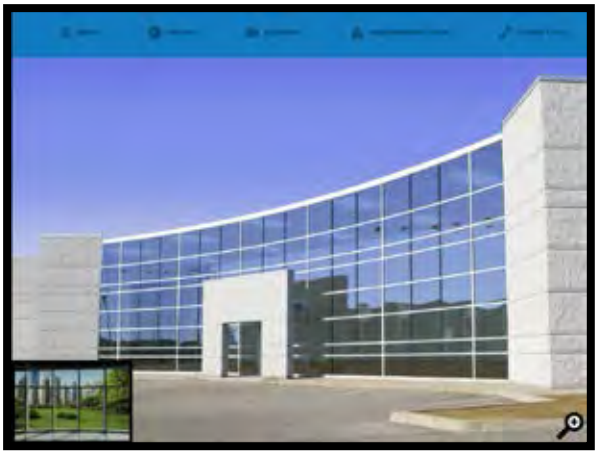
Custom 12" x 12" glass samples specific to your request

Glass Sample Kits:

- Viracon Insulating Low-E Kit
  - Contains 8 samples - 1" (5" x 7") Insulating units with black spacers and black silicone
- Viracon DigitalDistinctions™ Kit
  - Contains 16 samples - 1/4" (4" x 6") Monolithic Glass
- Viraspan™ Ceramic Frit Spandrel and Silk-screen Kit
  - Contains 16 samples - 1/4" (4" x 6") Monolithic Glass

MOBILE APP





The *ViraconGlass* app* offers different building types, heights, and lighting conditions to view your architectural glass products. You can select from all of Viracon's standard coatings and substrates to find the right glass for your next project. You can also compare different glass products side-by-side along with the performance data for each. *ViraconGlass* also allows you to understand size capability by dragging a corner or entering the dimensions manually to identify minimum and maximum sizes for each glass product.

Download on the App Store

*The ViraconGlass app is only available on the iPad®.

**Viracon strongly recommends using glass samples and mock-up wall evaluations to assist in making final glass selections.

EDUCATIONAL RESOURCES

We understand there are a number of factors and considerations that must be made when selecting glass products for a building design. Viracon has provided design and educational resources to assist with this process.

- **AIA Presentations** – Viracon is an AIA/CES Approved Provider and offers interactive and in person presentations for architects.

- **BIM Library** – We've created a Viracon library to simplify the process of adding our glass products into Revit Building Information Models.

- **Glazing Guidelines** – Documents and information regarding Viracon's guidelines for glazing, glass handling and storage, maintenance and cleaning and glass breakage. See page 118.

- **Green Design / LEED** – Learn how Viracon products contribute to LEED (Leadership in Energy and Environmental Design) Rating Systems.

- **Specification** – Using CSI's MasterFormat, our recommended 08 80 00 specification provides a comprehensive list of items to include when specifying glass products. See page 100.

- **Tech Talks** – See viracon.com for specific and detailed documents covering the following topics:
  - Bird Friendly Glass
  - Field-Applied Coatings and Films on Glass
  - Glass Staining
  - Heat Soak Testing
  - Insulating Glass Sealant Visual Characteristics
  - Moiré Pattern
  - Quench Pattern Characteristics
  - Reflective Glass
  - The Role of Reflectivity in Glass
  - Thermal Stress Breakage
  - Viewing Windows for Swimming Pools and Aquariums

RECOMMENDED ARCHITECTURAL GLASS SPECIFICATION

The specification on the following pages is written according to the Construction Specifications Institute (CSI) 3-Part Format. The specification can be customized for your project by including details for the products you are specifying in Article 2.6 Product Schedule. The blue text below is intended to be altered to identify the specific product you selected. Please contact the Architectural Design team at 800.533.2080 or email glass@viracon.com with any glass specification questions.

PLEASE SEE EXAMPLE BELOW

STEP 1. Select a product: For Example - VRE6-54 Insulating Glass.

STEP 2. Find the product type in Article 2.6 Product Schedule.

A. Insulating Coated Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance: { }%
   b. Exterior Reflectance: { }%
   c. Winter U-Value: { }
   d. Summer U-Value: { }
   e. Shading Coefficient: { }
   f. Solar Heat Gain Coefficient: { }
   g. Light to Solar Gain Ratio: { }

STEP 3. Insert VRE6-54 into your specification including all of the details needed to manufacture the glass unit as well as the solar performance requirements.

A. Insulating Coated Glass:

1. 1" VRE6-54 Insulating Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: 1/4" Blue-green HS
   b. Coating: VRE-54 on #2 Surface
   c. Space: 1/2" – aluminum, black painted, air filled
   d. Silicone: black
   e. Interior Glass Ply: 1/4" Clear HS
2. Performance Requirements
   a. Visible Light Transmittance: 41%
   b. Exterior Reflectance: 24%
   c. Winter U-Value: 0.30
   d. Summer U-Value: 0.27
   e. Shading Coefficient: 0.29
   f. Solar Heat Gain Coefficient: 0.25
   g. Light to Solar Gain Ratio: 1.63

The information in the Architectural Glass Specification on pages 100 - 114 is offered to assist in specifying Viracon's Fabricated Glass Products. Viracon does not assume any responsibility for the adequacy of this specification for a particular application. The design professional must confirm applicable code and design.

DIVISION 08 – OPENINGS

08 80 00 GLAZING

PART 1 – GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

B. Section Includes:

1. Transparent and translucent glass glazing for general and special purpose applications including; coated, float, heat-strengthened, impact resistant, insulating, low emissivity, laminated, spandrel and tempered glass.
2. Work Results: Manufacture, handle, deliver and install glazing systems as shown on the architectural drawings or as otherwise specified and in accordance with the requirements of the contract documents.

1.2 REFERENCES

A. Abbreviations and Acronyms:

1.	AAMA	American Architectural Manufacturers Association
2.	ANSI	American National Standards Institute
3.	ASTM	Formerly the American Society for Testing and Materials
4.	CPSC	Consumer Products Safety Commission
5.	FT	Fully Tempered
6.	GANA	Glass Association of North America
7.	HS	Heat-strengthened
8.	ICC	International Code Council
9.	IGCC	Insulating Glass Certification Council
10.	IGMA	Insulating Glass Manufacturers Alliance
11.	LBNL	Lawrence Berkeley National Laboratories
12.	LEED	Leadership in Energy & Environmental Design
13.	Low-E	Low emissivity
14.	LSG	Light to Solar Gain
15.	NFRC	National Fenestration Rating Council
16.	SHGC	Solar Heat Gain Coefficient
17.	SC	Shading Coefficient
18.	USGBC	The U.S. Green Building Council
19.	VLT	Visible Light Transmittance

B. Definitions:

1. Deterioration of Coated Glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
2. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.
3. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delaminating material obstructing vision through glass and blemishes exceeding those allowed by referenced laminated glass standards.
4. Interspace or Airspace: The space between lites of any insulating glass unit that contains dehydrated air or a specified gas.
5. Manufacturer: A firm that produces primary glass or fabricated glass products as defined in referenced glazing publications.

C. Reference Standards: This section does not require compliance with standards, but is merely a listing of those used. If compliance is required, statements will be included in the appropriate Section.

1. ASTM C 1036 Standard Specification for Flat Glass
2. ASTM C 1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
3. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass
4. ASTM C 1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
5. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation (replaces ASTM E773, E774 CBA, CAN / CGSB 12.8)
6. ASTM E 546 Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units
7. ASTM E 576 Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units in the Vertical Position
8. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings
9. ASTM C 1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate
10. ANSI Z97.1 Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings
11. BS EN 14179 Glass in building - Heat-soaked thermally-toughened soda lime silicate safety glass
12. CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials

1.3 SUBMITTALS

A. Shop Drawings: Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.

B. Samples: Submit 12-inch (305 mm) long samples of each type of glass indicated except for clear monolithic glass products, and 12-inch (305 mm) long samples of each color required, except black, for each type of sealant or gasket exposed to view.

C. Test and Evaluation Reports: Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.

D. Manufacturer Reports: Submit Glass Fabricator's Shop Drawing Review indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.

E. Sustainable Design Submittals: Submit manufacturer's documentation verifying product content, origin or other attributes for projects requiring special sustainability provisions, to meet the USGBC's LEED requirements or other sustainable goals.

F. Warranties:

1. Provide a written 10-year warranty from date of manufacture for sputter coated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
2. Provide a written 10-year warranty from date of manufacture for laminated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
3. Provide a written 10-year warranty from date of manufacture for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
4. Provide a written 10-year warranty from date of manufacture for Viraspan ceramic frit. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
5. Provide a written 5-year warranty from date of manufacture for fully tempered glass that has been Heat Soaked. Warrants that heat soaked tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions at a rate exceeding 0.5% (5/1000) for a period of five years from the date of manufacture.
6. Provide a written 5-year warranty from date of manufacture for DigitalDistinctions™ digitally printed ceramic ink. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.

B. Mock-ups: Before glazing, build mockups for each glass product indicated in section 2.5 Product Schedule to verify selections and to demonstrate aesthetic effects and qualities of materials and execution.

1. Construction: Build mockups with glass and glazing systems specified for the project, including typical lite size, framing systems and glazing methods.
2. Scheduling: Notify architect seven days in advance of dates and times when mockups will be available for viewing.
3. Quality Assurance: Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work. Accepted mockups may become part of the completed work if undisturbed at the time of substantial completion.

C. Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or in Article 1.2 References.

1. GANA Glazing Manual
2. GANA Engineering Standards Manual
3. GANA Laminated Glazing Reference Manual

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and Handling Requirements:

1. Protect glass from edge damage during handling. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.
2. Storage and Protection: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

1.6 SITE CONDITIONS

A. Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40°F (4.4°C).

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Source Listing: Acceptable source, Viracon, Inc.

B. Substitution Limitations: In some cases, it may be necessary to use the specified product without substitution, either to match work-in-place or to match similar products used in another facility or for another reason determined by the owner. Confirm constraints with the Owner or other Authority Having Jurisdiction.

C. Product Options: Obtain glass and glazing materials from one source for each product indicated. Coatings and finished assemblies, such as insulating units and laminated units, to be manufactured by the same fabricator in order to have a common source of warranty.

2.2 DESCRIPTION

A. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.

2.3 PERFORMANCE / DESIGN CRITERIA

A. Glass Strength: Analysis shall comply with ASTM E 1300 Determining Load Resistance of Glass in Buildings. Provide glass products in the thickness and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions.

1. Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:
   a. 8 breaks per 1000 for glass installed vertically or not 15 degrees or more from the vertical plane and under wind action.
   b. 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.
2. Deflection must be limited to prevent disengagement from the frame and be less than or equal to 1” (25mm).

B. Thermal and Optical Performance: Provide glass products with performance properties specified in 2.5 Product Schedule. Performance properties to be manufacturer’s published data as determined according to the following procedures:

1. Center of glass U-Value: NFRC 100 methodology using LBNL WINDOW 5.2/6.3 computer program.
2. Center of glass solar heat gain coefficient: NFRC 200 methodology using LBNL-35298 WINDOW 5.2/6.3 computer program.
3. Solar optical properties: NFRC 300

2.4 FABRICATION

A. Flat Glass:

1. Shall comply with ASTM C1036 Standard Specification for Flat Glass, Type 1, Class 1 (clear) or Class 2 (tinted, heat-absorbing and light reducing) and Quality q3
2. ASTM C 1048 Heat Treated Flat Glass, Kind HS or FT (remove ASTM Standard C 1048 if annealed glass), Condition A (uncoated), B (spandrel glass, one surface coated), or C (other coated glass
   a. Heat Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
   b. Maximum peak to valley rollerwave 0.003" (0.08mm) in the central area and 0.008" (0.20mm) within 10.5" (267mm) of the leading and trailing edge
   c. For clear or low-iron glass ≥ 5mm thick without ceramic frit or ink, maximum + or – 125 mD (millidiopter) over 95% of the glass surface.
   d. Maximum bow and warp 1/32" per lineal foot (0.79mm).
   e. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
   f. For all fully tempered glass, provide heat soak testing conforming to EN14179 which includes a 2 hour dwell at 290°C±10°C.

B. Insulating Glass:

1. Shall comply with ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
   a. Units shall be certified for compliance by the IGCC in accordance with the above ASTM test method.
2. The unit overall thickness tolerance shall be -1/16" (1.59mm) / +1/32" (0.79mm) for a 1" two ply insulating unit. Unit constructed with patterned or laminated glass shall be +/-1/16" (1.59mm).
3. Shall comply with ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units
4. Shall comply with ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position
5. Sealed Insulating Glass Units to be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone.
   a. The minimum thickness of the secondary seal shall be 1/16" (1.59mm).
   b. The target width of the primary seal shall be 5/32" (3.97mm).
   c. There shall be no voids or skips in the primary seal.
   d. Up to a maximum of 3/32" of the airspacer may be visible above the primary polyisobutylene sealant.
   e. Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1/16" (1.59mm) by maximum length of 2" (51mm) with gaps separated by at least 18" (457mm). Continuous contact between the primary seal and the secondary seal is desired.
6. To provide a hermetically sealed and dehydrated space, lites shall be separated by a spacer with bent corners and straight butyl injected zinc plated steel straight key joints.

C. Laminated Glass:
   1. Shall comply with ASTM 1172 Standard Specification for Laminated Architectural Flat Glass.
   2. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
   3. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

D. Coated Vision Glass:
   1. Shall comply with ASTM C 1376 Standard for Pyrolytic and Vacuum Deposition Coatings on Glass
   2. Coated products to be magnetically sputtered vacuum deposition (MSVD)
   3. Edge Deletion – When low-e coatings are used within an insulating unit, coating shall be edge deleted to completely seal the coating within the unit.
      a. The edge deletion should be uniform in appearance (visually straight) and remove 95% of the coating.

E. Ceramic Coated Glass Products:
   1. Shall comply with ASTM C 1048 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated, Condition B
   2. Silk-screen pattern should be no more than 0.0625” (1.59 mm) off parallel from locating glass edge and no more than 0.125” (3.18 mm) from edges other than locating glass edge.
   3. Silk-screen pattern shall have a maximum of a 0.03125” (0.79 mm) variation in dot, hole or line location.
   4. Digital print should be no more than 1/16” (1.6 mm) off parallel from locating glass edge and no more than 1/8” (3 mm) from edges other than locating glass edge.
   5. Digital print shall have a maximum of a 1/32” (0.8 mm) variation in dot, hole or line location.
   6. Digital print may have an indefinite boarder of up to 1/32” (0.8 mm).

2.5 ACCESSORIES

A. Glazing Materials: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
   1. Setting blocks to be 100% silicone with a durameter hardness of 85±5.

2.6 PRODUCT SCHEDULE

All products shall comply with ASTM Standards and requirements in Article 2.3 Materials.

A. Insulating Coated Glass:
   1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Coated Glass as manufactured by Viracon.
      a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
      b. Coating: {Coating} on #2 Surface
      c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
      d. Silicone: {gray or black}
      e. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}

2. Performance Requirements
   a. Visible Light Transmittance: { }%
   b. Exterior Reflectance: { }%
   c. Winter U-Value: { }
   d. Summer U-Value: { }
   e. Shading Coefficient: { }
   f. Solar Heat Gain Coefficient: { }
   g. Light to Solar Gain Ratio: { }

B. Laminated Coated Glass:
1. {Overall Thickness} {Product Number, ex: VLE1-57} Laminated Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Interlayer: {Thickness} {Type – pvb, StormGuard, etc}
   d. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

C. Monolithic Reflective Glass:
1. {Overall Thickness} {Product Number, ex: VS1-14} Monolithic Reflective Glass as manufactured by Viracon.
   a. Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
2. Performance Requirements
   a. Visible Light Transmittance: { }%
   b. Exterior Reflectance: { }%
   c. Winter U-Value: { }
   d. Summer U-Value: { }
   e. Shading Coefficient: { }
   f. Solar Heat Gain Coefficient: { }
   g. Light to Solar Gain Ratio: { }

D. Insulating Laminated Coated Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Laminated Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Interior Glass Ply 1: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   f. Interlayer: {Thickness} {Type – pvb, StormGuard, etc}
   g. Interior Glass Ply 2: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

E. Laminated Insulating Coated Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Laminated Insulating Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply 1: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Interlayer: {Thickness} {Type – pvb, StormGuard, etc}
   c. Exterior Glass Ply 2: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   d. Coating: {Coating} on #4 Surface
   e. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   f. Silicone: {gray or black}
   g. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

F. Triple Insulating Coated Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Triple Insulating Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Spaces: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Middle Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   f. Coating: VE-85 on #4 Surface
   g. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance: { }%
   b. Exterior Reflectance: { }%
   c. Winter U-Value: { }
   d. Summer U-Value: { }
   e. Shading Coefficient: { }
   f. Solar Heat Gain Coefficient: { }
   g. Light to Solar Gain Ratio: { }

G. Insulating Coated Spandrel Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Coated Spandrel Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   f. Ceramic Frit: {Frit Color – ex: V933 Warm Gray} on #4 Surface
2. Performance Requirements
   a. Winter U-Value: { }
   b. Summer U-Value: { }

H. Viraspan™ Insulating Coated Silk-screened Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Coated Silk-screened Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Ceramic Frit: {Frit Color – ex: V933 Warm Gray} on #2 Surface
   d. Pattern: {Viraspan Design, Viraspan Design-Plus or Viraspan Design-Original} {Screen #} {Pattern – dots, lines, custom, etc.}

e. Pattern Orientation: {Orientation - lines vertical, horizontal, etc.}

f. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled

g. Silicone: {gray or black}

h. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}

2. Performance Requirements

a. Visible Light Transmittance: { }%

b. Exterior Reflectance: { }%

c. Winter U-Value: { }

d. Summer U-Value: { }

e. Shading Coefficient: { }

f. Solar Heat Gain Coefficient: { }

g. Light to Solar Gain Ratio: { }

I. Viraspan™ Monolithic Spandrel Glass:

1. {Overall Thickness} Viraspan Monolithic Spandrel Glass as manufactured by Viracon.

a. Glass Ply: {Thickness} {Color} {Heat Treatment - HS or FT}

b. Ceramic Frit: {Frit Color – ex: V933 Warm Gray} on #2 Surface

2. Performance Requirements

a. Winter U-Value { }

b. Summer U-Value { }

J. Viraspan™ Monolithic Silk-screened Glass:

1. {Overall Thickness} Viraspan Monolithic Silk-screened Glass as manufactured by Viracon.

a. Glass Ply: {Thickness} {Color} {Heat Treatment - HS or FT}

b. Ceramic Frit: {Frit Color – ex: V933 Warm Gray} on #2 Surface

c. Pattern: {Viraspan Design, Viraspan Design-Plus or Viraspan Design-Original} {Screen #} {Pattern – dots, lines, custom, etc.}

d. Pattern Orientation: {Orientation - lines vertical, horizontal, etc.}

2. Performance Requirements

a. Visible Light Transmittance { }%

b. Exterior Reflectance { }%

c. Winter U-Value { }

d. Summer U-Value { }

e. Shading Coefficient { }

f. Solar Heat Gain Coefficient { }

g. Light to Solar Gain Ratio { }

K. ClearPoint™ Insulating Point Supported Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness, must be 3/8" or greater} {Color} Heat Treatment FT – Heat Soaked
   b. Coating: {Coating} on #2 Surface
   c. Exterior hole to be countersunk
   d. Space: 1/2" (13.2 mm) black air filled space
   e. Silicone: {gray or black}
   f. Interior Glass Ply: {Thickness, must be 1/4" or greater} {Color} Heat Treatment FT – Heat Soak
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

L. ClearPoint™ Insulating Laminated Point Supported Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Laminated Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness, must be 3/8" or greater} {Color} Heat Treatment FT – Heat Soaked
   b. Coating: {Coating} on #2 Surface
   c. Exterior hole to be countersunk
   d. Space: 1/2" (13.2 mm) black air filled space
   e. Silicone: {gray or black}
   f. Interior Glass Ply 1: {Thickness, must be 1/4" or greater} {Color} Heat Treatment FT – Heat Soak
   g. Interlayer: {Thickness} {Type – pvb, StormGuard, etc}
   h. Interior Glass Ply 2: {Thickness, must be 1/4" or greater} {Color} Heat Treatment FT – Heat Soak
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

M. DigitalDistinctions™ Insulating Digital Printed Glass:

1. {Overall Thickness} Insulating Digital Printed Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - HS or FT}
   b. Digital Print File: {File # – ex: D5555} or {Custom artwork to be supplied by architect} on #2 Surface
   c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Interior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
2. Performance Requirements
   a. Visible Light Transmittance: { }%
   b. Exterior Reflectance: { }%
   c. Winter U-Value: { }
   d. Summer U-Value: { }
   e. Shading Coefficient: { }
   f. Solar Heat Gain Coefficient: { }
   g. Light to Solar Gain Ratio: { }

N. CyberShield™ Insulating Laminated RF Shielding Glass:

1. {Overall Thickness} {Product Number, ex: VRE1-46} Insulating Laminated Coated Glass as manufactured by Viracon.
   a. Exterior Glass Ply: {Thickness} {Color} {Heat Treatment - AN, HS or FT}
   b. Coating: {Coating} on #2 Surface
   c. Space: {Thickness} {Material – aluminum, stainless steel, etc.} {finish – mill finish or black painted} {Gas – argon or air} filled
   d. Silicone: {gray or black}
   e. Interior Glass Ply 1: 1/4" Clear {Heat Treatment - HS or FT}
   f. Coating: Pilkington DATASTOP™ on #4 Surface
   g. Interlayer: {Thickness, must be greater than .060} {Type – pvb, StormGuard, etc}
   h. Interior Glass Ply 2: 1/4" Clear {Heat Treatment - HS or FT}
   i. Coating: Pilkington DATASTOP™ on #6 Surface
2. Performance Requirements
   a. Visible Light Transmittance { }%
   b. Exterior Reflectance { }%
   c. Winter U-Value { }
   d. Summer U-Value { }
   e. Shading Coefficient { }
   f. Solar Heat Gain Coefficient { }
   g. Light to Solar Gain Ratio { }

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Verify prepared openings for glazing are correctly sized and within tolerance. Verify that the minimum required face and edge clearances are being followed.
2. Verify that a functioning weep system is present.
3. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Immediately before glazing, clean glazing channels and other framing members receiving glass. Remove coatings not firmly bonded to substrates.

B. Demolition / Removal: Remove and replace glass that is broken, chipped, cracked or damaged in any way.

3.3 INSTALLATION

A. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials including those in the GANA Glazing Manual except where more stringent requirements are indicated.

B. Prevent glass from contact with contaminating substances that result from construction operations such as weld splatter, fire-safing or plastering.

3.4 CLEANING

A. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers.

CONFIDENTIAL PROJECT

LOCATION: CHANTILLY, VIRGINIA // **GLASS TYPE:** VRE1-46, VE1-85 // **ARCHITECT:** KGD ARCHITECTURE
GLAZING CONTRACTOR: HARMON INC. // **PHOTOGRAPHER:** © COURTESY JAMES G. DAVIS CONSTRUCTION

QUALITY STANDARDS

INSULATING GLASS UNITS

Viracon's insulating glass units are Insulating Glass Certification Council (IGCC) certified to ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

LAMINATED GLASS UNITS

Viracon's laminated glass units with a minimum .030" pvb interlayer comply with ANSI Z97.1 and CPSC 16 CFR 1201, which are the industry safety standards for glazing materials. In addition, Viracon's laminated glass units comply with ASTM 1172 Standard Specification for Laminated Architectural Flat Glass.

EDGE BLUSHING In both structural and butt glazed applications, silicone sealants may come in contact with the polyvinyl butyral (pvb) interlayer used in laminated glass. When silicone contacts the laminated glass edge, a cosmetic blushing of the pvb interlayer will occur over time. It generally begins as a small bubble formation at the contacted edge, which then grows to form a limited unbonded area at the glass edge. This reaction is limited and generally does not exceed more than 3/8" (9.5 mm). Edge blushing may be visible however does not affect the structural integrity of the laminated glass with respect to its ability to resist uniform loads.

COATED GLASS - LOW-E OR REFLECTIVE

Viracon's coated glass products comply with ASTM Standard C1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

INSPECTION GUIDELINES

PINHOLES Inspect glass from a distance of 10 ft. (3 m) in transmission, at a viewing angle of 90° 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" (75 mm) diameter circle and no more than five readily apparent blemishes are allowed in a 12" (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, and 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 80 percent central glass area, and scratches up to 3" (75 mm) are allowed in the outer area. Concentrated scratches or abraded areas are not allowed.

DIGITALDISTINCTIONS™ GLASS

Please reference pages 030-033 for more information.

SILK-SCREENED GLASS

Viracon's silk-screened glass products comply with ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass – Kind HS, Kind FT Coated and Uncoated, Condition B.

INSPECTION GUIDELINES

View silk-screened glass from a distance of 10 feet (3m) under natural daylight conditions. Pinholes larger than 1/16" (1.6mm) are not allowed if noticeable from a distance of 10 feet or greater. Color as well as opacity of the ceramic frit pattern may vary slightly due to paint thickness variations.

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

PATTERN DEFINITION a print definition of 1/32" (0.8mm) indefinite border is acceptable.

PATTERN REGISTRY Maximum variation of +/- 1/32" (0.8mm) in dot, line or hole location is acceptable. Full coverage translucent frit is available with the following criteria:

- Pinholes to 1/16" diameter, fisheyes, streaks from screening process and paint particles are allowed. Large clusters of close spacing of pinholes or other defects are not allowed in the central 80% of the glass area.
- Color and uniformity may vary slightly due to variations in ceramic frit thickness.
- Approval of a full-size mock-up at an 11 foot inspection distance and a 90-degree angle to glass surface against a bright uniform background is required.
- Not for use in interior applications

SPANDREL GLASS

Viracon's spandrel glass products comply with ASTM C 1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass – Kind HS, Kind FT Coated and Uncoated, Condition B

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.

In structurally glazed applications, a clear edge may be visible. Contact Viracon's Architectural Inside Sales Department for more information.

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.

ISO 9001

When products, systems, machinery and devices work well and safely, it is often because they meet standards and the organization responsible for many thousands of the standards which benefit the world is ISO the International Organization for Standardization. Viracon is an ISO 9001 certified company. This certification encompasses Viracon's entire operation – sales, customer service, financial services, scheduling, purchasing, fabricating and shipping – to ensure a consistent level of quality in production.

GLAZING GUIDELINES

Viracon specifies that 100% silicone setting blocks be used for all types of glazing systems. The blocks should have a Shore-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 1). For additional recommendations, contact the appropriate gasket or framing manufacturer.

Viracon specifies that edge blocks or anti-walk blocks be used for dry glazed systems. Viracon also specifies that edge blocks be silicone and have a Shore-A Durometer hardness of 60 ±5 and be a minimum of 4" in length. They should be installed in the vertical channel with a 1/8" (3mm) clearance between glass edge and block. This will limit lateral movement of the glass. 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, (See Figure 2).

WEEP SYSTEM

The edges of laminated, insulating, and spandrel glass should not be exposed to water or moisture vapor for extended periods of time. Exposure of the glass to moisture vapor or liquid water for extended periods will ultimately result in seal failure, coating deterioration, sealant deterioration, or delamination. Viracon requires either a positive weather seal, or an adequate weep system to prevent this occurrence (See Figure 3). The effectiveness of the weep system or weather seal depends on the design, workmanship, engineering, and mock-up verification testing completed by the glazing manufacturer, installer, or designer. Responsibility for the weep system and its performance is the responsibility of those parties or others, and is not the responsibility of Viracon.

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 the Technical Services Department at Viracon.

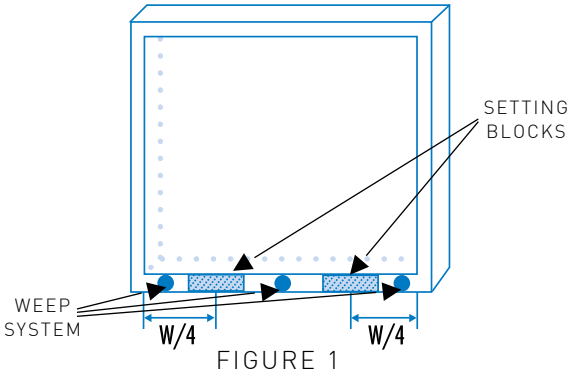


FIGURE 1

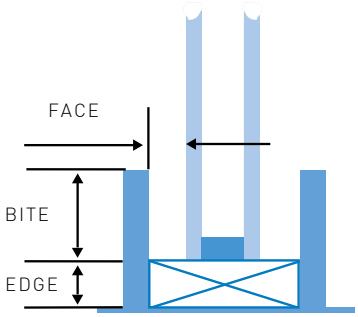


FIGURE 2

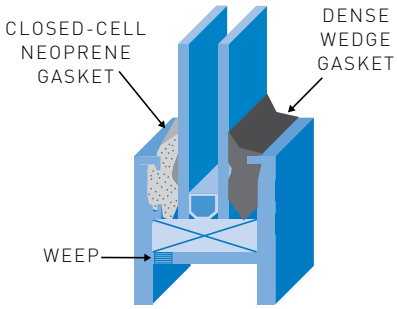


FIGURE 3

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.

HANDLING INSTRUCTIONS

Translucent frits are ceramic enamels that are silk-screened onto glass and fused onto the surface during heat treatment. The silk-screening process involves depositing the frit on the glass through a nylon mesh. Due to the paint composition, the resultant surface retains some surface irregularity after it is fired onto the glass surface.

Since the surface is rougher than a normal glass surface, clean conditions must exist during installation to prevent contaminants or sealants from begriming the glass. Viracon recommends wearing clean cotton or rubber gloves when handling this product. In addition, caution is recommended when working with sealants because liquid sealants that penetrate the porous surface may become difficult to remove once cured. Be aware of the rough surface so appropriate precautions can be taken by the other trades.

MAINTENANCE

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 glass surfaces. Do not use abrasive cleaners, razor blades, putty knives and metal parts of cleaning equipment, since these will scratch the coating. Fingerprints, grease, smears, dirt, scum and sealant residue are more noticeable on coated glass, requiring more frequent cleaning. Follow the same cleaning techniques used for non-coated glass. If detergent residue is still present, it can be effectively removed with a 50/50 solution of isopropyl alcohol and water. The glass surface should then be wiped dry with a clean grit-free cloth or squeegee.

▶ *For more detailed cleaning and maintenance recommendations, please visit viracon.com.*

GLASS BREAKAGE

It is important to first determine appropriate loads for the glass. Viracon can supply 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 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. If not, Viracon will transfer the pattern to mylar at an additional charge. Viracon will not be responsible for size accuracy. For additional information, contact Viracon Inside Sales.

WARRANTY INFORMATION

Viracon 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 glass. 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 4). Visit viracon.com for copies of our product warranties.

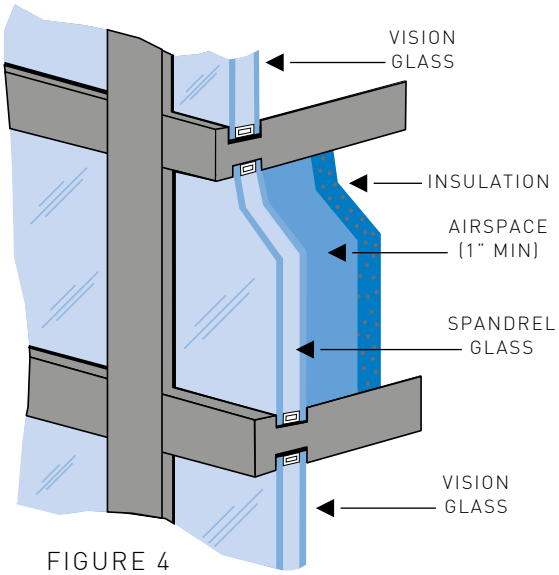


FIGURE 4

RECOMMENDED GLASS CLEARANCES AND TOLERANCES	Glass Thickness	Edge Clearance	Face Clearance	Glass Bite	Dimensional Tolerance	Thickness Tolerance
Monolithic	1/4" (6mm)	1/4" (6mm)	1/8" (3mm)	3/8" (10mm)	±1/16 (±1.6mm)	ASTM C1036
Laminated - 2 plies 1/4" (6mm)	1/2" (12mm)	1/4" (6mm)	1/8" (3mm)	1/2" (13mm)	+3/16" / -1/16" (+4.8mm / -1.6mm)	ASTM C1172
Insulating - 1/4" (6mm) Exterior Lite 1/2" (13.2mm) Spacer 1/4" (6mm) Interior Lite	1" (25mm)	1/4" (6mm)	3/16" (5mm)	1/2" (13mm)	+3/16" / -1/16" (+4.8mm / -1.6mm)	+1/32" / -1/16" (+.8mm / -1.6mm)

GLOSSARY

Acoustics: The science of sound and sound control.

Air Side: The side of float glass that was up, or exposed to the “air”, when it was manufactured. The bottom side is referred to as the “tin” side because it floated on a liquid tin bath. Coatings are applied to the air side.

Air Spacer: A desiccant filled frame used to separate two lites of glass in an insulating unit.

Annealed: Raw glass with low residual stresses. This enables cutting and fabrication.

Argon Gas: An invisible non toxic gas used in insulating units to enhance the units insulating performance (u-value).

Autoclave: A vessel that employs high pressure and heat. In the glass industry, used to produce a bond between glass interlayers creating a laminated glass product.

Bite: The dimension by which the framing system overlaps the edge of the glazing infill.

Blast Resistant Glass: A laminated glazing construction commonly specified to mitigate injuries from flying glass resulting from an air-blast explosive.

Butt Glazed: The installation of glass products where the vertical glass edges are without structural supporting mullions.

Butyl: Shortened term for polyisobutylene. The primary seal of an insulating unit and key component in restricting moisture vapor transmission.

Capillary Tube: A small tube factory-placed into the air spacer of an insulating unit used for balancing interior and exterior pressures during transportation over higher elevations i.e. mountain ranges or air transport.

Ceramic Frit: An enamel applied to glass for decorative/aesthetic appearances and/or functionality such as solar control, ceramic frit is applied with a large roller for full spandrel applications or through a screen for silk-screen applications.

Ceramic Ink: An enamel applied to glass for decorative and aesthetic appearances and/or functionality such as solar control, ceramic ink is applied with a programmable print head for digital inkjet printing. Ceramic ink has a thinner viscosity than ceramic frit which allows it to flow through the print head.

Coated Glass: A general reference to any glass incorporating a reflective or low-e coating.

Condensation: The appearance of moisture (water vapor) on the surface of an object caused by warm moist air coming into contact with a colder object.

Conventionally Glazed: A framing system that captures the glazing component in the glazing channel.

CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

Delamination: An unbonded area in laminated glass between glass and PVB.

Desiccant: Small extremely porous beads used to absorb moisture in the sealed air spacer of an insulating unit.

Distortion: Alteration of viewed images caused by variations in glass flatness or inhomogeneous portions within the glass, an inherent characteristic of heat-treated glass.

Double Laminated Insulating Glass: An insulating glass unit in which both the interior and exterior components are a laminated glass.

Double Strength: Refers to clear 1/8” (3mm) thick float glass.

Dual Seal: Refers to an insulating unit with a primary seal of polyisobutylene (butyl) and a secondary seal of silicone.

Emissivity: The measure of a surface’s ability to emit long-wave infrared radiation.

Etch: To alter the surface of glass with hydrofluoric acid or other caustic agents. Permanent etching of glass may occur from alkali and other runoff from surrounding building materials.

Float Glass: Glass formed on a bath of molten tin. The surface in contact with the tin is known as the tin surface or tin side. The top surface is known as the atmosphere surface or air side.

Fully Tempered Glass (FT): Glass that has been heat-treated to have either a minimum surface compression of 10,000 psi or an edge compression not less than 9700 psi in accordance with the requirements of ASTM C 1048 kind FT or meet the requirements of ANSI Z97.1 or CPSC 16 CFR 1201 safety glazing standards. Tempered glass is 4-5 times stronger than annealed glass and when broken breaks into small relatively harmless pieces.

Glazing: (n) A generic term used to describe an infill material such as glass. (v) The process of installing an infill material into a prepared opening in windows, door panels, partitions, etc.

Ground Edge: A special fabrication done to the edge of a piece of glass. Makes the edge smooth and gives it a whitish/gray appearance.

Heat Soak: A process of heating glass to a specific temperature for a specified time in a special oven in an attempt to find any impurities in the glass known as “nickel sulfide inclusions”.

Heat Strengthened (HS): Glass that has been heat-treated to have a surface compression between 3500 and 7500 psi and meet the requirements for ASTM C 1048 kind HS. It is ~2-3 times the strength of annealed glass. Heat-strengthened glass is not a safety glazing material and will not meet the requirements of ANSI Z97.1 or CPSC 16 CFR 1201.

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.

Heat Treated: Term used for both fully tempered glass and heat-strengthened glass.

Hurricane / cyclic wind-resistant glass: Laminated glazing tested to one or more test protocols for high velocity hurricane winds and windborne debris.

Infrared (IR): IR is part of the solar spectrum or sunlight that is invisible to the human eye. It has a wavelength range of ~790-3000 nanometers and has a penetrating heat effect. Short-wave IR converts to heat when it is absorbed by an object.

Insulating Glass (IG): Two glass components separated by an air spacer and hermetically sealed. Inherently insulating glass increases a window’s thermal performance.

Insulating Laminated Glass: An insulating glass unit in which the exterior component is a monolithic glass ply and the interior component is laminated glass.

Interlayer: Refers to the plastic or vinyl in a laminated unit.

Iridescence: Also called strain pattern or Q-lines. It is a pattern in heat treated glass not normally visible except under certain lighting conditions. It is especially visible with the use of a polarized lens. Iridescence is an inherent characteristic of heat treated glass.

Laminated Glass: Two or more pieces of glass bonded together by a piece of plastic/vinyl called polyvinyl butyral (PVB.) A minimum interlayer thickness of .030 (.76mm) meets the requirements of ANSI Z97.1 or CPSC 16 CFR 1201 safety glazing standards.

Laminated Insulating Glass: An insulating glass unit in which the exterior component is a laminated glass and the interior component is a monolithic glass ply.

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.

Lite: Another term for a pane of glass. Sometimes spelled "light" in industry literature.

Low-E: An abbreviation for Low Emissivity coatings. They are applied to glass to reflect invisible long-wave infrared or heat. They reduce heat gain or loss in a building by redirecting the heat. In addition they typically provide greater light transmission low reflection and reduce heat transfer.

Low iron: Low iron glass is a type of float glass manufactured with less iron than standard clear glass. With this reduction in iron content the greenish tint is reduced. UltraWhite™, Starphire® and Optiwhite™ are low iron glass substrates.

Lucor: A powder used to separate lites of glass to prevent damage from scratching or rubbing.

Mock-Up: A full size sample or model of a unit normally used to judge appearance and performance.

Monolithic: Refers to a single lite of glass as a finished product.

Mullion: A horizontal or vertical member that supports and holds such items as panels, glass, sash or sections of a curtain wall.

Negative Air: Refers to an insulating unit wherein the two lites of glass are closer together in the center of the unit than they are at the edge. This gives the unit the appearance of being "bowed in".

Nickel Sulfide: An inclusion in float glass that can cause spontaneous breakage in fully tempered glass.

Offset Glass: unit wherein the two glass ply edges are intentionally not aligned.

OITC Rating: Outside-Inside Transmission Class Rating is used to classify acoustic performance of glazing in exterior applications.

Pattern Glass: Glass with textured surface to emit light but restrict vision.

Polished Edge: A special fabrication done to the edge of a piece of glass. Makes the edge smooth and gives it an extremely shiny or polished appearance.

Polyisobutylene (PIB): The primary seal of an insulating unit and the key component in restricting moisture vapor transmission.

Polyurethane: Also commonly called urethane. Used by some insulating fabricators for a secondary sealant. It is also an interlayer used in polycarbonate security products.

Polyvinyl Butyral (PVB): The plastic or vinyl used in the makeup of a laminated unit. The vinyl is what holds that unit together.

Positive Air: The opposite of negative air. In an insulating unit where the center of the unit is farther apart than around the air spacer these units have a bowed out appearance.

Pyrolytic Deposition: A process of applying a thin metallic coating to the surface of flat glass during the float glass manufacturing process.

R-Value: Thermal resistance of a glazing system expressed ft2/hr/°F/BTU (m2/W/°C). The r-value is the reciprocal of the U-value. The higher the R-value, the less heat is transmitted through the glazing material.

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” (3mm) 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.

Reflective Glass: See Solar Reflective Coatings

Relative Heat Gain (RHG): The amount of heat gained through glass taking into consideration the effects U-value and shading coefficient. The English System relative heat gain is calculated as: RHG = (Summer U-value x 14°F) + (Shading Coefficient x 200). The Metric System is calculated as: RHG = (Summer U-value x 7.8°C) + (Shading Coefficient x 630). The lower the RHG the more the glass product restricts heat gain.

Roller Wave: The appearance of waviness sometimes seen in heat treated glass caused by the glass moving over rollers in the tempering furnace.

Sandblasted Finish: A surface treatment for flat glass obtained by spraying the glass with hard particles to roughen the surface. The method restricts vision while maintaining a level of light transmission.

Setting Blocks: Generally rectangular, cured extrusions on which the glass product bottom edge is placed to effectively support the weight of the glass. Viracon recommends that only 100% silicone setting blocks be used for all types of glazing systems.

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"" (3mm) ply of clear glass under identical conditions. As the shading coefficient number decreases heat gain is reduced which means a better performing product.

Sightline for Insulating Glass: Edge dimension of insulating glass covered by spacer and intended to be covered in glazing channel.

Silk-screen: A process of applying a specific design or pattern to glass. The design is made by placing a screen over a piece of glass and then pressing ceramic frit by means of a large squeegee through the pores of the screen. After the frit is applied the glass goes through an infrared oven to dry the frit and then through a tempering furnace to fire (bond) the frit to the glass permanently.

Skylight: A window glazed in a roof or ceiling of a building.

Sloped Glazing: Glass units that are glazed more than 15° off vertical.

Solar Control Glass: Tinted and/or coated glass that reduces the amount of solar heat gain transmitted through a glazing product.

Solar Energy: The sum total of the solar spectrum.

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.

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

Solar Reflective Coatings: Coatings that reduce heat gain through higher solar reflection.

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.

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

Spandrel: The panel(s) of a wall located between vision areas of windows which conceal structural columns floors and shear walls.

STC Rating: Sound Transmission Class Rating is a single-number rating system for interior building partitions and viewing windows used to categorize acoustic performance. Its original intent was to quantify interior building partitions not exterior wall components. As a result it is not recommended for glass selection of exterior wall applications since the single-number rating was achieved under a specific set of laboratory conditions.

Structural Silicone Glazing: The use of a silicone sealant for the structural transfer of loads from the glass to its perimeter support system and retention of the glass in the opening.

Substrate: The raw glass or base material to which other materials or fabrication procedures are applied.

Tin Side: The bottom side of float glass as it was manufactured called "tin side" because float glass rides on a bath of liquid tin while it is being cooled.

U-Value: A measure of heat gain or heat loss through glass due to the thermal conductance and the difference in indoor and outdoor temperatures. As the u-value decreases, so does the amount of heat that is transferred through the glazing material. The lower the u-value the more restrictive the fenestration product is to heat transfer; reciprocal of r-value.

Ultraviolet Light (UV): The name of the invisible portion of the light spectrum with wavelengths shorter than 390 nanometers. The damaging effects on long-term UV exposure results in fabric fading and plastic deterioration.

Vacuum (Sputtering) Deposition: Process for applying multiple layers of metallic coatings to the surface of flat glass in a vacuum chamber.

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

Visible Light Transmittance: The percentage of visible light (380 - 780 nanometers) that is transmitted through the glass. (Visible light is the only portion of the solar spectrum visible to the human eye.)

Warm Edge: Term used to describe insulating spacer technologies that achieve better center of glass thermal performance (u-value) than a traditional aluminum spacer.

Weeps (or Weep Holes): Drain holes or slots in the sash or framing member to prevent accumulation of condensation and water.

Wet Seal: Application of an elastomeric sealant between the glass and sash to form a weather-tight seal.

HUSKY STADIUM, UNIVERSITY OF WASHINGTON (RENOVATION)

LOCATION: SEATTLE, WASHINGTON // **GLASS TYPE:** VE1-45 // **ARCHITECT:** 360 ARCHITECTURE

GLAZING CONTRACTOR: WALTERS & WOLF // **PHOTOGRAPHER:** © DALE LANG

WARRANTY

INSULATING GLASS UNIT (DUAL SEAL UNIT)
STANDARD LIMITED WARRANTY

Viracon warrants its dual seal insulating glass **for a period of ten (10) years from date of manufacture** against defective materials or workmanship which result in fogging or moisture residue formation on internal glass surfaces due to failure of the insulating glass seal.

In the event that a Viracon dual seal insulating glass unit is found and verified by Viracon to be defective, Viracon will provide a replacement unit at no charge (FOB nearest shipping point to the place of installation) or, at Viracon's option, refund the purchase price of the glass. In no event will Viracon's liability exceed the purchase price of the glass. If Viracon elects to replace the defective glass, Viracon will not be liable for any other expenses, including, but not limited to, removal of the defective unit, installation of replacement units, any labor, materials, and/or any other damages, including incidental, indirect, special, or consequential damages. Further, the warranty of the replacement glass will be limited to the remainder of the warranty period of the original dual seal insulating glass.

Viracon expressly assumes no responsibility for and this warranty does not cover the following: glass breakage, product failure due to improper usage; product failure due to improper handling, loading, unloading or storage; incompatibility with other glazing or installation materials, including, but not limited to, coatings, sealants, gaskets, setting blocks, lubricants, insulation or any other materials; faulty installation or building construction; damage caused by water not attributable to the Viracon product; use in sloped glazing installations; failure to adhere to Viracon's instructions regarding installation and/or maintenance of the unit, including written proof of routine maintenance (consult Glass Association of North America Glazing Manual); improper design; errors in provided specifications; scratches or abrasions to the product; abnormal weather conditions; or damage caused by cleaners, solvents, acids, alkalies or any other chemicals used on or around the products. Viracon reserves the right to inspect, in the field, any dual seal insulating glass which is alleged to be defective.

The purchaser's exclusive remedy is limited to the legal remedies described in this warranty. Viracon will not be liable for any incidental or consequential damages of any kind. Viracon's warranty will be void in the event that full payment is not received for goods and services within the agreed upon terms of sale. VIRACON MAKES NO OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, REGARDING THE PRODUCT, INCLUDING, BUT NOT LIMITED TO, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. This warranty may only be modified upon written approval of Viracon's President or Vice President(s). Any inquiries on these warranties or defective items should be directed to:

Viracon Sales Department, 800 Park Drive, Owatonna, MN 55060 Phone: (507) 451-9555

Project Name: _____ Project Number: _____

For Viracon, Inc.

Signed: _____ Title: _____

Name: _____

Date Signed: _____

2.3-65-MGU 12/03/2012

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PATENTS

Viracon's VUE coatings are covered by one or more of the following U.S. Patents: 8,574,718 and 8,895,150.

PERFOR
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SUSTAINABLE DESIGNS START WITH THE RIGHT PERFORMANCE.

NOVA SCOTIA POWER CORPORATE HEADQUARTERS

LOCATION: HALIFAX, NOVA SCOTIA, CANADA

GLASS TYPE: VRE1-59, VE1-2M

ARCHITECT: WZMH ARCHITECTS

GLAZING CONTRACTOR: ZIMMCOR INC.

PHOTOGRAPHER: © TOM ARBAN

VERTEX PHARMACEUTICALS GLOBAL HEADQUARTERS (PREVIOUS)

LOCATION: BOSTON, MASSACHUSETTS

GLASS TYPE: VRE1-59, VRE1-38 (LEFT); VE2-2M, VE1-2M (RIGHT)

ARCHITECT: TSOI/KOBUS & ASSOCIATES (LEFT); ELKUS | MANFREDI ARCHITECTS (RIGHT)

GLAZING CONTRACTOR: KARAS & KARAS GLASS CO.

PHOTOGRAPHER: © BRUCE T MARTIN

VIRACON NOMENCLATURE

Viracon utilizes an alphanumeric code for each coated glass product. The code designates the coating as well as the glass substrate the coating is applied to. This nomenclature is meant to aid in specifying our fabricated glass products however it is not enough on its own to clearly identify the full glass unit. In a specification, it is important to include the Viracon nomenclature along with an outline including each component of the glass unit.

The first portion of the code represents the coating family. Within each family, the coatings available have varying degrees of light transmittance. In our nomenclature, this is represented by the number following the dash.

Coating Type	Outboard Glass Substrate	Transmittance of Coating
VE	1	85

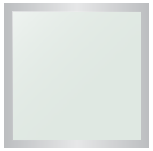
The number between the Viracon coating family and the nominal light transmittance of the coating is the color of glass the coating is applied to. In this example, VE-85 is the coating and VE1-85 is the VE-85 coating applied to clear glass.

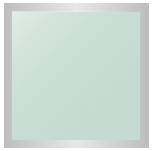
For more information reference the "Components and Enhancements" section on page 006.

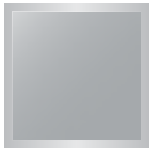
EXAMPLE SPECIFICATION

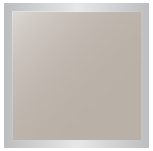
1. 1” VE1-85 Insulating Coated Glass as manufactured by Viracon.
    a. Exterior Glass Ply: 1/4” Clear Heat Strengthened
    b. Coating: VE-85 on #2 Surface
    c. Space: 1/2” aluminum, black, air filled
    d. Silicone: black
    e. Interior Glass Ply: 1/4” Clear Heat Strengthened
2. Performance Requirements
    a. Visible Light Transmittance: 76%
    b. Exterior (Vis-Out) Reflectance: 12%
    c. Winter U-Value: 0.31
    d. Summer U-Value: 0.29
    e. Shading Coefficient: 0.63
    f. Solar Heat Gain Coefficient: 0.54
    g. Light to Solar Gain Ratio: 1.41

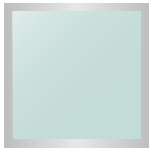
AVAILABLE SUBSTRATE COLORS

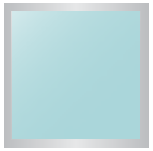

1=Clear

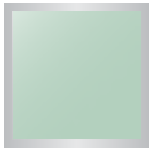

2=Green

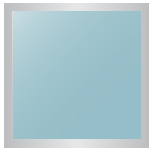

3=Gray


4=Bronze

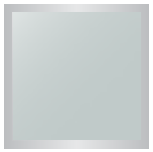

6=Blue Green


7=Azuria™

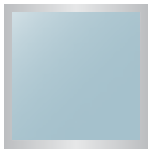

8=EverGreen™


11=Arctic Blue™


13=Starphire® (low iron)


19=CrystalGray™

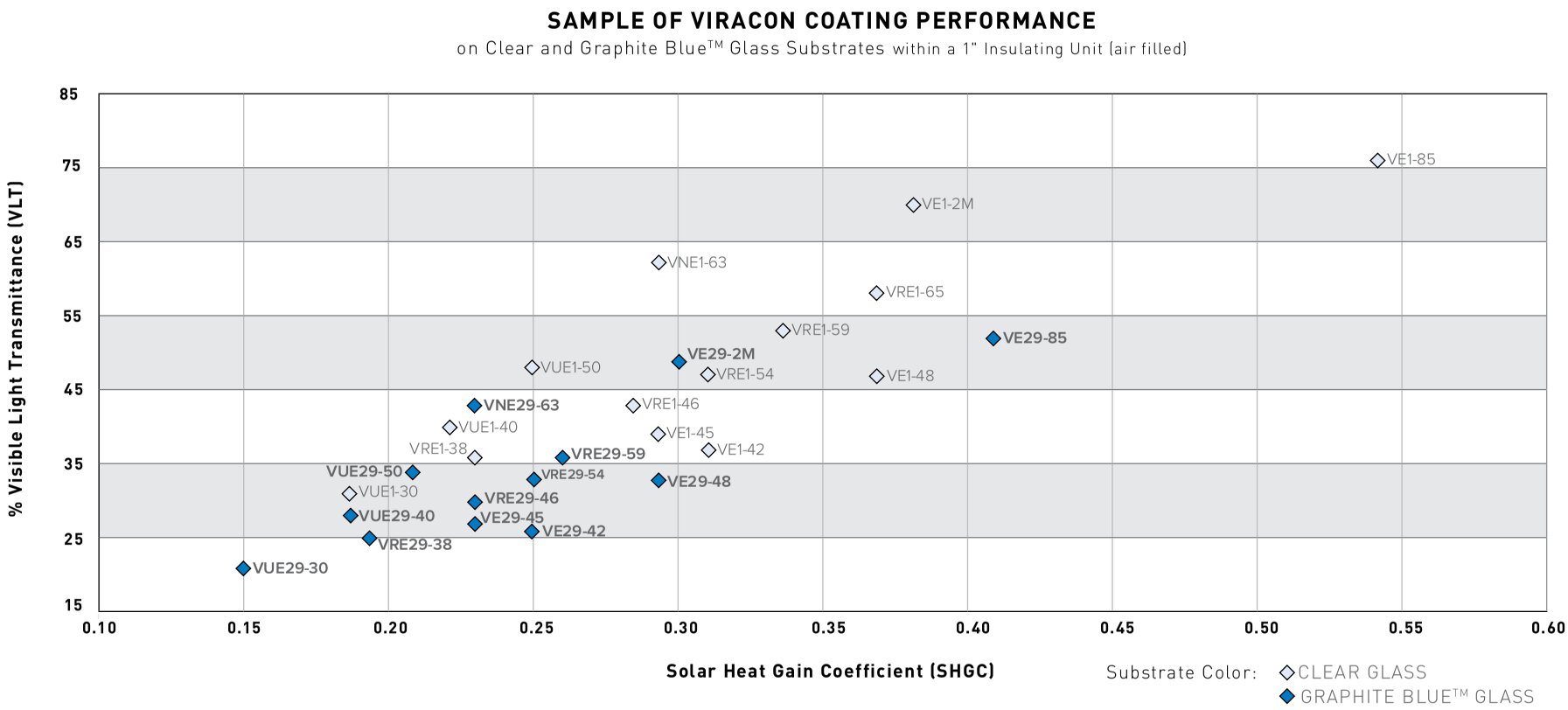

24=Optiwhite™ (low iron)


26=Solarblue™

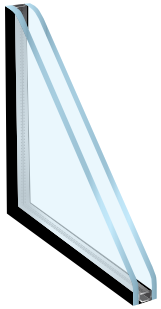

27=Pacifica™


29=Graphite Blue™

VIRACON COATING PERFORMANCE



INSULATING TABLES



INSULATING LOW-E

The performance data applies to insulating glass units with two plies (clear inboard) of 1/4" (6mm) glass and a 1/2" (13.2 mm) airspace or argon space. The coating is applied to the second (#2) surface. *Note: Low-iron substrates on the outboard have a low-iron substrate on the inboard lite as well.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▸ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85	76%	47%	26%	12%	13%	21%	.31	.29	.63	129	.54	1.41	.27	.24	.63	128	.54	1.41
VE 1-2M	70%	33%	10%	11%	12%	31%	.29	.26	.44	91	.38	1.84	.25	.21	.43	89	.37	1.89
VE 1-48	47%	30%	19%	17%	11%	22%	.31	.29	.43	90	.37	1.27	.27	.24	.43	89	.37	1.27
VE 1-45	39%	22%	10%	7%	28%	22%	.30	.26	.34	71	.29	1.34	.25	.21	.33	68	.28	1.39
VE 1-42	37%	24%	16%	19%	14%	21%	.31	.29	.36	77	.31	1.19	.27	.24	.36	75	.31	1.19
VNE 1-63	62%	24%	5%	10%	10%	37%	.29	.26	.33	70	.29	2.14	.25	.21	.32	68	.28	2.21
VUE 1-50	48%	20%	5%	11%	11%	26%	.29	.26	.29	62	.25	1.92	.25	.20	.29	61	.25	1.96
VUE 1-40	40%	16%	4%	16%	15%	27%	.29	.26	.25	54	.22	1.82	.24	.20	.24	51	.21	1.90
VUE 1-30	31%	12%	3%	19%	20%	27%	.29	.26	.20	44	.18	1.72	.25	.20	.19	42	.17	1.82
VRE 1-65	59%	31%	16%	27%	20%	34%	.30	.27	.43	89	.37	1.59	.25	.22	.42	88	.37	1.59
VRE 1-59	53%	28%	17%	30%	19%	38%	.30	.27	.39	81	.33	1.61	.26	.22	.38	79	.33	1.61
VRE 1-54	47%	25%	16%	32%	16%	37%	.30	.27	.35	74	.31	1.52	.25	.22	.35	74	.31	1.55
VRE 1-46	43%	23%	16%	34%	15%	40%	.30	.27	.33	69	.28	1.54	.25	.22	.32	68	.28	1.54
VRE 1-38	36%	19%	12%	44%	21%	46%	.30	.26	.27	57	.23	1.57	.25	.21	.26	55	.23	1.57
VE 2-85	65%	31%	13%	10%	12%	9%	.31	.29	.45	93	.39	1.67	.27	.24	.44	91	.38	1.71
VE 2-2M	60%	24%	6%	9%	11%	10%	.29	.26	.36	75	.31	1.94	.25	.21	.35	77	.30	2.00
VE 2-48	39%	19%	9%	13%	11%	10%	.31	.29	.31	67	.27	1.44	.27	.24	.30	64	.26	1.50
VE 2-45	34%	15%	5%	7%	28%	8%	.30	.26	.26	55	.22	1.55	.25	.21	.25	52	.21	1.62
VE 2-42	31%	16%	8%	15%	14%	10%	.31	.29	.27	58	.23	1.35	.27	.24	.26	55	.22	1.41
VNE 2-63	53%	20%	3%	10%	11%	12%	.29	.26	.30	64	.26	2.04	.25	.21	.29	61	.25	2.12
VUE 2-50	41%	15%	3%	10%	11%	10%	.29	.26	.26	55	.22	1.86	.25	.20	.24	52	.21	1.95
VUE 2-40	34%	13%	2%	12%	15%	10%	.29	.26	.22	48	.19	1.79	.24	.20	.21	45	.18	1.89
VUE 2-30	26%	9%	1%	15%	20%	11%	.29	.26	.19	41	.16	1.63	.25	.20	.17	38	.15	1.73

INSULATING LOW-E

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VRE 2-65	49%	21%	8%	20%	19%	14%	.30	.27	.32	69	.28	1.75	.25	.22	.31	66	.27	1.81
VRE 2-59	44%	19%	8%	23%	19%	15%	.30	.27	.30	64	.26	1.69	.26	.22	.29	61	.25	1.76
VRE 2-54	40%	17%	8%	24%	16%	15%	.30	.27	.28	60	.24	1.67	.25	.22	.27	57	.23	1.74
VRE 2-46	36%	16%	7%	26%	15%	16%	.30	.27	.26	56	.23	1.57	.25	.22	.25	53	.22	1.64
VRE 2-38	30%	13%	6%	33%	21%	19%	.30	.26	.22	48	.19	1.58	.25	.21	.21	45	.18	1.67
VE 3-85	38%	25%	11%	7%	10%	10%	.31	.29	.38	81	.33	1.15	.27	.24	.38	78	.32	1.19
VE 3-2M	35%	17%	4%	6%	10%	12%	.29	.26	.28	59	.24	1.46	.25	.21	.27	56	.23	1.52
VE 3-48	24%	16%	9%	7%	10%	10%	.31	.29	.28	61	.24	1.00	.27	.24	.27	58	.24	1.00
VE 3-45	20%	12%	4%	5%	27%	11%	.30	.26	.23	50	.20	1.00	.25	.21	.22	47	.19	1.05
VE 3-42	19%	13%	7%	8%	14%	10%	.31	.29	.25	53	.21	0.90	.27	.24	.24	50	.20	0.95
VNE 3-63	30%	12%	2%	7%	10%	16%	.29	.26	.22	47	.19	1.58	.25	.21	.20	44	.18	1.67
VUE 3-50	24%	10%	2%	6%	10%	13%	.29	.26	.20	44	.17	1.41	.25	.20	.19	41	.17	1.41
VUE 3-40	20%	9%	2%	7%	15%	11%	.29	.26	.18	40	.15	1.33	.24	.20	.17	36	.14	1.43
VUE 3-30	15%	6%	1%	8%	20%	12%	.29	.26	.15	35	.13	1.15	.25	.20	.14	31	.12	1.25
VRE 3-65	30%	17%	7%	10%	19%	14%	.30	.27	.28	60	.24	1.25	.25	.22	.27	57	.23	1.30
VRE 3-59	27%	15%	7%	11%	19%	15%	.30	.27	.26	56	.22	1.23	.26	.22	.25	53	.21	1.29
VRE 3-54	24%	14%	7%	11%	15%	15%	.30	.27	.24	53	.21	1.14	.25	.22	.23	49	.20	1.20
VRE 3-46	22%	12%	7%	12%	14%	15%	.30	.27	.23	49	.20	1.10	.25	.22	.22	46	.19	1.16
VRE 3-38	18%	10%	5%	14%	21%	17%	.30	.26	.20	43	.17	1.06	.25	.21	.18	40	.16	1.13
VE 4-85	45%	28%	11%	7%	11%	11%	.31	.29	.43	89	.37	1.22	.27	.24	.42	87	.36	1.25
VE 4-2M	41%	20%	5%	7%	10%	15%	.29	.26	.31	65	.26	1.58	.25	.21	.30	62	.26	1.58
VE 4-48	28%	18%	8%	9%	10%	12%	.31	.29	.31	66	.27	1.04	.27	.24	.30	63	.26	1.08
VE 4-45	24%	14%	4%	5%	28%	12%	.30	.26	.25	53	.21	1.14	.25	.21	.24	50	.20	1.20
VE 4-42	22%	15%	7%	10%	14%	11%	.31	.29	.27	58	.23	0.96	.27	.24	.26	55	.22	1.00
VNE 4-63	37%	15%	2%	8%	11%	20%	.29	.26	.24	52	.21	1.76	.25	.21	.23	49	.20	1.85
VUE 4-50	29%	12%	2%	7%	11%	15%	.29	.26	.22	47	.19	1.53	.25	.20	.21	45	.18	1.61
VUE 4-40	24%	10%	2%	8%	15%	14%	.29	.26	.19	42	.17	1.41	.24	.20	.18	39	.15	1.60
VUE 4-30	18%	7%	1%	10%	20%	15%	.29	.26	.16	36	.14	1.29	.25	.20	.15	33	.13	1.38
VRE 4-65	35%	19%	7%	12%	19%	17%	.30	.27	.31	65	.27	1.30	.25	.22	.30	62	.26	1.35
VRE 4-59	32%	17%	7%	14%	19%	18%	.30	.27	.28	60	.24	1.33	.26	.22	.27	58	.24	1.33
VRE 4-54	29%	16%	7%	14%	15%	18%	.30	.27	.26	57	.23	1.26	.25	.22	.25	54	.22	1.32
VRE 4-46	26%	14%	7%	15%	14%	19%	.30	.27	.25	53	.21	1.24	.25	.22	.24	50	.20	1.30
VRE 4-38	22%	11%	5%	19%	21%	22%	.30	.26	.21	45	.18	1.22	.25	.21	.20	42	.17	1.29
VE 6-85	65%	33%	15%	11%	12%	10%	.31	.29	.46	97	.40	1.63	.27	.24	.46	95	.40	1.63
VE 6-2M	60%	25%	6%	10%	11%	12%	.29	.26	.36	76	.31	1.94	.25	.21	.35	74	.31	1.94

INSULATING LOW-E

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 6-48	40%	21%	11%	14%	11%	11%	.31	.29	.33	70	.29	1.38	.27	.24	.32	68	.28	1.43
VE 6-45	33%	16%	5%	7%	28%	10%	.30	.26	.27	57	.23	1.43	.25	.21	.26	54	.22	1.50
VE 6-42	32%	17%	9%	15%	14%	11%	.31	.29	.29	61	.25	1.28	.27	.24	.27	58	.24	1.33
VNE 6-63	53%	20%	3%	10%	11%	13%	.29	.26	.30	64	.26	2.04	.25	.21	.29	61	.25	2.12
VUE 6-50	42%	16%	3%	10%	11%	11%	.29	.26	.26	56	.23	1.83	.25	.20	.25	53	.22	1.91
VUE 6-40	34%	13%	2%	13%	15%	12%	.29	.26	.23	49	.20	1.70	.24	.20	.22	46	.19	1.79
VUE 6-30	26%	10%	2%	15%	20%	12%	.29	.26	.19	41	.16	1.63	.25	.20	.18	38	.15	1.73
VRE 6-65	50%	23%	10%	21%	19%	16%	.30	.27	.34	72	.30	1.67	.25	.22	.33	69	.29	1.72
VRE 6-59	45%	20%	10%	24%	19%	18%	.30	.27	.31	66	.27	1.67	.26	.22	.30	64	.26	1.73
VRE 6-54	41%	19%	10%	24%	16%	18%	.30	.27	.29	62	.25	1.64	.25	.22	.28	59	.24	1.71
VRE 6-46	37%	17%	9%	26%	15%	19%	.30	.27	.27	58	.23	1.61	.25	.22	.26	55	.23	1.61
VRE 6-38	31%	14%	7%	34%	21%	22%	.30	.26	.23	50	.20	1.55	.25	.21	.22	47	.19	1.63
VE 7-85	58%	24%	19%	9%	12%	7%	.31	.29	.36	77	.31	1.87	.27	.24	.35	74	.31	1.87
VE 7-2M	54%	20%	8%	8%	11%	6%	.29	.26	.32	67	.27	2.00	.25	.21	.30	64	.26	2.08
VE 7-48	36%	16%	14%	12%	11%	8%	.31	.29	.27	58	.23	1.57	.27	.24	.26	55	.22	1.64
VE 7-45	31%	12%	7%	7%	28%	6%	.30	.26	.23	50	.20	1.55	.25	.21	.22	46	.19	1.63
VE 7-42	29%	13%	12%	13%	14%	8%	.32	.30	.24	52	.21	1.38	.28	.25	.23	49	.20	1.45
VNE 7-63	48%	17%	4%	9%	11%	7%	.29	.26	.28	59	.24	2.00	.25	.21	.26	56	.23	2.09
VUE 7-50	38%	14%	4%	9%	11%	7%	.29	.26	.24	51	.21	1.81	.25	.20	.23	48	.19	2.00
VUE 7-40	31%	11%	3%	11%	15%	8%	.29	.26	.21	46	.18	1.72	.25	.21	.20	43	.17	1.82
VUE 7-30	24%	8%	2%	13%	20%	8%	.29	.26	.18	40	.15	1.60	.25	.20	.17	36	.14	1.71
VRE 7-65	45%	18%	12%	18%	19%	10%	.30	.27	.28	60	.25	1.80	.25	.22	.27	57	.24	1.88
VRE 7-59	41%	16%	13%	20%	19%	11%	.30	.27	.26	56	.23	1.78	.26	.22	.25	53	.22	1.86
VRE 7-54	37%	15%	12%	21%	16%	12%	.30	.27	.25	54	.21	1.76	.25	.22	.24	50	.20	1.85
VRE 7-46	33%	13%	11%	23%	15%	12%	.30	.27	.23	50	.20	1.65	.25	.22	.22	47	.19	1.74
VRE 7-38	28%	11%	9%	29%	21%	14%	.30	.26	.20	45	.18	1.56	.25	.21	.19	41	.17	1.65
VE 8-85	57%	24%	7%	9%	11%	7%	.31	.29	.37	77	.32	1.78	.27	.24	.36	75	.31	1.84
VE 8-2M	54%	20%	3%	8%	11%	7%	.29	.26	.31	66	.27	2.00	.25	.21	.30	63	.26	2.08
VE 8-48	35%	15%	5%	12%	10%	8%	.31	.29	.27	58	.23	1.52	.27	.24	.26	55	.22	1.59
VE 8-45	29%	11%	2%	6%	28%	6%	.30	.26	.22	47	.19	1.53	.25	.21	.20	44	.18	1.61
VE 8-42	28%	12%	5%	13%	14%	8%	.31	.29	.24	51	.20	1.40	.27	.24	.22	48	.19	1.47
VNE 8-63	47%	16%	1%	8%	10%	7%	.29	.26	.27	57	.23	2.04	.25	.21	.25	54	.22	2.14
VUE 8-50	37%	13%	2%	9%	11%	7%	.29	.26	.23	50	.20	1.85	.25	.20	.22	47	.19	1.95
VUE 8-40	30%	11%	1%	11%	15%	8%	.29	.26	.20	44	.18	1.67	.25	.21	.19	40	.16	1.81
VUE 8-30	23%	8%	1%	13%	20%	8%	.29	.26	.18	39	.15	1.53	.25	.20	.16	35	.14	1.64

INSULATING LOW-E

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VRE 8-65	44%	17%	5%	17%	19%	10%	.30	.27	.28	60	.24	1.83	.25	.22	.27	57	.23	1.91
VRE 8-59	40%	15%	5%	19%	19%	11%	.30	.27	.26	56	.23	1.74	.26	.22	.25	53	.22	1.82
VRE 8-54	36%	14%	5%	20%	15%	11%	.30	.27	.25	53	.21	1.71	.26	.22	.23	50	.20	1.80
VRE 8-46	32%	13%	4%	21%	15%	12%	.30	.27	.23	50	.20	1.60	.25	.22	.22	47	.19	1.68
VRE 8-38	27%	10%	3%	27%	21%	14%	.30	.26	.20	44	.17	1.59	.25	.21	.19	41	.16	1.69
VE 11-85	45%	22%	10%	7%	11%	7%	.31	.29	.35	74	.30	1.50	.27	.24	.34	71	.29	1.55
VE 11-2M	45%	19%	5%	7%	10%	8%	.29	.26	.30	64	.26	1.73	.25	.21	.29	60	.25	1.80
VE 11-48	28%	14%	8%	9%	10%	8%	.31	.29	.26	56	.23	1.22	.27	.24	.25	53	.22	1.27
VE 11-45	23%	11%	3%	6%	28%	7%	.30	.26	.21	47	.18	1.28	.25	.21	.20	43	.17	1.35
VE 11-42	24%	12%	7%	10%	14%	8%	.32	.30	.24	52	.21	1.14	.27	.24	.23	49	.19	1.21
VNE 11-63	37%	14%	2%	6%	9%	8%	.29	.26	.24	52	.21	1.76	.25	.21	.23	49	.20	1.85
VUE 11-50	29%	11%	2%	7%	11%	7%	.29	.26	.22	47	.19	1.53	.25	.20	.20	43	.17	1.71
VUE 11-40	24%	9%	2%	8%	15%	8%	.29	.26	.19	42	.16	1.50	.25	.21	.18	39	.16	1.56
VUE 11-30	18%	7%	1%	10%	20%	8%	.29	.26	.16	37	.14	1.29	.25	.20	.15	33	.13	1.38
VRE 11-65	35%	16%	6%	13%	19%	10%	.30	.27	.27	57	.23	1.52	.25	.22	.25	54	.22	1.59
VRE 11-59	34%	15%	7%	15%	19%	11%	.30	.27	.26	55	.22	1.55	.26	.22	.24	50	.20	1.70
VRE 11-54	30%	14%	7%	16%	15%	11%	.30	.27	.24	52	.21	1.43	.26	.22	.22	47	.19	1.47
VRE 11-46	27%	13%	7%	17%	14%	12%	.30	.27	.23	49	.20	1.35	.25	.22	.21	44	.18	1.44
VRE 11-38	23%	10%	5%	21%	21%	14%	.30	.26	.20	44	.17	1.35	.25	.21	.19	40	.16	1.44
VE 13-85	78%	52%	27%	13%	13%	28%	.31	.29	.69	142	.60	1.30	.27	.24	.69	142	.60	1.30
VE 13-2M	71%	34%	11%	10%	11%	42%	.29	.26	.44	92	.38	1.87	.25	.21	.44	91	.38	1.87
VE 13-48	50%	38%	23%	18%	11%	29%	.31	.29	.48	100	.42	1.19	.27	.24	.48	98	.41	1.22
VE 13-45	42%	28%	14%	7%	30%	31%	.30	.26	.36	77	.32	1.31	.25	.21	.36	75	.31	1.35
VE 13-42	40%	30%	18%	20%	15%	27%	.32	.30	.40	84	.35	1.14	.27	.24	.39	82	.34	1.18
VNE 13-63	66%	27%	6%	11%	11%	55%	.29	.26	.33	70	.29	2.28	.25	.21	.33	69	.29	2.28
VUE 13-50	52%	23%	6%	12%	12%	37%	.29	.26	.31	65	.27	1.93	.25	.20	.30	63	.26	2.00
VUE 13-40	43%	18%	6%	16%	16%	37%	.29	.26	.26	55	.22	1.95	.25	.21	.25	52	.21	2.05
VUE 13-30	33%	14%	3%	20%	21%	38%	.29	.26	.21	45	.18	1.83	.25	.20	.20	42	.17	1.94
VRE 13-65	63%	39%	19%	28%	21%	47%	.30	.27	.46	97	.40	1.58	.25	.22	.46	96	.40	1.58
VRE 13-59	56%	34%	20%	32%	20%	52%	.30	.27	.42	87	.36	1.56	.26	.22	.41	86	.36	1.56
VRE 13-54	50%	31%	19%	34%	17%	50%	.30	.27	.38	79	.33	1.52	.26	.22	.37	78	.33	1.52
VRE 13-46	46%	29%	18%	36%	16%	53%	.30	.27	.35	74	.31	1.45	.25	.22	.35	73	.30	1.53
VRE 13-38	38%	23%	14%	47%	23%	62%	.30	.26	.28	59	.24	1.58	.25	.21	.27	58	.24	1.58

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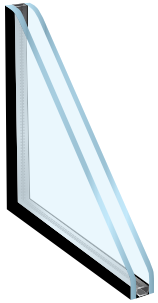
Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 19-85	54%	33%	15%	8%	11%	11%	.31	.29	.48	99	.41	1.32	.27	.24	.47	97	.41	1.32
VE 19-2M	50%	24%	7%	7%	10%	15%	.29	.26	.35	74	.31	1.61	.25	.21	.34	72	.30	1.67
VE 19-48	34%	21%	12%	11%	10%	13%	.31	.29	.34	72	.29	1.17	.27	.24	.33	68	.29	1.17
VE 19-45	28%	15%	6%	6%	28%	12%	.30	.26	.26	57	.23	1.22	.25	.21	.25	54	.22	1.27
VE 19-42	26%	17%	10%	13%	13%	13%	.32	.30	.29	53	.25	1.08	.27	.24	.28	60	.24	1.08
VNE 19-63	45%	17%	3%	8%	10%	18%	.29	.26	.27	58	.23	1.96	.25	.21	.26	55	.23	1.96
VUE 19-50	36%	15%	3%	8%	11%	15%	.29	.26	.25	53	.21	1.71	.25	.20	.24	50	.20	1.80
VUE 19-40	29%	12%	3%	10%	15%	15%	.29	.26	.21	46	.18	1.61	.24	.20	.20	43	.17	1.71
VUE 19-30	22%	9%	2%	12%	20%	15%	.29	.26	.18	39	.15	1.47	.25	.20	.16	36	.14	1.57
VRE 19-65	43%	23%	10%	16%	19%	19%	.30	.27	.34	72	.30	1.43	.25	.22	.33	69	.29	1.48
VRE 19-59	39%	20%	11%	18%	20%	21%	.30	.27	.31	66	.27	1.41	.25	.21	.30	63	.26	1.50
VRE 19-54	35%	18%	9%	18%	16%	20%	.30	.27	.29	61	.25	1.36	.26	.22	.28	59	.24	1.46
VRE 19-46	30%	16%	9%	19%	14%	20%	.30	.27	.27	58	.23	1.35	.25	.21	.25	53	.21	1.43
VRE 19-38	26%	13%	7%	26%	21%	25%	.30	.26	.23	49	.20	1.30	.25	.21	.22	46	.19	1.37
VE 24-85	81%	61%	30%	13%	13%	26%	.31	.29	.73	150	.63	1.29	.27	.24	.73	149	.63	1.29
VE 24-2M	74%	38%	14%	12%	12%	44%	.29	.26	.46	95	.40	1.85	.25	.21	.45	94	.39	1.90
VE 24-48	50%	38%	28%	18%	11%	29%	.31	.29	.48	100	.42	1.19	.27	.24	.47	98	.41	1.22
VE 24-45	41%	28%	14%	8%	30%	31%	.30	.26	.36	76	.32	1.28	.25	.21	.36	74	.31	1.32
VE 24-42	39%	30%	22%	20%	15%	27%	.31	.29	.40	84	.35	1.11	.27	.24	.39	82	.34	1.15
VNE 24-63	66%	27%	7%	11%	11%	55%	.29	.26	.33	70	.29	2.28	.25	.21	.33	68	.28	2.36
VUE 24-50	51%	23%	7%	12%	12%	37%	.29	.26	.31	65	.27	1.89	.25	.21	.30	63	.26	1.96
VUE 24-40	42%	19%	5%	16%	16%	36%	.29	.26	.26	55	.22	1.91	.24	.20	.25	53	.22	1.91
VUE 24-30	32%	14%	4%	20%	21%	36%	.29	.26	.20	45	.18	1.78	.24	.20	.20	42	.17	1.88
VRE 24-65	62%	38%	24%	28%	21%	46%	.30	.27	.46	96	.40	1.55	.25	.22	.46	95	.40	1.55
VRE 24-59	56%	34%	25%	32%	20%	51%	.30	.27	.42	87	.36	1.56	.26	.22	.41	96	.36	1.56
VRE 24-54	50%	31%	24%	33%	17%	50%	.30	.27	.38	79	.33	1.52	.26	.22	.37	78	.32	1.56
VRE 24-46	45%	29%	23%	36%	16%	53%	.30	.27	.35	74	.30	1.50	.25	.22	.35	73	.30	1.50
VRE 24-38	38%	22%	18%	46%	23%	62%	.30	.26	.28	59	.24	1.58	.25	.21	.27	58	.24	1.58
VE 26-85	48%	29%	15%	8%	11%	10%	.31	.29	.43	87	.37	1.30	.27	.24	.42	87	.36	1.33
VE 26-2M	45%	21%	6%	7%	10%	13%	.29	.26	.32	68	.28	1.61	.25	.21	.31	65	.27	1.67
VE 26-48	30%	19%	11%	10%	10%	11%	.31	.29	.31	66	.27	1.11	.27	.24	.30	63	.26	1.15
VE 26-45	25%	14%	6%	6%	28%	10%	.30	.26	.25	54	.22	1.14	.25	.21	.24	51	.21	1.19
VE 26-42	24%	15%	9%	10%	14%	11%	.31	.29	.27	58	.23	1.04	.27	.24	.26	55	.22	1.09
VNE 26-63	39%	16%	3%	7%	10%	15%	.29	.26	.26	55	.22	1.77	.25	.21	.24	52	.21	1.86
VUE 26-50	31%	13%	3%	7%	11%	12%	.29	.26	.23	50	.20	1.55	.25	.20	.22	47	.19	1.63

INSULATING LOW-E

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VUE 26-40	26%	11%	2%	9%	15%	12%	.29	.26	.20	44	.17	1.53	.24	.20	.19	41	.16	1.63
VUE 26-30	20%	8%	2%	11%	20%	12%	.29	.26	.17	38	.15	1.33	.25	.20	.16	35	.14	1.43
VRE 26-65	37%	20%	9%	14%	19%	15%	.30	.27	.31	66	.27	1.37	.25	.22	.30	63	.26	1.42
VRE 26-59	33%	18%	10%	15%	19%	17%	.30	.27	.29	61	.25	1.32	.26	.22	.28	58	.24	1.38
VRE 26-54	30%	16%	9%	15%	15%	16%	.30	.27	.26	57	.23	1.30	.26	.22	.25	54	.22	1.36
VRE 26-46	27%	15%	9%	16%	14%	17%	.30	.27	.25	54	.22	1.23	.25	.22	.24	51	.21	1.29
VRE 26-38	23%	12%	7%	20%	21%	20%	.30	.26	.21	46	.18	1.28	.25	.21	.20	43	.17	1.35
VE 27-85	36%	18%	7%	6%	11%	6%	.31	.29	.31	66	.27	1.33	.24	.24	.30	63	.26	1.38
VE 27-2M	34%	15%	3%	6%	10%	6%	.29	.26	.25	55	.22	1.55	.25	.21	.24	51	.21	1.62
VE 27-48	23%	12%	5%	7%	10%	7%	.31	.29	.24	51	.20	1.15	.27	.24	.22	48	.19	1.21
VE 27-45	19%	9%	3%	5%	28%	6%	.30	.26	.20	43	.17	1.12	.25	.21	.18	40	.16	1.19
VE 27-42	18%	10%	5%	8%	13%	7%	.31	.29	.21	46	.18	1.00	.27	.24	.20	43	.17	1.06
VNE 27-63	30%	12%	1%	6%	9%	7%	.29	.26	.22	47	.19	1.58	.25	.21	.20	44	.18	1.67
VUE 27-50	24%	10%	2%	6%	10%	6%	.29	.26	.20	43	.17	1.41	.25	.20	.18	39	.16	1.50
VUE 27-40	19%	8%	1%	7%	15%	7%	.29	.26	.17	38	.15	1.27	.24	.20	.16	35	.14	1.36
VUE 27-30	15%	6%	1%	8%	20%	7%	.29	.26	.15	34	.13	1.15	.25	.20	.16	35	.14	1.43
VRE 27-65	28%	13%	5%	10%	18%	8%	.30	.27	.24	51	.21	1.33	.25	.22	.22	48	.20	1.40
VRE 27-59	25%	12%	5%	11%	18%	9%	.30	.27	.22	48	.19	1.32	.26	.22	.21	45	.18	1.39
VRE 27-54	23%	11%	5%	11%	15%	9%	.30	.27	.21	46	.18	1.28	.26	.22	.20	43	.17	1.35
VRE 27-46	21%	10%	4%	11%	14%	9%	.30	.27	.20	44	.17	1.24	.25	.22	.19	40	.16	1.31
VRE 27-38	17%	8%	3%	14%	21%	10%	.30	.26	.18	39	.15	1.13	.25	.21	.16	36	.14	1.21
VE 29-85	52%	33%	17%	8%	12%	13%	.31	.29	.48	99	.41	1.27	.27	.24	.47	97	.41	1.27
VE 29-2M	49%	24%	8%	8%	11%	16%	.29	.26	.35	74	.30	1.63	.25	.21	.34	71	.30	1.63
VE 29-48	33%	21%	13%	10%	10%	13%	.31	.29	.34	72	.29	1.14	.27	.24	.33	69	.29	1.14
VE 29-45	27%	16%	6%	6%	28%	13%	.30	.26	.27	57	.23	1.17	.25	.21	.26	54	.22	1.23
VE 29-42	26%	17%	10%	11%	14%	13%	.31	.29	.29	62	.25	1.04	.27	.24	.28	60	.24	1.08
VNE 29-63	43%	17%	3%	8%	11%	19%	.29	.26	.27	58	.23	1.87	.25	.21	.26	55	.23	1.87
VUE 29-50	34%	14%	4%	8%	11%	15%	.29	.26	.24	52	.21	1.62	.25	.21	.23	49	.20	1.70
VUE 29-40	28%	12%	3%	10%	15%	15%	.29	.26	.21	46	.18	1.56	.25	.21	.20	43	.17	1.65
VUE 29-30	21%	9%	2%	11%	20%	16%	.29	.26	.18	39	.15	1.40	.25	.20	.16	36	.14	1.50
VRE 29-65	41%	22%	11%	15%	19%	20%	.30	.27	.34	71	.29	1.41	.25	.22	.33	69	.28	1.46
VRE 29-59	36%	19%	10%	18%	20%	21%	.30	.27	.30	63	.26	1.38	.26	.22	.29	61	.25	1.44
VRE 29-54	33%	18%	10%	18%	16%	21%	.30	.27	.28	61	.25	1.32	.26	.22	.27	58	.24	1.38
VRE 29-46	30%	16%	9%	19%	16%	22%	.30	.27	.26	56	.23	1.30	.25	.22	.25	54	.22	1.36
VRE 29-38	25%	13%	8%	23%	21%	26%	.30	.26	.22	48	.19	1.32	.25	.21	.21	46	.18	1.39

INSULATING ROOMSIDE™ LOW-E



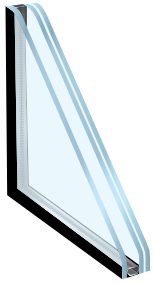
The performance data applies to insulating glass units with two plies (clear inboard) of 1/4" (6mm) glass and a 1/2" (13.2 mm) airspace or argon space. The coating is applied to the second (#2) surface with a RoomSide Low-e coating (RS) applied to the fourth (#4) surface.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85/RS	75%	46%	26%	12%	12%	21%	.24	.22	.60	124	0.53	1.42	.22	.19	.61	124	.53	1.42
VE 1-2M/RS	70%	32%	10%	11%	11%	31%	.23	.20	.42	88	0.37	1.89	.20	.17	.42	87	.37	1.89
VE 1-48/RS	47%	29%	19%	17%	10%	22%	.24	.22	.41	85	0.36	1.31	.21	.19	.41	85	.35	1.34
VE 1-45/RS	39%	22%	10%	7%	27%	22%	.23	.20	.32	67	0.28	1.39	.20	.17	.32	66	.27	1.44
VE 1-42/RS	37%	23%	15%	19%	13%	21%	.25	.22	.34	72	0.30	1.23	.22	.19	.34	71	.29	1.28
VNE 1-63/RS	62%	24%	5%	10%	10%	37%	.23	.20	.32	67	0.28	2.21	.20	.17	.32	66	.28	2.21
VUE 1-50/RS	48%	20%	5%	11%	11%	26%	.23	.20	.28	59	0.24	2.00	.20	.17	.28	57	.24	2.00
VUE 1-40/RS	40%	16%	4%	15%	14%	26%	.23	.20	.24	51	0.21	1.90	.20	.17	.24	50	.20	2.00
VUE 1-30/RS	30%	12%	3%	19%	19%	27%	.23	.20	.19	41	0.17	1.76	.20	.17	.19	40	.16	1.88
VRE 1-59/RS	52%	28%	17%	30%	18%	38%	.24	.21	.37	78	0.32	1.63	.21	.18	.37	77	.32	1.63
VRE 1-54/RS	47%	25%	16%	32%	15%	37%	.24	.21	.34	71	0.29	1.62	.21	.18	.34	70	.29	1.62
VRE 1-46/RS	43%	23%	15%	34%	14%	40%	.24	.21	.32	66	0.27	1.59	.20	.17	.31	65	.27	1.59
VRE 1-38/RS	36%	18%	12%	44%	20%	46%	.23	.20	.26	54	0.22	1.64	.20	.17	.25	53	.22	1.64

INSULATING LAMINATED LOW-E (AIR FILLED)



The performance data applies to insulating laminated glass constructed with three plies (clear inboard laminate) of 1/4" (6mm) glass, a .060 (1.52mm) clear polyvinyl butyral (PVB) interlayer and a 1/2" (13.2 mm) airspace. The coating is applied to the second (#2) surface. *Note: Low-iron substrates on the outboard have a low-iron substrate on the inboard lite as well.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85	72%	40%	<1%	12%	12%	20%	.31	.28	.61	127	.53	1.36
VE 1-2M	67%	29%	<1%	11%	11%	30%	.29	.26	.43	90	.37	1.81
VE 1-45	38%	19%	<1%	7%	26%	22%	.29	.26	.33	69	.28	1.36
VE 1-42	36%	21%	<1%	19%	13%	21%	.31	.28	.36	75	.31	1.16
VNE 1-63	60%	23%	<1%	10%	9%	37%	.29	.26	.33	69	.28	2.14
VUE 1-50	46%	18%	<1%	11%	10%	26%	.29	.25	.29	61	.25	1.84
VRE 1-59	50%	25%	<1%	30%	18%	38%	.29	.27	.38	80	.33	1.52
VRE 1-54	46%	22%	<1%	31%	14%	38%	.30	.27	.35	74	.30	1.53
VRE 1-46	41%	20%	<1%	34%	14%	40%	.29	.26	.32	68	.28	1.46
VRE 1-38	35%	16%	<1%	44%	20%	46%	.29	.26	.26	56	.23	1.52
VE 2-85	62%	28%	<1%	10%	11%	9%	.31	.28	.44	92	.38	1.63
VE 2-2M	58%	22%	<1%	9%	10%	10%	.29	.26	.35	74	.31	1.87
VE 2-45	32%	13%	<1%	7%	25%	8%	.29	.26	.25	54	.22	1.45
VE 2-42	30%	14%	<1%	15%	13%	10%	.31	.28	.27	57	.23	1.30
VNE 2-63	51%	18%	<1%	10%	10%	12%	.29	.26	.30	63	.26	1.96
VUE 2-50	40%	14%	<1%	10%	10%	10%	.29	.25	.25	54	.22	1.82
VRE 2-59	42%	17%	<1%	23%	17%	15%	.29	.27	.30	63	.26	1.62
VRE 2-54	38%	16%	<1%	24%	14%	15%	.30	.27	.28	59	.24	1.58
VRE 2-46	35%	14%	<1%	25%	13%	16%	.29	.26	.26	55	.22	1.59
VRE 2-38	29%	12%	<1%	32%	19%	19%	.29	.26	.22	48	.19	1.53
VE 3-85	36%	21%	<1%	6%	9%	10%	.31	.28	.38	79	.33	1.09
VE 3-2M	33%	15%	<1%	6%	9%	12%	.29	.26	.27	58	.24	1.38
VE 3-45	19%	10%	<1%	5%	25%	11%	.29	.26	.23	49	.19	1.00
VE 3-42	18%	19%	<1%	8%	12%	10%	.31	.28	.24	52	.21	0.86
VNE 3-63	29%	11%	<1%	7%	9%	16%	.29	.26	.21	46	.18	1.61
VUE 3-50	23%	9%	<1%	6%	9%	13%	.29	.25	.20	43	.17	1.35

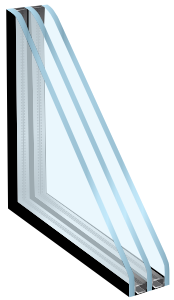
INSULATING LAMINATED LOW-E (AIR FILLED)

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VRE 3-59	25%	13%	<1%	11%	17%	15%	.29	.27	.25	55	.22	1.14
VRE 3-54	23%	12%	<1%	11%	14%	15%	.30	.27	.24	52	.21	1.10
VRE 3-46	21%	11%	<1%	12%	13%	15%	.29	.26	.22	48	.19	1.11
VRE 3-38	17%	9%	<1%	14%	19%	17%	.29	.26	.19	42	.17	1.00
VE 4-85	43%	24%	<1%	7%	10%	11%	.31	.28	.42	88	.36	1.19
VE 4-2M	40%	18%	<1%	7%	9%	15%	.29	.26	.30	64	.26	1.54
VE 4-45	23%	12%	<1%	5%	25%	12%	.29	.26	.24	52	.21	1.10
VE 4-42	21%	13%	<1%	10%	12%	11%	.31	.28	.26	56	.23	0.91
VNE 4-63	36%	14%	<1%	7%	10%	20%	.29	.26	.24	51	.21	1.71
VUE 4-50	28%	11%	<1%	7%	10%	15%	.29	.25	.21	46	.18	1.56
VRE 4-59	30%	15%	<1%	14%	17%	18%	.29	.27	.28	59	.24	1.25
VRE 4-54	27%	14%	<1%	14%	14%	18%	.30	.27	.26	56	.22	1.23
VRE 4-46	25%	13%	<1%	15%	13%	19%	.29	.26	.24	52	.21	1.19
VRE 4-38	21%	10%	<1%	19%	19%	22%	.29	.26	.20	45	.18	1.17
VE 6-85	62%	29%	<1%	10%	11%	10%	.31	.28	.46	95	.40	1.55
VE 6-2M	57%	23%	<1%	9%	10%	12%	.29	.26	.36	76	.31	1.84
VE 6-45	32%	14%	<1%	7%	25%	10%	.29	.26	.26	56	.23	1.39
VE 6-42	31%	15%	<1%	15%	13%	11%	.31	.28	.28	60	.24	1.29
VNE 6-63	51%	18%	<1%	10%	10%	13%	.29	.26	.30	63	.26	1.96
VUE 6-50	39%	14%	<1%	9%	10%	10%	.29	.25	.25	54	.22	1.77
VRE 6-59	43%	18%	<1%	23%	17%	17%	.29	.27	.31	65	.27	1.59
VRE 6-54	39%	17%	<1%	24%	14%	18%	.30	.27	.29	61	.25	1.56
VRE 6-46	35%	15%	<1%	26%	13%	19%	.29	.26	.27	57	.23	1.52
VRE 6-38	30%	12%	<1%	34%	19%	22%	.29	.26	.23	49	.20	1.50
VE 7-85	59%	23%	<1%	10%	11%	7%	.31	.28	.38	79	.33	1.79
VE 7-2M	54%	20%	<1%	9%	10%	7%	.29	.26	.32	68	.28	1.93
VE 7-45	30%	11%	<1%	7%	25%	6%	.29	.26	.23	49	.19	1.58
VE 7-42	29%	12%	<1%	14%	13%	9%	.31	.28	.24	53	.21	1.38
VNE 7-63	47%	16%	<1%	9%	10%	7%	.29	.26	.27	58	.24	1.96
VUE 7-50	36%	13%	<1%	9%	10%	7%	.29	.25	.23	50	.20	1.80
VRE 7-59	39%	14%	< 1%	20%	17%	11%	.29	.27	.26	56	.22	1.77
VRE 7-54	35%	13%	<1%	21%	14%	12%	.30	.27	.25	53	.21	1.67
VRE 7-46	32%	12%	<1%	23%	13%	12%	.29	.26	.23	50	.20	1.60
VRE 7-38	27%	10%	<1%	28%	19%	14%	.29	.26	.20	44	.17	1.59
VE8-45	27%	10%	<1%	6%	26%	6%	.29	.26	.21	46	.18	1.50
VNE 8-63	45%	15%	<1%	7%	9%	7%	.29	.26	.26	56	.23	1.96
VUE 8-50	34%	12%	<1%	8%	10%	7%	.29	.25	.22	48	.19	1.79

INSULATING LAMINATED LOW-E (AIR FILLED)

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 11-45	22%	10%	<1%	6%	25%	7%	.29	.26	.21	46	.18	1.22
VNE 11-63	36%	13%	<1%	6%	9%	8%	.29	.26	.24	52	.21	1.71
VUE 11-50	28%	11%	<1%	7%	10%	7%	.29	.25	.21	46	.18	1.56
VE 13-45	41%	26%	<1%	7%	29%	31%	.29	.26	.36	76	.31	1.32
VNE 13-63	66%	27%	<1%	10%	10%	55%	.29	.26	.33	70	.29	2.28
VUE 13-50	51%	22%	<1%	11%	11%	35%	.29	.25	.30	63	.26	1.96
VE 19-85	53%	28%	<1%	8%	11%	12%	.30	.28	.47	97	.41	1.29
VE 19-2M	49%	21%	<1%	8%	10%	16%	.29	.26	.34	72	.30	1.63
VE 19-45	27%	13%	<1%	6%	25%	12%	.29	.26	.26	55	.22	1.23
VE 19-42	26%	15%	<1%	12%	12%	12%	.31	.29	.29	61	.25	1.04
VNE 19-63	44%	16%	<1%	8%	9%	18%	.29	.26	.27	57	.23	1.91
VUE 19-50	34%	13%	<1%	8%	10%	14%	.29	.25	.24	51	.21	1.62
VRE 19-59	37%	18%	<1%	18%	17%	21%	.29	.27	.31	65	.26	1.42
VRE 19-54	33%	16%	<1%	19%	14%	20%	.29	.27	.28	60	.24	1.38
VRE 19-46	30%	15%	<1%	20%	13%	22%	.29	.26	.27	57	.23	1.30
VRE 19-38	25%	12%	<1%	25%	19%	25%	.29	.26	.22	48	.19	1.32
VE 24-45	41%	26%	<1%	7%	28%	31%	.29	.26	.36	75	.31	1.32
VE 26-45	24%	12%	<1%	6%	25%	10%	.29	.26	.25	53	.21	1.14
VE 27-45	19%	8%	<1%	5%	25%	6%	.29	.26	.19	42	.17	1.12
VE 29-85	50%	28%	<1%	8%	11%	12%	.30	.28	.46	97	.40	1.25
VE 29-2M	47%	21%	<1%	7%	10%	16%	.29	.26	.34	73	.30	1.57
VE 29-48	31%	18%	<1%	10%	9%	13%	.30	.28	.33	70	.29	1.07
VE 29-45	26%	14%	<1%	6%	25%	13%	.29	.26	.26	56	.23	1.13
VE 29-42	25%	14%	<1%	11%	12%	13%	.30	.28	.28	61	.24	1.04
VNE 29-63	41%	16%	<1%	8%	10%	18%	.28	.25	.27	57	.23	1.78
VUE 29-50	33%	13%	<1%	8%	10%	15%	.28	.25	.24	51	.20	1.65
VUE 29-40	27%	11%	<1%	10%	13%	15%	.28	.25	.21	45	.18	1.50
VUE 29-30	20%	8%	<1%	11%	18%	16%	.28	.25	.17	38	.15	1.33
VRE 29-59	34%	16%	<1%	17%	18%	21%	.29	.26	.29	62	.25	1.36
VRE 29-54	32%	15%	<1%	18%	15%	21%	.29	.27	.28	59	.24	1.33
VRE 29-46	29%	14%	<1%	19%	15%	22%	.29	.26	.26	55	.22	1.32
VRE 29-38	24%	11%	<1%	23%	19%	26%	.29	.26	.22	47	.19	1.26

TRIPLE INSULATING SINGLE COATED LOW-E



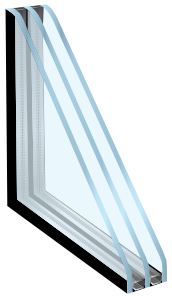
The performance data applies to triple insulating glass units with three plies (clear lites) of 1/4" (6mm) glass and two 1/2" (13.2mm) airspaces or argon spaces. The coating is applied to the second (#2) surface.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85	68%	38%	21%	17%	18%	23%	.22	.23	.57	117	.49	1.39	.20	.19	.57	116	.49	1.39
VE 1-2M	63%	28%	8%	15%	17%	32%	.21	.21	.40	82	.34	1.85	.19	.17	.39	81	.34	1.85
VE 1-52	44%	26%	17%	18%	17%	21%	.23	.23	.41	85	.36	1.22	.20	.20	.41	84	.35	1.26
VE 1-48	42%	25%	15%	19%	17%	23%	.22	.23	.39	81	.34	1.24	.20	.19	.39	80	.33	1.27
VE 1-42	33%	20%	13%	20%	19%	21%	.22	.23	.32	68	.28	1.18	.20	.19	.32	67	.28	1.18
VE 1-55	42%	23%	11%	13%	21%	22%	.22	.23	.36	75	.31	1.35	.20	.19	.36	74	.31	1.35
VE 1-40	33%	17%	8%	16%	23%	25%	.22	.23	.28	60	.25	1.32	.20	.19	.28	59	.24	1.38
VRE 1-59	47%	24%	14%	33%	23%	39%	.22	.22	.35	73	.30	1.57	.19	.18	.35	73	.30	1.57
VRE 1-54	42%	21%	13%	34%	21%	38%	.22	.22	.32	67	.28	1.50	.19	.18	.32	66	.27	1.56
VRE 1-46	38%	20%	12%	36%	20%	40%	.22	.21	.30	62	.26	1.46	.19	.18	.30	62	.26	1.46
VRE 1-38	32%	16%	10%	45%	25%	47%	.22	.21	.24	51	.21	1.52	.19	.17	.24	50	.21	1.52
VRE 1-30	25%	12%	8%	48%	20%	47%	.22	.21	.20	43	.17	1.47	.19	.18	.20	42	.17	1.47
VNE 1-63	55%	21%	4%	13%	16%	38%	.21	.21	.30	63	.26	2.12	.18	.17	.30	62	.26	2.12
VUE 1-50	43%	17%	4%	13%	17%	27%	.21	.21	.26	55	.23	1.87	.18	.17	.26	54	.22	1.95

TRIPLE INSULATING DOUBLE COATED LOW-E



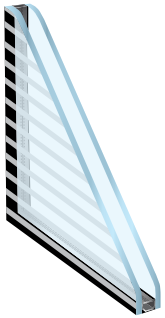
The performance data applies to triple insulating glass units with three plies (clear lites) of 1/4" (6mm) glass and two 1/2" (13.2mm) airspaces or argon spaces. The coating listed is applied to the second (#2) surface and a VE-85 coating is applied to the fourth (#4) surface.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			AIR U-Value						ARGON U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85/85	65%	33%	12%	16%	16%	23%	.17	.17	.51	104	.44	1.48	.14	.14	.51	104	.44	1.48
VE 1-2M/85	60%	26%	5%	14%	16%	32%	.16	.16	.37	77	.32	1.88	.13	.13	.37	76	.32	1.88
VE 1-52/85	43%	23%	10%	17%	15%	21%	.17	.17	.36	75	.31	1.39	.14	.14	.36	74	.31	1.39
VE 1-48/85	40%	21%	9%	18%	15%	23%	.17	.17	.34	71	.30	1.33	.14	.14	.34	70	.29	1.38
VE 1-42/85	32%	17%	8%	20%	17%	22%	.17	.17	.28	59	.25	1.28	.14	.14	.28	58	.24	1.33
VRE 1-59/85	45%	21%	8%	32%	21%	39%	.16	.16	.32	67	.28	1.61	.13	.13	.32	66	.28	1.61
VRE 1-54/85	41%	19%	8%	33%	19%	38%	.16	.17	.29	61	.25	1.64	.13	.13	.29	60	.25	1.64
VRE 1-46/85	37%	18%	7%	35%	18%	40%	.16	.16	.27	57	.24	1.54	.13	.13	.27	56	.23	1.61
VRE 1-38/85	31%	14%	6%	45%	23%	47%	.16	.16	.22	47	.19	1.63	.13	.13	.22	46	.19	1.63
VRE 1-30/85	24%	11%	5%	48%	18%	47%	.16	.16	.18	39	.16	1.50	.13	.13	.18	38	.15	1.60
VNE 1-63/85	53%	20%	2%	12%	15%	38%	.16	.16	.28	59	.25	2.12	.13	.13	.28	58	.24	2.21
VUE 1-50/85	42%	16%	3%	12%	15%	27%	.16	.16	.25	51	.21	2.00	.13	.13	.24	50	.21	2.00

SILK-SCREEN TABLES



INSULATING LOW-E SILK-SCREENED (AIR FILLED)

The performance data applies to insulating glass units with two plies (clear lites) of 1/4" (6mm) glass and one 1/2" (13.2mm) airspace. The silk-screen pattern is applied to the second (#2) surface in a white (V175) ceramic frit or a warm gray (V933) ceramic frit and a Low-E coating is applied over the silk-screen on the second (#2) surface.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Viraspan	Silk-screen	Transmittance			Reflectance			U-Value					
	Color	Coverage	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE1-2M	---	---	70%	33%	10%	11%	12%	31%	.29	.26	.44	91	.38	1.84
VE1-2M	V175	20%	60%	28%	8%	5%	18%	30%	.29	.26	.38	80	.33	1.82
VE1-2M	V933	20%	58%	27%	8%	11%	13%	27%	.29	.26	.37	78	.32	1.81
VE1-2M	V175	30%	55%	25%	7%	17%	20%	29%	.29	.26	.35	74	.31	1.77
VE1-2M	V933	30%	51%	24%	7%	11%	14%	25%	.29	.26	.34	72	.30	1.70
VE1-2M	V175	40%	49%	23%	6%	20%	23%	29%	.29	.26	.33	69	.28	1.75
VE1-2M	V933	40%	45%	21%	6%	12%	15%	23%	.29	.26	.31	66	.27	1.67
VE1-2M	V175	50%	44%	20%	5%	22%	26%	29%	.29	.26	.30	63	.26	1.69
VE1-2M	V933	50%	39%	18%	5%	12%	16%	22%	.29	.26	.28	60	.24	1.63
VE1-2M	V175	60%	39%	18%	4%	24%	30%	28%	.29	.26	.27	58	.23	1.70
VE1-2M	V933	60%	33%	15%	4%	12%	17%	20%	.29	.26	.25	54	.22	1.50
VE1-85	---	---	76%	47%	26%	12%	13%	21%	.31	.29	.63	129	.54	1.41
VE1-85	V175	20%	64%	40%	21%	16%	20%	22%	.31	.29	.55	113	.47	1.36
VE1-85	V933	20%	62%	39%	21%	12%	15%	19%	.31	.29	.54	111	.46	1.35
VE1-85	V175	30%	59%	36%	18%	18%	23%	22%	.31	.29	.51	105	.44	1.34
VE1-85	V933	30%	55%	35%	19%	12%	16%	18%	.31	.29	.49	102	.43	1.28
VE1-85	V175	40%	53%	33%	16%	20%	26%	23%	.31	.29	.46	97	.40	1.33
VE1-85	V933	40%	49%	31%	16%	12%	17%	17%	.31	.29	.45	93	.39	1.26
VE1-85	V175	50%	47%	29%	13%	23%	30%	23%	.31	.29	.42	89	.37	1.27
VE1-85	V933	50%	42%	27%	13%	13%	18%	16%	.31	.29	.40	84	.35	1.20
VE1-85	V175	60%	42%	26%	11%	25%	34%	24%	.31	.29	.38	81	.33	1.27
VE1-85	V933	60%	35%	23%	11%	13%	19%	16%	.31	.29	.35	75	.31	1.13

INSULATING LOW-E SILK-SCREENED (AIR FILLED)

Product	Viraspan Color	Silk-screen Coverage	Transmittance			Reflectance			U-Value					
			Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE1-48	---	---	47%	30%	19%	17%	11%	22%	.31	.29	.43	90	.37	1.27
VE1-48	V175	20%	40%	26%	16%	21%	13%	23%	.31	.29	.38	80	.33	1.21
VE1-48	V933	20%	39%	25%	16%	16%	12%	20%	.31	.29	.37	79	.32	1.22
VE1-48	V175	30%	36%	23%	14%	22%	15%	23%	.31	.29	.35	75	.31	1.16
VE1-48	V933	30%	34%	22%	14%	16%	12%	19%	.31	.29	.35	73	.30	1.13
VE1-48	V175	40%	33%	21%	12%	24%	16%	24%	.31	.29	.33	69	.28	1.18
VE1-48	V933	40%	30%	20%	12%	16%	12%	18%	.31	.29	.32	67	.27	1.11
VE1-48	V175	50%	29%	19%	10%	26%	17%	24%	.31	.29	.30	64	.26	1.12
VE1-48	V933	50%	26%	17%	10%	16%	13%	17%	.31	.29	.29	62	.25	1.04
VE1-48	V175	60%	25%	17%	8%	27%	19%	25%	.31	.29	.27	59	.24	1.04
VE1-48	V933	60%	22%	15%	8%	15%	13%	16%	.31	.29	.26	56	.22	1.00
VE1-45	---	---	39%	22%	10%	7%	28%	22%	.30	.26	.34	71	.29	1.34
VE1-45	V175	20%	33%	19%	8%	13%	30%	23%	.30	.26	.30	63	.26	1.27
VE1-45	V933	20%	32%	18%	8%	9%	29%	20%	.30	.26	.29	62	.25	1.28
VE1-45	V175	30%	30%	17%	7%	15%	31%	23%	.30	.26	.28	59	.24	1.25
VE1-45	V933	30%	29%	16%	7%	9%	29%	19%	.30	.26	.27	58	.23	1.26
VE1-45	V175	40%	27%	16%	6%	18%	32%	24%	.30	.26	.26	55	.22	1.23
VE1-45	V933	40%	25%	15%	6%	10%	29%	18%	.30	.26	.25	54	.22	1.14
VE1-45	V175	50%	24%	14%	5%	21%	33%	24%	.30	.26	.24	51	.20	1.20
VE1-45	V933	50%	22%	13%	5%	11%	30%	18%	.30	.26	.23	49	.20	1.10
VE1-45	V175	60%	21%	12%	4%	23%	34%	25%	.30	.26	.22	47	.19	1.11
VE1-45	V933	60%	18%	11%	4%	12%	30%	17%	.30	.26	.21	45	.18	1.00
VE1-42	---	---	37%	24%	16%	19%	14%	21%	.31	.29	.36	77	.31	1.20
VE1-42	V175	20%	32%	20%	12%	22%	16%	22%	.31	.29	.32	68	.28	1.14
VE1-42	V933	20%	31%	20%	13%	18%	14%	19%	.31	.29	.32	68	.27	1.15
VE1-42	V175	30%	29%	19%	11%	24%	16%	22%	.31	.29	.30	64	.26	1.12
VE1-42	V933	30%	27%	18%	11%	18%	15%	18%	.31	.29	.29	63	.25	1.08
VE1-42	V175	40%	26%	17%	9%	25%	17%	23%	.31	.29	.28	60	.24	1.08
VE1-42	V933	40%	24%	16%	9%	17%	15%	17%	.31	.29	.27	58	.23	1.04
VE1-42	V175	50%	23%	15%	8%	27%	18%	23%	.31	.29	.26	55	.22	1.05
VE1-42	V933	50%	21%	14%	8%	17%	15%	17%	.31	.29	.25	54	.21	1.00
VE1-42	V175	60%	20%	13%	6%	28%	19%	24%	.31	.29	.23	51	.20	1.00
VE1-42	V933	60%	17%	12%	6%	16%	15%	16%	.31	.29	.23	49	.20	.85

INSULATING LOW-E SILK-SCREENED (AIR FILLED)

Product	Viraspan Color	Silk-screen Coverage	Transmittance			Reflectance			U-Value					
			Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VRE1-59	---	---	53%	28%	17%	30%	19%	38%	.30	.27	.39	81	.33	1.60
VRE1-59	V175	20%	45%	24%	14%	31%	23%	36%	.30	.27	.34	72	.29	1.55
VRE1-59	V933	20%	43%	23%	14%	27%	20%	33%	.30	.27	.33	71	.29	1.48
VRE1-59	V175	30%	41%	22%	12%	32%	24%	35%	.30	.27	.32	67	.27	1.52
VRE1-59	V933	30%	39%	21%	12%	25%	21%	31%	.30	.27	.31	66	.27	1.44
VRE1-59	V175	40%	37%	20%	10%	32%	26%	34%	.30	.27	.29	62	.25	1.48
VRE1-59	V933	40%	34%	18%	10%	24%	21%	28%	.30	.27	.28	60	.24	1.42
VRE1-59	V175	50%	33%	17%	9%	32%	28%	33%	.30	.27	.27	58	.23	1.43
VRE1-59	V933	50%	29%	16%	9%	22%	22%	26%	.30	.27	.26	55	.22	1.32
VRE1-59	V175	60%	29%	15%	7%	33%	29%	32%	.30	.27	.25	53	.21	1.38
VRE1-59	V933	60%	24%	13%	7%	21%	22%	23%	.30	.27	.23	50	.20	1.20
VRE1-54	---	---	47%	25%	16%	32%	16%	37%	.30	.27	.35	74	.31	1.54
VRE1-54	V175	20%	40%	21%	13%	32%	19%	35%	.30	.27	.31	66	.27	1.48
VRE1-54	V933	20%	39%	21%	13%	28%	17%	32%	.30	.27	.31	65	.27	1.44
VRE1-54	V175	30%	36%	19%	11%	33%	20%	34%	.30	.27	.29	62	.25	1.44
VRE1-54	V933	30%	34%	19%	12%	26%	17%	30%	.30	.27	.28	60	.25	1.36
VRE1-54	V175	40%	33%	17%	10%	33%	21%	33%	.30	.27	.27	57	.23	1.43
VRE1-54	V933	40%	30%	16%	10%	25%	18%	28%	.30	.27	.26	56	.23	1.30
VRE1-54	V175	50%	29%	16%	8%	33%	23%	32%	.30	.27	.25	53	.21	1.38
VRE1-54	V933	50%	26%	14%	8%	23%	18%	25%	.30	.27	.24	51	.21	1.24
VRE1-54	V175	60%	26%	14%	7%	34%	24%	31%	.30	.27	.23	49	.20	1.30
VRE1-54	V933	60%	22%	12%	7%	21%	18%	23%	.30	.27	.22	47	.19	1.16
VRE1-46	---	---	43%	23%	16%	34%	15%	40%	.30	.27	.33	69	.28	1.53
VRE1-46	V175	20%	36%	20%	12%	34%	17%	37%	.30	.27	.29	62	.25	1.44
VRE1-46	V933	20%	35%	19%	13%	30%	16%	34%	.30	.27	.29	61	.25	1.40
VRE1-46	V175	30%	33%	18%	11%	34%	18%	36%	.30	.27	.27	58	.23	1.43
VRE1-46	V933	30%	31%	17%	11%	28%	16%	32%	.30	.27	.27	57	.23	1.35
VRE1-46	V175	40%	30%	16%	9%	35%	19%	35%	.30	.27	.25	54	.22	1.36
VRE1-46	V933	40%	28%	15%	9%	26%	16%	29%	.30	.27	.25	53	.21	1.33
VRE1-46	V175	50%	27%	14%	8%	35%	20%	34%	.30	.27	.23	50	.20	1.35
VRE1-46	V933	50%	24%	13%	8%	24%	17%	27%	.30	.27	.22	49	.19	1.26
VRE1-46	V175	60%	23%	13%	6%	35%	21%	32%	.30	.27	.21	46	.18	1.28
VRE1-46	V933	60%	20%	11%	6%	22%	17%	24%	.30	.27	.20	44	.18	1.11

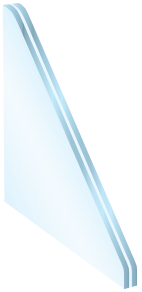
INSULATING LOW-E SILK-SCREENED (AIR FILLED)

Product	Viraspan Color	Silk-screen Coverage	Transmittance			Reflectance			U-Value					
			Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VRE1-38	---	---	36%	19%	12%	44%	21%	46%	.30	.26	.27	57	.23	1.56
VRE1-38	V175	20%	31%	16%	10%	42%	23%	43%	.30	.26	.24	51	.20	1.55
VRE1-38	V933	20%	30%	15%	10%	38%	22%	40%	.30	.26	.23	51	.20	1.50
VRE1-38	V175	30%	28%	14%	8%	42%	24%	41%	.30	.26	.22	48	.19	1.47
VRE1-38	V933	30%	26%	14%	8%	35%	22%	37%	.30	.26	.22	47	.19	1.37
VRE1-38	V175	40%	25%	13%	7%	41%	25%	39%	.30	.26	.21	45	.18	1.39
VRE1-38	V933	40%	23%	12%	7%	32%	22%	33%	.30	.26	.20	44	.18	1.28
VRE1-38	V175	50%	22%	11%	6%	40%	25%	37%	.30	.26	.19	42	.17	1.29
VRE1-38	V933	50%	20%	10%	6%	29%	23%	30%	.30	.26	.19	41	.16	1.25
VRE1-38	V175	60%	20%	10%	5%	39%	26%	35%	.30	.26	.18	39	.15	1.33
VRE1-38	V933	60%	17%	9%	5%	27%	23%	27%	.30	.26	.17	38	.15	1.13
VNE1-63	---	---	62%	24%	5%	10%	10%	37%	.29	.26	.33	70	.29	2.14
VNE1-63	V175	20%	53%	21%	4%	15%	15%	35%	.29	.26	.29	62	.25	2.12
VNE1-63	V933	20%	51%	20%	4%	11%	12%	32%	.29	.26	.29	61	.25	2.04
VNE1-63	V175	30%	48%	19%	3%	17%	17%	34%	.29	.26	.27	58	.23	2.09
VNE1-63	V933	30%	46%	18%	3%	11%	12%	30%	.29	.26	.26	56	.23	2.00
VNE1-63	V175	40%	43%	17%	3%	19%	20%	33%	.29	.26	.25	54	.22	1.95
VNE1-63	V933	40%	40%	16%	3%	11%	13%	28%	.29	.26	.24	52	.21	1.90
VNE1-63	V175	50%	39%	15%	2%	22%	22%	32%	.29	.26	.23	50	.20	1.95
VNE1-63	V933	50%	34%	13%	2%	12%	14%	25%	.29	.26	.22	48	.19	1.79
VNE1-63	V175	60%	34%	13%	2%	24%	24%	32%	.29	.26	.21	46	.18	1.89
VNE1-63	V933	60%	29%	11%	2%	12%	15%	23%	.29	.26	.20	43	.17	1.71
VUE1-50	---	---	48%	20%	5%	11%	11%	26%	.29	.26	.29	62	.25	1.92
VUE1-50	V175	20%	41%	17%	4%	16%	14%	27%	.29	.26	.26	56	.23	1.78
VUE1-50	V933	20%	40%	17%	4%	12%	12%	24%	.29	.26	.26	56	.23	1.74
VUE1-50	V175	30%	38%	16%	4%	18%	15%	27%	.29	.26	.25	53	.21	1.81
VUE1-50	V933	30%	36%	15%	4%	12%	13%	22%	.29	.26	.24	52	.21	1.71
VUE1-50	V175	40%	34%	14%	3%	20%	17%	27%	.29	.26	.23	49	.20	1.70
VUE1-50	V933	40%	31%	13%	3%	13%	13%	21%	.29	.26	.22	48	.19	1.63
VUE1-50	V175	50%	30%	13%	3%	23%	18%	27%	.29	.26	.21	46	.18	1.67
VUE1-50	V933	50%	27%	11%	3%	13%	13%	20%	.29	.26	.20	44	.18	1.50
VUE1-50	V175	60%	26%	11%	2%	25%	20%	27%	.29	.26	.19	42	.17	1.53
VUE1-50	V933	60%	22%	10%	2%	13%	14%	19%	.29	.26	.18	40	.16	1.38

INSULATING LOW-E SILK-SCREENED (AIR FILLED)

Product	Viraspan Color	Silk-screen Coverage	Transmittance			Reflectance			U-Value					
			Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VUE1-40	---	---	40%	16%	4%	16%	15%	27%	.29	.26	.25	54	.22	1.84
VUE1-40	V175	20%	34%	14%	3%	19%	17%	26%	.29	.26	.23	49	.19	1.79
VUE1-40	V933	20%	33%	14%	3%	15%	16%	23%	.29	.26	.22	48	.19	1.74
VUE1-40	V175	30%	31%	13%	3%	21%	18%	26%	.29	.26	.21	46	.18	1.72
VUE1-40	V933	30%	29%	12%	3%	15%	16%	22%	.29	.26	.21	45	.18	1.61
VUE1-40	V175	40%	28%	11%	3%	23%	19%	27%	.29	.26	.20	43	.17	1.65
VUE1-40	V933	40%	26%	10%	3%	15%	16%	22%	.29	.26	.19	42	.17	1.53
VUE1-40	V175	50%	25%	10%	2%	25%	20%	26%	.29	.26	.18	40	.16	1.56
VUE1-40	V933	50%	22%	9%	2%	15%	17%	20%	.29	.26	.18	39	.15	1.47
VUE1-40	V175	60%	22%	9%	2%	27%	21%	27%	.29	.26	.17	37	.14	1.57
VUE1-40	V933	60%	19%	8%	2%	15%	17%	18%	.29	.26	.16	36	.14	1.36

LAMINATED TABLES



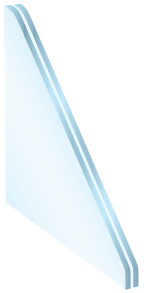
UNCOATED LAMINATED GLASS

The performance data applies to laminated glass with two plies (clear inboard) of 1/4" (6mm) glass and .060" (1.52mm) clear PVB interlayer. *Note: Low-iron substrates on the outboard have a low-iron substrate on the inboard lite as well.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▸ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
Clear	85%	60%	< 1%	7%	7%	6%	.95	.87	.81	175	.71	1.21
Green	71%	36%	< 1%	6%	6%	5%	.95	.87	.64	140	.55	1.29
Gray	43%	32%	< 1%	5%	5%	5%	.95	.87	.61	133	.52	0.83
Bronze	51%	37%	< 1%	5%	5%	5%	.95	.87	.65	141	.56	0.91
Blue-Green	73%	40%	< 1%	6%	6%	5%	.95	.87	.66	145	.57	1.28
Azuria™	65%	28%	< 1%	6%	6%	5%	.95	.87	.57	127	.49	1.33
EverGreen™	64%	29%	< 1%	6%	6%	5%	.95	.87	.58	129	.50	1.28
Arctic Blue™	54%	29%	< 1%	5%	5%	5%	.95	.87	.58	129	.50	1.08
Starphire®	90%	81%	< 1%	11%	11%	10%	.95	.87	.96	205	.84	1.07
CrystalGray™	62%	42%	< 1%	6%	6%	5%	.95	.87	.68	148	.59	1.05
Optiwhite™	90%	78%	< 1%	8%	8%	7%	.95	.87	.95	202	.83	1.08
Solarblue™	54%	36%	< 1%	5%	5%	5%	.95	.87	.64	140	.55	0.98



VIRACON (VS) STAINLESS STEEL REFLECTIVE LAMINATED GLASS

The performance data applies to laminated glass with two plies (clear inboard) of 1/4" (6mm) glass and .060" (1.52mm) clear PVB interlayer. The coating is applied to the second (#2) surface. *Note: Low-iron substrates on the outboard have a low-iron substrate on the inboard lite as well.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

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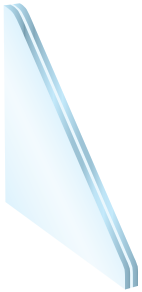
Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VS 1-20	19%	13%	< 1%	24%	31%	21%	.95	.87	.39	91	.33	0.58
VS 1-14	13%	8%	< 1%	32%	36%	27%	.95	.87	.34	80	.29	0.45
VS 1-08	8%	5%	< 1%	42%	36%	33%	.95	.87	.29	70	.24	0.33
VS 2-20	16%	8%	< 1%	18%	31%	11%	.95	.87	.40	92	.34	0.47
VS 2-14	11%	5%	< 1%	24%	36%	13%	.95	.87	.37	86	.31	0.35
VS 2-08	7%	3%	< 1%	31%	36%	16%	.95	.87	.34	81	.29	0.24
VS 3-20	10%	7%	< 1%	9%	31%	9%	.95	.87	.40	91	.34	0.29
VS 3-14	7%	5%	< 1%	11%	36%	11%	.95	.87	.37	87	.32	0.22
VS 3-08	4%	3%	< 1%	14%	36%	13%	.95	.87	.35	83	.30	0.13
VS 4-20	12%	8%	< 1%	11%	31%	11%	.95	.87	.40	92	.34	0.35
VS 4-14	8%	5%	< 1%	14%	36%	13%	.95	.87	.37	86	.31	0.26
VS 4-08	5%	3%	< 1%	18%	36%	16%	.95	.87	.34	81	.29	0.17
VS 6-20	16%	8%	< 1%	19%	31%	12%	.95	.87	.40	92	.34	0.47
VS 6-14	11%	6%	< 1%	25%	36%	15%	.95	.87	.37	85	.31	0.35
VS 6-08	7%	4%	< 1%	32%	36%	18%	.95	.87	.34	80	.29	0.24
VS 7-20	15%	6%	< 1%	16%	31%	9%	.95	.87	.39	90	.33	0.45
VS 7-14	10%	4%	< 1%	22%	36%	11%	.95	.87	.37	86	.31	0.32
VS 7-08	6%	3%	< 1%	27%	35%	13%	.95	.87	.35	82	.29	0.21
VS 8-20	14%	6%	< 1%	16%	31%	9%	.95	.87	.39	91	.33	0.44
VS 8-14	10%	4%	< 1%	20%	36%	10%	.95	.87	.37	87	.32	0.30
VS 8-08	6%	3%	< 1%	26%	35%	12%	.95	.87	.35	83	.3	0.20

VIRACON (VS) STAINLESS STEEL REFLECTIVE LAMINATED GLASS

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VS 11-20	12%	6%	< 1%	12%	31%	9%	.95	.87	.39	91	.33	0.37
VS 11-14	8%	4%	< 1%	16%	36%	10%	.95	.87	.37	87	.32	0.26
VS 11-08	5%	3%	< 1%	20%	36%	12%	.95	.87	.35	83	.30	0.17
VS 13-20	20%	16%	< 1%	25%	33%	26%	.95	.87	.40	92	.34	0.60
VS 13-14	14%	11%	< 1%	34%	38%	34%	.95	.87	.33	79	.28	0.49
VS 13-08	8%	7%	< 1%	44%	38%	43%	.95	.87	.26	65	.22	0.39
VS 19-20	14%	9%	< 1%	15%	31%	13%	.95	.87	.40	92	.34	0.41
VS 19-14	9%	6%	< 1%	19%	36%	16%	.95	.87	.37	85	.31	0.29
VS 19-08	6%	4%	< 1%	24%	36%	19%	.95	.87	.33	79	.28	0.21
VS 24-20	20%	16%	< 1%	25%	33%	26%	.95	.87	.40	91	.34	0.59
VS 24-14	14%	11%	< 1%	34%	38%	34%	.95	.87	.33	78	.28	0.50
VS 24-08	8%	7%	< 1%	44%	37%	43%	.95	.87	.26	65	.22	0.36
VS 26-20	12%	7%	< 1%	12%	31%	11%	.95	.87	.40	91	.34	0.35
VS 26-14	8%	5%	< 1%	16%	36%	13%	.95	.87	.37	86	.31	0.26
VS 26-08	5%	3%	< 1%	20%	36%	16%	.95	.87	.34	81	.29	0.17



VIRACON LOW-E SERIES LAMINATED GLASS

The performance data applies to laminated glass with two plies (clear inboard) of 1/4" (6mm) glass and .060" (1.52mm) clear PVB interlayer. The low-e coating is applied to the second (#2) surface. *Note: Low-iron substrates on the outboard have a low-iron substrate on the inboard lite as well.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

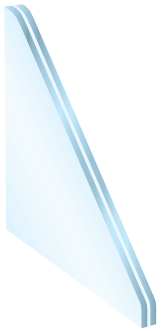
Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 1-85	82%	48%	< 1%	9%	9%	19%	.95	.87	.67	147	.58	1.40
VE 1-48	51%	31%	< 1%	16%	7%	21%	.95	.87	.53	118	.45	1.13
VE 1-42	40%	25%	< 1%	18%	11%	20%	.95	.87	.49	110	.42	0.95
VLE 1-70	68%	31%	< 1%	13%	13%	30%	.95	.87	.50	111	.43	1.58
VLE 1-57	57%	29%	< 1%	29%	16%	37%	.95	.87	.45	103	.39	1.45
VLE 1-51	51%	26%	< 1%	31%	13%	37%	.95	.87	.43	99	.37	1.38
VLE 1-47	46%	24%	< 1%	33%	12%	39%	.95	.87	.41	94	.35	1.31
VLE 1-39	39%	19%	< 1%	43%	19%	46%	.95	.87	.35	81	.30	1.30
VE 2-85	68%	32%	< 1%	8%	9%	8%	.95	.87	.59	130	.50	1.37
VE 2-48	43%	20%	< 1%	13%	7%	10%	.95	.87	.49	111	.42	1.02
VE 2-42	34%	16%	< 1%	14%	10%	10%	.95	.87	.46	105	.40	0.84
VLE 2-70	57%	22%	< 1%	10%	13%	10%	.95	.87	.51	114	.44	1.29
VLE 2-57	48%	20%	< 1%	22%	16%	15%	.95	.87	.47	107	.41	1.16
VLE 2-51	43%	18%	< 1%	23%	12%	15%	.95	.87	.46	103	.39	1.10
VLE 2-47	39%	16%	< 1%	25%	11%	16%	.95	.87	.44	101	.38	1.03
VLE 2-39	33%	13%	< 1%	32%	18%	19%	.95	.87	.41	94	.35	0.94
VE 3-85	41%	26%	< 1%	6%	7%	9%	.95	.87	.54	120	.46	0.89
VE 3-48	26%	16%	< 1%	7%	7%	10%	.95	.87	.47	105	.40	0.65
VE 3-42	20%	13%	< 1%	8%	10%	10%	.95	.87	.44	101	.38	0.53
VLE 3-70	34%	16%	< 1%	6%	12%	13%	.95	.87	.46	103	.39	0.87
VLE 3-57	28%	15%	< 1%	10%	15%	15%	.95	.87	.44	100	.38	0.74
VLE 3-51	26%	14%	< 1%	11%	12%	14%	.95	.87	.43	98	.37	0.70
VLE 3-47	23%	13%	< 1%	12%	11%	15%	.95	.87	.42	96	.36	0.64
VLE 3-39	19%	10%	< 1%	14%	18%	17%	.95	.87	.39	90	.33	0.58

VIRACON LOW-E SERIES LAMINATED GLASS

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 4-85	49%	30%	< 1%	6%	8%	11%	.95	.87	.57	125	.49	1.00
VE 4-48	31%	19%	< 1%	8%	7%	12%	.95	.87	.48	108	.41	0.76
VE 4-42	24%	15%	< 1%	9%	10%	11%	.95	.87	.45	103	.39	0.62
VLE 4-70	41%	19%	< 1%	7%	12%	16%	.95	.87	.46	105	.40	1.02
VLE 4-57	34%	18%	< 1%	13%	15%	18%	.95	.87	.45	101	.38	0.90
VLE 4-51	31%	16%	< 1%	14%	12%	18%	.95	.87	.43	98	.37	0.84
VLE 4-47	28%	15%	< 1%	15%	11%	19%	.95	.87	.42	96	.36	0.78
VLE 4-39	23%	12%	< 1%	18%	18%	22%	.95	.87	.38	89	.33	0.70
VE 6-85	70%	34%	< 1%	8%	9%	9%	.95	.87	.60	133	.52	1.34
VE 6-48	44%	21%	< 1%	13%	7%	11%	.95	.87	.50	112	.43	1.02
VE 6-42	34%	17%	< 1%	15%	10%	11%	.95	.87	.47	106	.40	0.86
VLE 6-70	58%	24%	< 1%	10%	13%	12%	.95	.87	.51	115	.44	1.32
VLE 6-57	48%	21%	< 1%	22%	16%	17%	.95	.87	.47	107	.41	1.17
VLE 6-51	44%	19%	< 1%	24%	13%	17%	.95	.87	.46	103	.39	1.13
VLE 6-47	40%	17%	< 1%	26%	11%	18%	.95	.87	.44	100	.38	1.05
VLE 6-39	33%	14%	< 1%	33%	18%	22%	.95	.87	.40	93	.34	0.97
VE 7-85	63%	25%	< 1%	7%	8%	6%	.95	.87	.55	121	.47	1.34
VE 7-42	31%	13%	< 1%	13%	10%	8%	.95	.87	.45	102	.38	0.82
VLE 7-57	44%	16%	< 1%	19%	16%	11%	.95	.87	.46	104	.39	1.12
VLE 7-51	39%	15%	< 1%	20%	12%	11%	.95	.87	.45	102	.38	1.03
VLE 7-47	36%	14%	< 1%	22%	11%	12%	.95	.87	.44	100	.37	0.97
VLE 7-39	30%	11%	< 1%	28%	18%	14%	.95	.87	.41	94	.35	0.86
VE 8-85	62%	25%	< 1%	7%	8%	6%	.95	.87	.55	122	.47	1.31
VE 8-42	30%	13%	< 1%	12%	10%	8%	.95	.87	.45	102	.38	0.80
VE 11-85	52%	25%	< 1%	6%	8%	7%	.95	.87	.54	121	.46	1.13
VE 11-42	26%	13%	< 1%	10%	10%	8%	.95	.87	.45	102	.38	0.68
VE 13-85	87%	61%	< 1%	10%	10%	26%	.95	.87	.75	162	.65	1.33
VE 13-42	43%	31%	< 1%	19%	11%	26%	.95	.87	.51	115	.44	0.97

VIRACON LOW-E SERIES LAMINATED GLASS

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE 19-85	60%	34%	< 1%	7%	8%	11%	.95	.87	.59	131	.51	1.18
VE 19-48	37%	22%	< 1%	11%	7%	13%	.95	.87	.50	111	.42	0.88
VE 19-42	29%	17%	< 1%	12%	10%	12%	.95	.87	.46	105	.40	0.73
VLE 19-70	50%	22%	< 1%	9%	12%	17%	.95	.87	.49	109	.42	1.19
VLE 19-57	41%	21%	< 1%	17%	16%	20%	.95	.87	.46	104	.39	1.05
VLE 19-51	37%	19%	< 1%	18%	12%	20%	.95	.87	.44	101	.38	0.97
VLE 19-47	34%	17%	< 1%	20%	11%	21%	.95	.87	.43	98	.37	0.92
VLE 19-39	28%	14%	< 1%	25%	18%	25%	.95	.87	.39	90	.33	0.85
VE 24-85	87%	60%	< 1%	10%	10%	26%	.95	.87	.74	160	.64	1.36
VE 24-48	54%	39%	< 1%	17%	8%	28%	.95	.87	.56	125	.49	1.10
VE 24-42	43%	30%	< 1%	19%	11%	26%	.95	.87	.51	114	.44	0 .98
VLE 24-70	70%	33%	< 1%	13%	13%	44%	.95	.87	.46	105	.40	1.75
VLE 24-51	54%	31%	< 1%	32%	13%	49%	.95	.87	.43	98	.37	1.46
VLE 24-47	49%	29%	< 1%	35%	12%	53%	.95	.87	.40	92	.34	1.44
VLE 24-39	41%	23%	< 1%	46%	19%	62%	.95	.87	.32	76	.27	1.52
VE 26-85	52%	30%	< 1%	6%	8%	9%	.95	.87	.57	126	.49	1.06
VE 26-48	32%	19%	< 1%	9%	7%	11%	.95	.87	.48	109	.41	0.78
VE 26-42	26%	15%	< 1%	10%	10%	10%	.95	.87	.46	103	.39	0.67
VLE 26-70	43%	20%	< 1%	8%	12%	13%	.95	.87	.48	108	.41	1.05
VLE 26-51	32%	16%	< 1%	15%	12%	16%	.95	.87	.44	100	.38	0.84
VLE 26-47	29%	15%	< 1%	16%	11%	17%	.95	.87	.43	98	.37	0.78
VLE 26-39	25%	12%	< 1%	20%	18%	20%	.95	.87	.39	91	.34	0.74



LAMINATED ROOMSIDE™ LOW-E

The performance data applies to laminated glass units with two plies (clear inboard) of 1/4" (6mm) glass and .060" (1.52mm) clear PVB interlayer. The low-e coating is applied to the second (#2) surface with a RoomSide Low-e coating (RS) applied to the fourth (#4) surface.

The solar and optical data presented in this guide is center-of-glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▸ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VE1-85/RS	82%	47%	< 1%	9%	9%	19%	.61	.48	.62	130	.53	1.55
VE1-48/RS	51%	30%	< 1%	16%	7%	22%	.61	.48	.46	98	.39	1.31
VE1-42/RS	40%	24%	< 1%	18%	10%	20%	.61	.48	.40	87	.34	1.18
VLE1-70/RS	68%	31%	< 1%	12%	12%	30%	.61	.48	.44	95	.38	1.79
VLE1-57/RS	56%	28%	< 1%	29%	15%	37%	.61	.48	.40	88	.35	1.60
VLE1-51/RS	51%	25%	< 1%	30%	12%	37%	.61	.48	.38	82	.32	1.59
VLE1-47/RS	46%	24%	< 1%	33%	11%	39%	.61	.48	.36	78	.30	1.53
VLE1-39/RS	39%	19%	< 1%	43%	17%	46%	.61	.48	.29	66	.25	1.56

MONOLITHIC TABLES

UNCOATED MONOLITHIC PERFORMANCE

The performance data applies to 1/4" (6mm) monolithic glass.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

	Transmittance			Reflectance			U-Value					
Substrate	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
Clear	88%	77%	62%	8%	8%	7%	1.02	.93	.94	201	.82	1.07
Green	76%	46%	29%	7%	7%	5%	1.02	.93	.70	153	.61	1.25
Gray	44%	41%	21%	5%	5%	5%	1.02	.93	.66	145	.58	0.76
Bronze	51%	48%	22%	6%	6%	5%	1.02	.93	.72	156	.62	0.82
Blue-Green	75%	48%	32%	7%	7%	6%	1.02	.93	.72	156	.62	1.21
Azuria™	68%	32%	42%	7%	7%	5%	1.02	.93	.59	132	.52	1.31
EverGreen™	66%	33%	14%	6%	6%	5%	1.02	.93	.60	134	.53	1.25
Arctic Blue™	53%	33%	20%	6%	6%	5%	1.02	.93	.60	133	.52	1.02
Starphire®	91%	89%	87%	8%	8%	8%	1.02	.93	1.03	220	.90	1.01
CrystalGray™	65%	54%	34%	6%	6%	6%	1.03	.93	.76	166	.67	0.97
Optiwhite™	91%	89%	84%	8%	8%	8%	1.02	.93	1.03	220	.90	1.01
Solarblue™	56%	47%	31%	6%	6%	5%	1.02	.93	.71	154	.61	0.92
Pacifica™	42%	27%	15%	5%	5%	5%	1.02	.93	.56	125	.49	0.86
Graphite Blue™	61%	54%	37%	6%	6%	6%	1.02	.93	.77	166	.67	0.91

REFLECTIVE MONOLITHIC PERFORMANCE

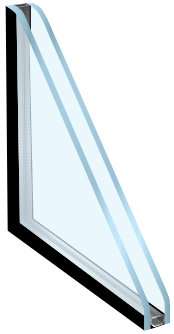
The performance data applies to 1/4" (6mm) monolithic glass. The Reflective coating is applied to the second (#2) surface.

The solar and optical data presented in this guide is center of glass data based on the National Fenestration Rating Council measurement standards. They were calculated using Lawrence Berkeley National Laboratory's (LBNL) WINDOW 5.2/6.3 software. In some cases performance data changed in comparison to previous versions of LBNL's WINDOW program.

▶ Contact Viracon at 800.533.2080 to obtain performance data on products not listed here.

Product	Transmittance			Reflectance			U-Value					
	Visible	Solar	U-V	Exterior	Interior	Solar	Winter	Summer	Shading Coefficient	Relative Heat Gain	SHGC	LSG
VP 1-13	14%	12%	13%	29%	47%	24%	.86	.75	.33	77	.29	0.48
VP 1-18	18%	16%	16%	24%	41%	20%	.88	.77	.38	87	.33	0.55
VP 1-22	24%	21%	21%	18%	35%	15%	.92	.82	.45	101	.39	0.62
VS 1-08	8%	6%	4%	42%	37%	34%	.76	.63	.23	55	.20	0.40
VS 1-14	13%	11%	8%	32%	38%	27%	.80	.68	.30	69	.26	0.50
VS 1-20	20%	15%	11%	24%	32%	21%	.86	.75	.37	84	.32	0.63
VS 2-08	7%	4%	2%	31%	37%	17%	.76	.63	.26	61	.22	0.32
VS 2-14	11%	6%	4%	24%	38%	14%	.80	.68	.30	69	.26	0.42
VS 2-20	17%	9%	5%	18%	32%	11%	.86	.75	.35	80	.30	0.57
VS 3-08	4%	4%	2%	14%	37%	15%	.76	.63	.26	61	.22	0.18
VS 3-14	7%	6%	4%	12%	38%	13%	.80	.68	.30	70	.26	0.27
VS 3-20	10%	9%	5%	10%	32%	11%	.86	.75	.35	81	.30	0.33
VS 4-08	5%	4%	2%	17%	37%	16%	.76	.63	.26	61	.22	0.23
VS 4-14	8%	7%	3%	14%	38%	13%	.80	.68	.30	70	.26	0.31
VS 4-20	12%	9%	4%	11%	31%	11%	.86	.75	.35	81	.30	0.40
VS 6-08	7%	4%	2%	31%	38%	18%	.76	.63	.26	60	.22	0.32
VS 6-14	11%	7%	4%	25%	38%	15%	.80	.68	.30	70	.26	0.42
VS 6-20	17%	10%	5%	18%	32%	12%	.86	.75	.35	81	.30	0.57
VS 7-08	6%	3%	3%	27%	37%	13%	.76	.63	.26	61	.22	0.27
VS 7-14	11%	5%	4%	23%	38%	12%	.80	.68	.29	68	.25	0.44
VS 7-20	15%	7%	7%	16%	32%	9%	.86	.75	.34	78	.28	0.54
VS 8-14	10%	5%	2%	20%	37%	10%	.80	.68	.30	69	.26	0.38
VS 19-14	10%	7%	4%	19%	38%	15%	.80	.68	.30	70	.26	0.38
VS 26-14	9%	6%	4%	16%	38%	13%	.80	.68	.30	70	.26	0.35
VS 27-14	6%	4%	2%	11%	38%	8%	.80	.68	.30	69	.26	0.23
VS 29-14	9%	8%	5%	18%	38%	16%	.80	.68	.30	70	.26	0.35

ACOUSTIC PERFORMANCE DATA TABLES



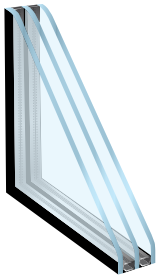
INSULATING ACOUSTICAL DATA

Viracon Acoustical Glass is made from combinations of various glass types along with acoustical window frames to help you effectively reduce sound transmission from airplanes, trains, vehicles and other unwanted noises. The performance data below applies to an insulating unit constructed with two plies of glass and an air or argon filled space. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating.

The **STC (Sound Transmission Class)** rating is a single-number rating system for interior building partitions and viewing windows used to categorize acoustic performance. Its original intent was to quantify interior building partitions not exterior wall components. As a result it is not recommended for glass selection of exterior wall applications since the single-number rating was achieved under a specific set of laboratory conditions.

The **OITC (Outside-Inside Transmission Class)** rating is used to classify acoustic performance of glazing in exterior applications.

Insulating Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1/2" overall - 1/8" glass, 1/4" airspace, 1/8" glass	**28**	**26**	26	21	23	23	26	21	19	24	27	30	33	36	40	44	46	39	34	45
5/8" overall - 1/8" glass, 3/8" airspace, 1/8" glass	**31**	**26**	26	23	23	20	23	19	23	27	29	32	35	39	44	47	48	41	36	43
1" overall - 1/4" glass, 1/2" airspace, 1/4" glass	**35**	**30**	27	24	29	22	22	25	30	33	35	38	40	42	42	37	37	43	46	49
1" overall - 1/4" glass, 1/2" **argon** space, 1/4" glass	**35**	**29**	32	29	28	22	20	25	30	33	37	40	43	45	44	39	40	45	49	52
1" overall - 1/4" glass, 9/16" airspace, 3/16" glass	**37**	**30**	32	26	25	20	24	29	33	34	38	41	43	46	46	42	36	43	48	53
1-1/8" overall - 5/16" glass, 1/2" airspace, 5/16" glass	**37**	**32**	26	24	25	31	24	32	32	35	37	39	39	38	36	38	42	44	46	49
1-1/4" overall - 3/8" glass, 1/2" airspace, 3/8" glass	**37**	**32**	29	23	23	29	31	34	34	35	36	36	35	35	36	40	43	47	49	48
1-1/2" overall - 1/4" glass, 1" airspace, 1/4" glass	**37**	**30**	22	19	27	23	31	30	35	35	36	39	41	42	41	36	37	46	51	56
1-1/16" overall - 1/4" glass, 1/2" airspace, 5/16" glass	**38**	**33**	30	24	29	26	29	33	34	36	39	41	41	40	38	37	39	43	46	48
1-1/4" overall - 1/4" glass, 3/4" airspace, 1/4" glass	**38**	**31**	27	23	28	21	27	29	34	35	37	41	43	45	44	39	39	46	49	52
1-1/8" overall - 1/4" glass, 1/2" airspace, 3/8" glass	**39**	**34**	28	26	32	29	29	31	35	37	38	39	41	43	41	40	41	44	47	49
1-3/16" overall - 5/16" glass, 1/2" airspace, 3/8" glass	**39**	**34**	29	26	26	31	30	37	36	37	39	39	40	37	35	39	43	46	48	49
1-3/8" overall - 1/4" glass, 3/4" airspace, 3/8" glass	**40**	**33**	30	23	31	28	33	37	39	40	41	39	38	38	39	39	40	47	51	53



TRIPLE INSULATING ACOUSTICAL DATA

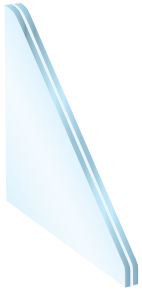
The performance data below applies to triple insulating glass units constructed with three plies of glass, two airspaces and an interlayer (where applicable). Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating.

Triple Insulating Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1-3/4" overall - 1/4" glass, 1/2" airspace, 1/4" glass, 1/2" airspace, 1/4" glass	**39**	**31**	25	22	29	24	25	29	34	37	40	43	46	48	47	41	41	47	52	58
1-7/8" overall - 1/4" glass, 1/2" airspace, 1/4" glass, 1/2" airspace, 3/16" glass, .030" PVB, 3/16" glass	**41**	**33**	24	25	31	29	31	36	37	39	39	41	41	42	42	43	44	48	50	49
2-3/4" overall - 3/8" glass, 3/4" airspace, 5/16" glass, 3/4" airspace, 1/4" glass, .060" PVB, 1/4" glass	**45**	**35**	33	30	34	37	39	43	44	45	46	43	41	41	43	49	55	57	61	65

MONOLITHIC ACOUSTICAL DATA

The performance data below applies to monolithic glass. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating. The monolithic glass is one lite of glass.

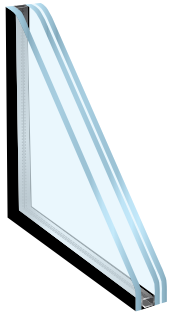
Monolithic Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1/8" overall - 1/8" glass	**30**	**25**	19	17	18	21	23	22	24	27	28	30	30	32	34	35	36	33	26	30
1/4" overall - 1/4" glass	**31**	**29**	23	25	25	24	28	26	29	31	33	34	34	35	34	30	27	32	37	31
3/8" overall - 3/8" glass	**34**	**32**	26	27	27	30	32	31	34	35	36	35	33	30	30	35	38	41	46	48
1/2" overall - 1/2" glass	**36**	**33**	26	30	26	30	33	33	34	36	37	35	32	32	36	40	43	46	50	51



LAMINATED ACOUSTICAL DATA

The performance data below applies to laminated glass units constructed with two plies of glass and an interlayer. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating.

Laminated Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1/4" overall - 1/8" glass, .015" PVB, 1/8" glass	**33**	**30**	27	23	27	24	27	28	29	31	33	35	35	35	33	31	32	37	41	45
3/16" overall - S/S glass, .030" PVB, S/S glass	**35**	**31**	29	29	29	25	27	29	29	31	32	34	34	34	34	35	33	36	39	41
1/4" overall - 1/8" glass, .030" PVB, 1/8" glass	**35**	**31**	25	26	28	27	29	29	30	32	34	35	35	36	36	35	35	38	43	46
1/4" overall - 1/8" glass, .045" PVB, 1/8" glass	**35**	**31**	24	27	27	28	28	29	30	32	34	35	36	36	37	36	35	38	43	46
5/16" overall - 1/8" glass, .060" PVB, 1/8" glass	**35**	**31**	25	25	26	29	28	30	30	32	34	35	35	36	36	36	36	39	43	46
3/8" overall - 3/16" glass, 0.15" PVB, 3/16" glass	**36**	**32**	27	25	26	30	31	31	33	35	35	35	35	33	33	37	41	44	48	51
3/8" overall - 3/16" glass, .030" PVB, 3/16" glass	**36**	**33**	27	27	27	30	31	31	33	34	35	36	36	35	34	37	41	45	49	52
3/8" overall - 1/4" glass, .030" PVB, 1/8" glass	**36**	**33**	27	28	26	30	31	31	32	34	35	36	36	35	35	36	40	44	48	51
1/2" overall - 1/4" glass, .015" PVB, 1/4" glass	**36**	**32**	25	25	27	30	32	32	34	35	35	35	33	32	35	40	43	46	49	51
9/16" overall - 1/4" glass, .075" Storm, 1/4" glass	**36**	**35**	27	30	30	31	31	33	32	33	34	35	35	34	36	40	43	45	47	47
9/16" overall - 1/4" glass, .090" SGP, 1/4"glass	**36**	**34**	31	30	29	31	32	33	33	34	35	35	34	32	34	37	40	42	44	47
7/16" overall - 1/4" glass, .060" PVB, 1/8" glass	**37**	**33**	27	28	27	30	31	31	33	35	36	37	37	37	36	37	41	44	48	51
9/16" overall - 1/4" glass, .100" StormGuard, 1/4" glass	**37**	**35**	32	31	30	31	33	34	34	34	35	36	35	35	37	41	44	47	49	51
1/2" overall - 1/4" glass, 030" PVB, 1/4" glass	**38**	**34**	25	29	28	30	33	33	34	36	37	37	37	36	37	41	45	48	51	53
1/2" overall - 1/4" glass, .045" PVB, 1/4" glass	**38**	**34**	26	30	27	30	33	33	34	36	37	38	37	36	37	41	45	48	51	54
9/16" overall - 1/4" glass, .060" PVB, 1/4" glass	**39**	**34**	26	29	28	30	33	33	35	36	37	38	38	37	38	41	44	47	51	54
3/4" overall - 1/2" glass, .030" PVB, 1/4" glass	**39**	**36**	31	35	33	33	34	36	36	37	36	35	34	39	41	46	48	50	52	56
5/8" overall - 3/8" glass, .030" PVB, 1/4" glass	**40**	**36**	29	30	28	32	34	35	36	38	38	38	36	38	42	46	49	52	55	57
13/16" overall - 1/2" glass, .060" PVB, 1/4" glass	**41**	**36**	29	30	29	32	35	35	37	38	38	38	37	41	44	48	50	53	56	56

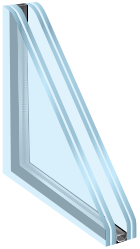


INSULATING LAMINATED ACOUSTICAL DATA

The performance data below applies to insulating laminated glass units constructed with three plies of glass, an interlayer and an airspace. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating.

Insulating Laminated Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
13/16" overall - 3/16" glass, 3/8" airspace, 1/8" glass, .030" PVB, 1/8" glass	**37**	**31**	27	27	26	24	22	28	32	35	38	38	39	40	42	43	41	45	52	57
15/16" overall - 3/16" glass, 1/2" airspace, 1/8" glass, .030" PVB, 1/8" glass	**39**	**31**	26	23	25	23	27	31	34	36	38	39	41	43	45	46	43	49	55	55
1" overall - 1/4" glass, 1/2" airspace, 1/8" glass, .030" PVB, 1/8" glass	**39**	**31**	28	20	29	24	26	30	34	36	39	42	43	44	44	41	40	47	52	56
1-5/16" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .075" Storm, 1/4" glass	**39**	**34**	29	25	30	27	31	34	35	34	36	38	40	41	42	43	44	47	50	49
1-5/16" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .090" SGP, 1/4" glass	**39**	**34**	29	24	32	27	32	34	35	34	36	38	40	40	41	41	42	46	48	49
1-1/8" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .030" PVB, 1/8" glass	**40**	**30**	28	17	28	29	33	34	38	40	40	41	41	41	41	40	43	49	54	58
1-1/16" overall - 1/4" glass, 7/16" airspace, 3/16" glass, .030" PVB, 3/16" glass	**40**	**33**	31	25	30	27	29	34	36	37	39	40	42	43	42	41	44	47	51	51
1-5/16" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .100" Stormguard, 1/4" glass	**40**	**34**	28	23	30	28	32	35	36	36	37	39	41	43	43	43	45	48	50	49
1-5/8" overall - 1/4" glass, 1" airspace, 3/16" glass, .030" PVB, 3/16" glass	**40**	**32**	24	24	31	28	33	36	37	39	39	40	41	41	41	42	43	47	49	47
1-1/16" overall - 1/4" glass, 1/2" airspace, 1/8" glass, .060" PVB, 1/8" glass	**41**	**32**	24	23	28	26	28	33	36	37	39	42	44	46	46	43	44	50	53	55
1-1/8" overall - 1/4" glass, 1/2" airspace, 3/16" glass, .030" PVB, 3/16" glass	**41**	**35**	32	27	29	28	31	35	37	39	41	42	43	44	43	42	45	50	53	54
1-1/16" overall - 1/4" glass, 7/16" airspace, 3/16" glass, .030" AC, 3/16" glass	**41**	**34**	31	26	29	26	30	33	36	36	39	42	44	45	45	44	45	49	51	50
1-3/16" overall - 1/4" glass, 1/2" airspace, 3/16" glass, .060" PVB, 3/16" glass	**42**	**35**	30	29	31	28	31	34	37	39	41	42	44	46	45	44	47	52	55	60
1-5/16" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .060" PVB, 1/4" glass	**42**	**34**	29	24	30	29	32	37	40	40	41	42	44	45	44	45	48	53	57	59

Insulating Laminated Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1-5/16" overall - 1/4" glass, 5/8" airspace, 3/16" glass, .060" PVB, 3/16" glass	**42**	**35**	29	24	30	29	32	37	40	40	41	42	44	45	44	45	48	53	57	59
1-1/4" overall - 1/4" glass, 1/2" airspace, 1/4" glass, .030" PVB, 1/4" glass	**43**	**36**	31	29	32	30	32	35	38	40	40	42	44	46	47	46	47	52	56	61
1-3/8" overall - 5/16" glass, 5/8" airspace, 3/16" glass,.060" PVB, 3/16" glass	**43**	**37**	28	28	34	36	33	40	41	42	43	43	42	40	40	43	49	53	57	61
1-7/16" overall - 3/16" glass, 11/16" airspace, 3/8" glass, .030" PVB, 3/16" glass	**43**	**35**	27	27	29	29	30	35	39	40	41	42	43	46	50	52	50	53	57	59
1-11/16" overall - 3/8" glass, 3/4" airspace, 1/4" glass, .060" PVB, 1/4" glass	**43**	**37**	25	31	38	33	37	39	42	43	43	42	40	40	41	56	50	55	58	61
1-7/16" overall - 1/4" glass, 3/4" airspace, 3/16" glass, .060" PVB, 3/16" glass	**44**	**36**	28	26	32	30	35	37	40	41	43	44	45	47	47	44	47	53	57	60
1-9/16" overall - 1/4" glass, 3/4" airspace, 1/4" glass, .060" PVB, 1/4" glass	**44**	**37**	28	29	36	32	34	39	41	41	41	43	44	45	45	46	47	52	56	61
1-15/16" overall - 3/8" glass, 1" airspace, 1/4" glass, .060" PVB, 1/4" glass	**46**	**36**	24	30	33	35	40	41	44	45	45	44	44	44	43	46	50	54	57	58



DOUBLE LAMINATED INSULATING ACOUSTICAL DATA

The performance data below applies to double laminated insulating glass units constructed with four plies of glass, two interlayers and an airspace. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating.

Double Laminated Insulating Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1-7/16" overall - 1/4" glass, .030" PVB, 1/4" glass, 1/2" airspace, 3/16" glass, .060" PVB, 3/16" glass	**41**	**35**	32	25	29	31	33	35	37	38	39	39	40	41	42	43	43	44	45	46
1" overall - 1/8" glass, .030" PVB, 1/8" glass, 1/2" airspace, 1/8" glass, .030" PVB, 1/8" glass	**42**	**33**	26	21	29	28	30	34	36	40	42	44	44	44	45	46	47	52	57	58
1-3/8" overall - 5/32" glass, .030" PVB, 5/16" glass, 1/2" airspace, 5/32" glass, .030" PVB, 1/4" glass	**42**	**35**	29	24	30	35	35	37	39	39	40	40	40	39	44	48	52	56	59	61
1-5/16" overall - 1/4" glass, .030" PVB, 1/4" glass, 1/2" airspace, 5/32" glass, .060" PVB, 5/32" glass	**43**	**36**	30	25	29	33	34	38	42	42	43	44	42	41	42	44	49	52	55	57
1-11/16" overall - 1/4" glass, .060" PVB, 1/4" glass, 3/4" airspace, 3/16" glass, .030" PVB, 3/16" glass	**44**	**33**	21	23	31	35	37	40	42	42	43	42	42	42	44	48	51	55	57	59
1-9/16" overall - 1/4" glass, .060" PVB, 1/4" glass, 3/4" airspace, 1/8" glass, .030" PVB, 1/8" glass	**44**	**37**	32	26	35	35	35	40	41	42	42	43	44	44	45	47	50	56	54	45
2-1/8" overall - 1/4" glass, .100" PVB, 1/4" glass, 3/4" airspace, 1/4" glass, .060" PVB, 1/2" glass	**45**	**38**	30	31	36	35	38	42	42	41	41	40	41	44	47	50	53	56	58	60
2-3/8" overall - 3/8" glass, .060" PVB, 3/8" glass, 3/4" airspace, 3/8" glass, .090" PVB, 3/8" glass	**45**	**38**	28	32	37	35	38	39	41	38	40	41	44	46	49	52	55	57	56	53
2-5/8" overall - 3/8" glass, .060" PVB, 3/8" glass, 1" airspace, 3/8" glass, .090" PVB, 3/8" glass	**45**	**38**	29	32	37	37	37	40	42	38	39	41	44	47	50	53	55	57	59	60

DOUBLE GLAZED INSULATING ACOUSTICAL DATA

The performance data below applies to double glazed insulating glass units. Data is based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. *OITC is estimated based on this test. Glass size and glazing system will affect STC rating. **These double-glazed applications are provided for information only and refer to field-glazed applications. Viracon supplies only the glass components.**

Double Glazed Insulating Glass Construction	STC	OITC*	Frequency (Hz)																	
			100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
			Sound Transmission Loss (dB)																	
1-7/16" overall - 1/8" glass, .030" PVB, 1/8" glass, 1" airspace, 3/16" glass	**42**	**33**	22	27	27	28	31	35	38	41	42	43	44	45	47	47	45	50	58	61
2-7/16" overall - 1/8" glass, .030" PVB, 1/8" glass, 2" airspace, 3/16" glass	**45**	**35**	24	25	34	33	34	40	41	44	44	46	47	47	48	48	46	50	55	56
1-13/16" overall - 1/4" glass, .030" PVB, 1/4" glass, 1" airspace, 1/8" glass, .060" PVB, 1/8" glass	**46**	**35**	21	28	33	37	38	42	43	45	44	44	44	45	49	53	57	59	62	63
2-11/16" overall - 1/4" glass, .030" PVB, 1/4" glass, 2" airspace, 3/16" glass	**46**	**39**	27	36	33	33	35	39	41	45	45	46	46	46	49	51	52	56	60	62
2-7/8" overall - 1/4" glass, .030" PVB, 1/4" glass, 2" airspace, 3/8" glass	**46**	**42**	34	37	33	38	40	42	44	48	47	46	45	52	56	51	55	59	61	62
4-7/16" overall - 1/8" glass, .030" PVB, 1/8" glass, 4" airspace, 3/16" glass	**48**	**39**	26	36	34	37	37	43	44	48	49	51	51	50	51	50	47	51	58	60
4-11/16" overall - 1/4" glass, .030" PVB, 1/4" glass, 4" airspace, 3/16" glass	**49**	**41**	30	37	33	38	37	42	45	49	50	51	50	48	50	53	58	57	61	64
4-7/8" overall - 1/4" glass, .030" PVB, 1/4" glass, 4" airspace, 3/8" glass	**49**	**44**	38	38	33	40	40	43	46	51	52	52	50	45	48	53	56	59	62	64
4-15/16" overall - 1/2" glass, .060" PVB, 1/4" glass, 4" airspace, 1/8" glass	**49**	**40**	29	33	31	36	38	43	44	46	47	49	50	52	52	55	59	59	58	60
5-1/16" overall - 1/4" glass, .060" PVB, 1/4" glass, 4" airspace, 1/4" glass, .030" PVB, 1/4" glass	**50**	**43**	31	39	35	39	41	43	46	51	52	52	49	48	50	54	59	61	63	64
5-5/16" overall - 1/2" glass, .060" PVB, 1/4" glass, 4" airspace, 1/4" glass, .030" PVB, 1/4" glass	**50**	**43**	31	42	33	40	42	43	46	50	50	50	49	50	52	55	60	62	64	64
4-3/4" overall - 1/4" glass, .030" PVB, 1/4" glass, 4" airspace, 1/8" glass, .030" PVB, 1/8" glass	**51**	**44**	34	38	34	40	41	45	47	51	52	53	53	51	52	55	58	60	62	64

VIETCOMBANK TOWER

LOCATION: HO CHI MINH CITY, VIETNAM // **GLASS TYPE:** VRE1-59, VLE1-70 // **ARCHITECT:** PELLI CLARKE PELLI ARCHITECTS

GLAZING CONTRACTOR: EUROWINDOW JSC // **PHOTOGRAPHER:** © VIRACON, NGUYEN HONG LONG

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