

**Specialty Glass Materials  
Products & Specifications**

11/22



# Specialty Glass Materials Products & Specifications

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It all starts with the basic element, the glass. Each substrate has unique and specific qualities which are matched to the application and specifications that your unique project requires.

## High Ion-Exchange (HIE™) Thin Glass

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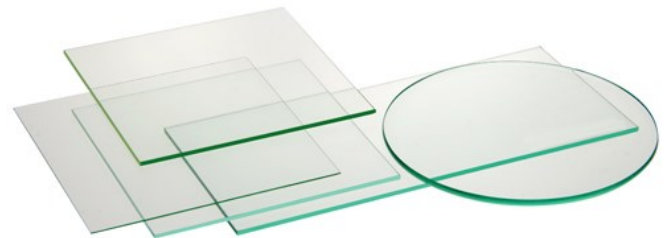
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## Specialty Glass

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### High Ion-Exchange (HIE™) Chemically Strengthened Aluminosilicate Thin Glass

High Ion-Exchange (HIE™) thin glass is strong, lightweight and flexible. It is a high quality aluminosilicate glass that is chemically strengthened to achieve incredible scratch, break/impact, and shock resistance. HIE™ glass is significantly stronger than similar thickness soda lime glass.

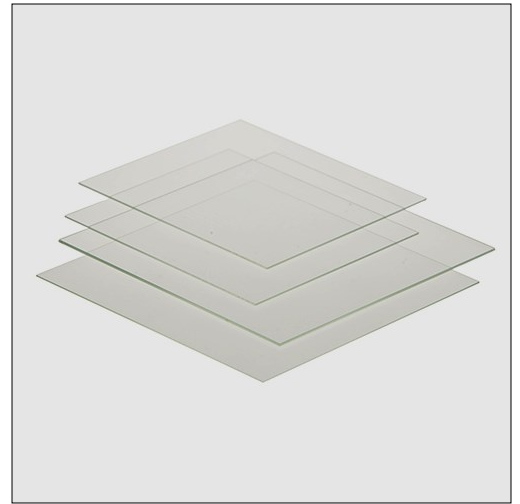
Specially designed material and unique salt bath processes combine to achieve a very high depth of layer during the chemical strengthening process, the end result of which is increased strength making HIE™ glass the ideal solution for cover glass and touch screen applications.

#### Features:

- Thin, lightweight
- Superior strength, scratch and shock resistant
- Excellent optical transmission
- High compression layer

#### Applications:

- Display & Touch Screen Cover & Back Plate Glass
  - Projected Capacitive (PCAP) Touch
  - Surface Acoustic Wave (SAW)
  - Acoustic Pulse Recognition (APR)
  - Multi-touch
  - Optical Touch
  - Micro-displays
- Optical Components



Abrisa Technologies can supply the following HIE™ glass substrates to meet your application-specific requirements.

- Asahi (AGC) Dragontrail™
- Corning® Gorilla® Glass
- SCHOTT Xensation™

#### Dimensions:

- Thicknesses: 0.55mm - 2mm stocked
- Sizes: Up to 32" x 24" (812.8 x 609.6mm)
- Non-standard sizes may also be available upon request.



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## Asahi Glass Corporation (AGC) Dragontrail™



Glass produced using a High Ion Exchange (HIE™) process is stronger and more durable than non HIE™ glass substrates. Abrisa Technologies distributes, fabricates and can apply coatings to three major manufactured HIE brands of glass; Asahi Dragontrail™, Corning® Gorilla® Glass, and Schott Xensation™.

(AGC) Dragontrail™ - Ideal glass for use as cover glass for portable equipment such as smart phones, tablet PCs, and handheld displays and instrumentation.

AGC's Dragontrail™ is a proprietary chemically strengthened and tempered float-glass material that is 6-times stronger and more durable than the widely used soda lime glass. This increased strength allows AGC to manufacture thinner sheets, allowing device manufacturers to answer the market's demand for thinner and lighter weight devices. Dragontrail™ is free of environmentally harmful materials such as arsenic, lead, and antimony.

### Key Features:

- 6X tougher than soda lime glass
- Lightweight , thinner sheets
- Highly scratch resistant
- Beautiful ultra-clear finish
- Environmentally friendly

### Dimensional Availability:

- Thicknesses - ranging from 0.5 to over 5.0 mm). Stock thicknesses include 0.8mm and 1.1mm.
- Sheet size - 48" x 29" (1219.2 x 736.6mm) standard and 60" x 48" (1524 x 736.6mm) available in 1.1mm. custom sizes may be available upon request.

### Physical Properties:

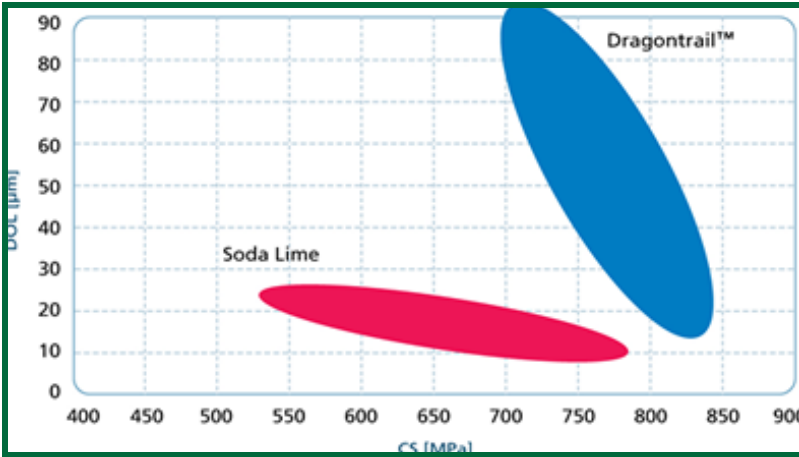
	Property	Measurement	Dragontrail	Soda Lime
<b>Mechanical</b>	Density	g/cm <sup>3</sup>	2.48	2.50
	Young's Modulus	GPa	74	73
	Shear Modulus	GPa	30	30
	Poisson's Ratio		0.23	0.21
	Vickers Hardness	Before CT	595	533
	Vickers Hardness	After CT	673	580
<b>Thermal</b>	CTE	[10 <sup>-7</sup> ](50~200°C)	98	85
	Tg	°C	604	550
	Softening Point	°C	831	733
	Annealing Point	°C	606	554
	Strain Point	°C	556	511
<b>Optical</b>	Refraction Index	Nd	1.51	1.52
	Photoelastic Constant	Nm/cm Mpa	28.3	25.6
<b>Electrical</b>	Volume Resistivity	Log (Ω .cm)	8.4	8.5



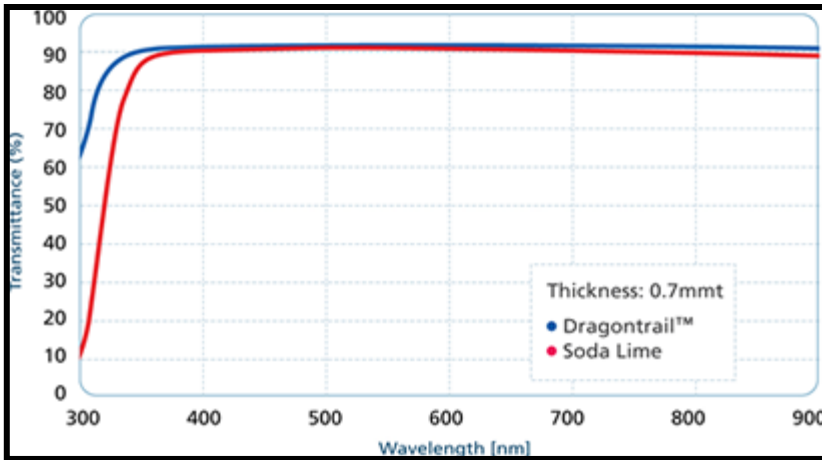


**Specialty Glass Materials  
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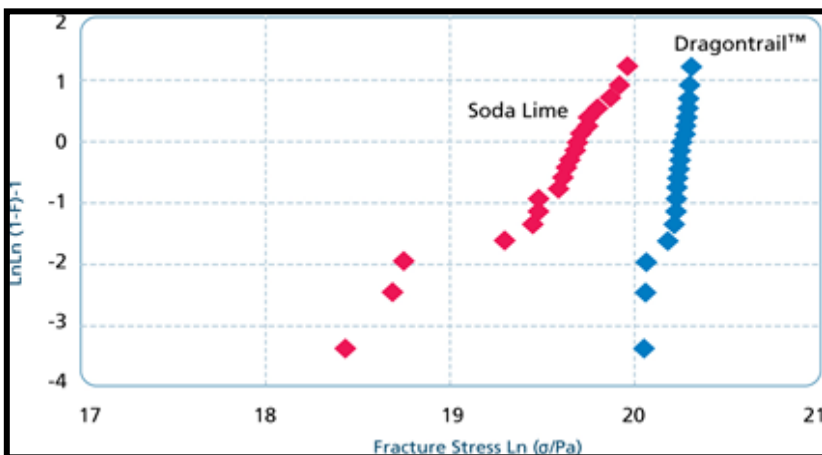
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**C/S  
Characteristics**



**Optical  
Transmittance**



**Three-Point  
Bending Result**

# Specialty Glass Materials Products & Specifications

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## CORNING Gorilla® Glass

Corning's New Gorilla® Glass 3 with Native Damage Resistance™ is an alkali-aluminosilicate thin sheet glass that is better able to survive the real-world events that most commonly cause glass failure. With its new core composition, this glass enables improved damage resistance and toughness by helping to prevent the deep chips and scratches that cause glass to break.

## Product Information

### Benefits

- Glass designed with improved native damage resistance,
  - Enhances retained strength after use
  - High resistance to scratch and sharp contact damage
  - Superior surface quality

### Applications

- Ideal protective cover for electronic displays in:
  - Smartphones
  - Laptop and tablet computer screens
  - Mobile devices
- Touchscreen devices
- Optical components
- High strength glass articles

### Dimensions

Available thicknesses 0.4 mm - 2.0 mm

### Viscosity

Softening Point ( $10^{7.6}$ poises)	900 °C
Annealing Point ( $10^{13.2}$ poises)	628 °C
Strain Point ( $10^{14.7}$ poises)	574 °C

### Properties

Density	2.39 g/cm <sup>3</sup>
Young's Modulus	69.3 GPa
Poisson's Ratio	0.22
Shear Modulus	28.5 GPa
Vickers Hardness (200 g load)	
Un-strengthened	534 kgf/mm <sup>2</sup>
Strengthened	649 kgf/mm <sup>2</sup>
Fracture Toughness	0.66 MPa m <sup>0.5</sup>
Coefficient of Expansion (0 °C - 300 °C)	75.8 x 10 <sup>-7</sup> /°C

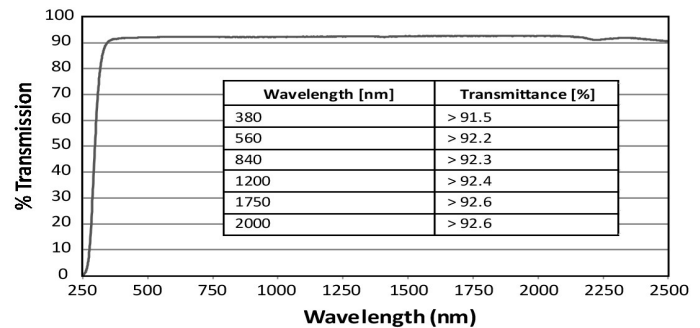
### Chemical Strengthening

Compressive stress	≥ 950 MPa @ 40 μm DOL
Depth of Layer	≥ 50 μm

### Optical

Refractive Index (590 nm)	
Core glass*	1.50
Compression layer	1.51
Photo-elastic constant	31.9 nm/cm/MPa

\* Core index is used for FSM-based measurements since it is unaffected by ion-exchange conditions.



### Chemical Durability

Durability is measured via weight loss per surface area after immersion in the solvents shown below. Values are highly dependent upon actual testing conditions. Data reported is for Corning's Gorilla Glass 3 with NDR™.

Reagent	Time	Temperature (C°)	Weight Loss (mg/cm <sup>2</sup> )
HCl - 5%	24 hrs	95	0.6
NH <sub>4</sub> F:HF - 10%	20 min	20	2.1
HF - 10%	20 min	20	12.3
NaOH - 5%	6 hrs	95	1.9

### Electrical

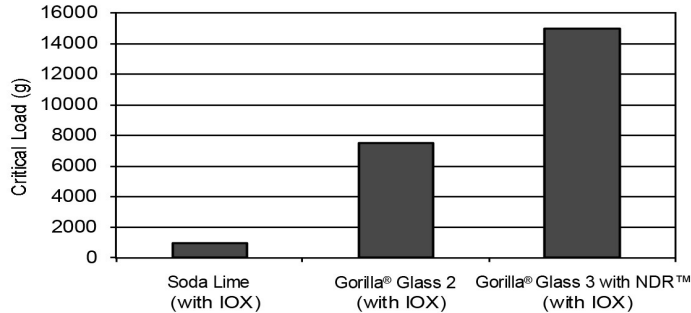
Frequency (MHz)	Dielectric Constant	Loss Tangent
54	7.59	0.022
163	7.48	0.022
272	7.44	0.021
381	7.42	0.022
490	7.38	0.021
599	7.37	0.022
912	7.30	0.023
1499	7.26	0.023
1977	7.23	0.023
2466	7.20	0.024
2986	7.19	0.025

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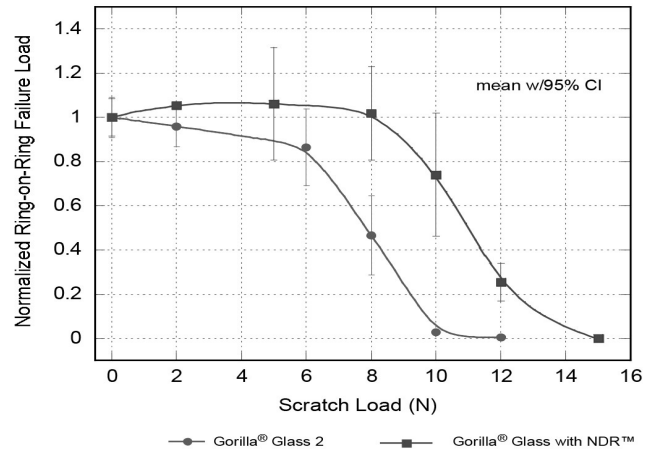
Putting Gorilla® Glass 3 with NDR™ to the Test.

Greater damage resistance

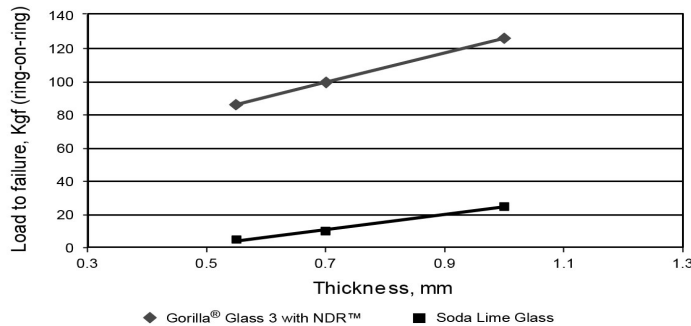


It takes more load to initiate radial cracks in the glass.

Greater retained strength

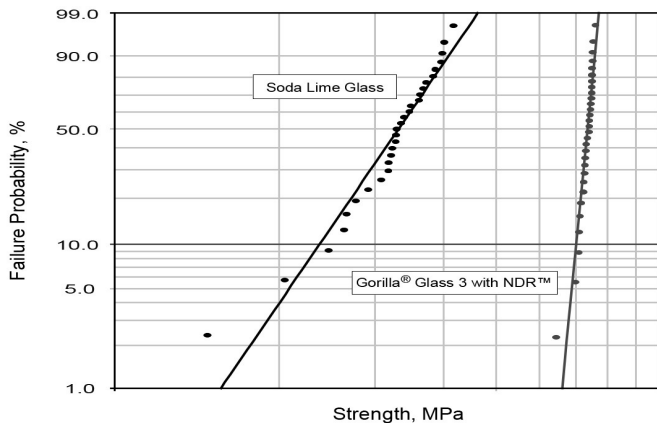


Enables the use of thinner cover glass



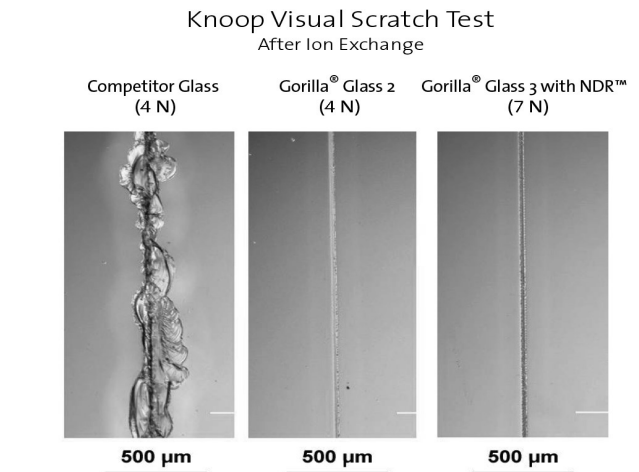
Devices benefit from greater retained strength.

Enables greater strength



Coming Gorilla Glass 3 with NDR™ exhibits tighter strength distribution.

Scratches are less visible



**CORNING**

For more information:  
Email: [specialty materials.com](mailto:specialty materials.com)  
Web: [www.corninggorillaglass.com](http://www.corninggorillaglass.com)

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## SCHOTT Xensation™

SCHOTT Xensation™ is a high-quality aluminosilicate glass with outstanding resistance to breakage and scratches for all cover and touch applications, including capacitive, resistive, optical, and acoustic touch technologies.

### Key-Benefits of Xensation™ Cover:

- SCHOTT's unique micro-float manufacturing process gives the Xensation™ Cover aluminosilicate glass its excellent sheet quality.
- Impressively high and very stable Compressive Stress (CS) and Depth of Layer (DoL), ensure that Xensation™ Cover offers outstanding strength.

### Thermal Properties:

### Electrical Properties:

Frequency MHz	Dielectric Constant $\epsilon'$	Loss Tangent $\tan\delta$
1	7.74	0.011
54	7.49	0.008
480	7.40	0.009
825	7.38	0.010
912	7.38	0.010
1977	7.35	0.012
2170	7.35	0.012
2986	7.34	0.012

Electric Volume Resistivity $\rho_D$ for A.C. at 50Hz	
$v = 250\text{ }^\circ\text{C}$	$1.5 \cdot 10^6 \Omega \cdot \text{cm}$
$v = 350\text{ }^\circ\text{C}$	$8.9 \cdot 10^4 \Omega \cdot \text{cm}$

\*These values are no guaranteed data - for customer orientation only.

### Mechanical Properties:

Density	2.477 g/cm <sup>3*</sup>
Young's Modulus E	74 kN/mm <sup>2</sup>
Poisson's Ratio	0.215
Shear Modulus	30 kN/mm <sup>2</sup>
Knoop Hardness HK <sub>0.1/20</sub>	
Non-strengthened	534
Strengthened	639
Vickers Hardness HV <sub>0.2/20</sub>	
Non-strengthened	617
Strengthened	681

\*cooled according to DIN

Compressive Stress	capable > 900 MPa
Depth of Layer	capable > 50 $\mu\text{m}$
4-Point Bending Strength	cap. > 800 MPa

Thermal Conductivity $\lambda$ (25 °C)	0.96 W/(m·K)
Specific Heat Capacity $C_p$ (20 °C; 100 °C)	0.84 KJ/(Kg·K)
Coefficient of Mean Linear Thermal Expansion $\alpha$ (20 °C; 300 °C)	$8.8 \cdot 10^{-6} \text{ K}^{-1}$ *
Transformation Point T <sub>g</sub>	615 °C*
Annealing Point (10 <sup>13</sup> dPas)	635 °C
Softening Point (10 <sup>7.6</sup> dPas)	880 °C
Working Point (10 <sup>4</sup> dPas)	1265 °C

\*cooled according to DIN

Hydrolytic Resistance	DIN ISO 719	Class HGB 1
Acid Resistance	DIN 12116	Class S 4
Alkali Resistance	DIN ISO 695	Class A 1

### Chemical Properties:

Refractive Index at	588 nm ( $n_d$ )	633 nm	780 nm
Core Glass	1.508	1.506	1.502
Compression Layer KNO <sub>3</sub> pure	1.516	1.514	1.510
Transmittance $\tau$ (Glass Thickness 0.7mm)			
840 nm			> 91.5 %
560 nm			> 91.5 %
380 nm			> 90 %
Photoelastic Constant			29.2 nm/cm/MPa

### Optical Properties:

### Sheet Dimensions:

- Sheet Size: 475 x 575mm (18.7 x 22.64")  
1150 x 950mm (45.27 x 37.4")
- Thickness Range: 0.55 to 2mm stocked other requirements available on request



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## Soda-Lime

### Soda Lime Float Glass (Clear & Tinted)

#### Description:

Soda lime glass is the most prevalent type of glass and is prepared by melting the raw materials, such as soda, lime, silica, alumina, and small quantities of fining agents in a glass furnace at temperatures up to 1675°C. Soda lime sheet glass is made by floating molten glass on a bed of molten tin. This method gives the sheet uniform thickness and very flat surfaces. Soda lime glass is the base material for most clear, colored and patterned glass types.

#### Features:

- Can be chemically strengthened to increase mechanical strength\*
- Can be heat strengthened or heat tempered to increase thermal shock resistance and mechanical strength
- Can be machined, optically coated, chemically etched, sandblasted, colored, or laminated
- Good flatness and surface quality due to float process
- The lowest cost solution for sheet fabricating glass components

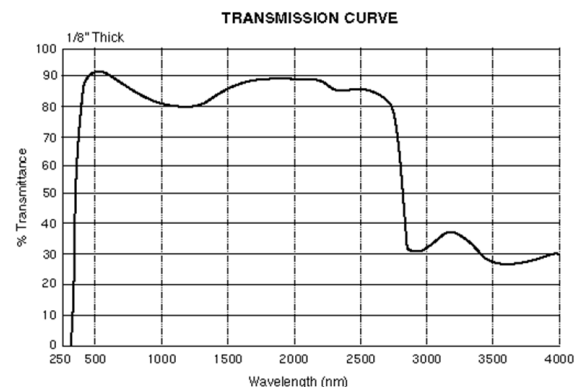
#### Physical Properties:

• Modulus of Elasticity (Young's)	7.2 x 10 <sup>10</sup> Pa	(10.4 x 10 <sup>6</sup> psi)
• Modulus of Rigidity (Shear)	3.0 x 10 <sup>10</sup> Pa	(4.3 x 10 <sup>6</sup> psi)
• Bulk Modulus	4.3 x 10 <sup>10</sup> Pa	(6.18 x 10 <sup>6</sup> psi)
• Poisson's Ration	0.23	
• Specific Gravity	2.53	
• Density	2530 kg/m <sup>3</sup>	(158 lb/ft <sup>3</sup> )
• Coefficient of Thermal Stress	0.62 mPa/°C	(50 psi/°F)
• Thermal Conductivity	0.937 W.m/m <sup>2</sup> °C	(6.5 btu.in/hr. °F.ft <sup>2</sup> )
• Specific Heat	0.21	
• Coefficient of Linear Expansion	8.9 x 10 <sup>-6</sup> strain/°C	(4.9 x 10 <sup>-6</sup> strain/°F)
• Hardness (Moh's Scale)	5 to 6	
• Refractive Index (Sodium D line)	1.523	
• (1 µm)	1.511	
• (2 µm)	1.499	
• Softening Point	340°F	(726°C)
• Annealing Point	1015°F	(546°C)
• Strain Point	957°F	
	(514°C)	
• Emissivity (Hemispherical) at 75°F	0.84	

#### Dimensions of Standard Products:

- Thicknesses: 0.02" - 1" (0.55mm - 25.4mm)
- Sizes: Up to 96" x 72" (2440mm x 1830mm)
- Other sizes may be available upon request

\*Mechanical strength is the general ability of a material to withstand stress and strain. The mechanical strength of tempered or chemically strengthened glass can be 4 times as much as ordinary glass.



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## Soda-Lime

### Soda Lime - Grey Glass

**Description:** Grey Glass or smoked glass in lay terms; is a tinted soda lime glass that is primarily used to restrict or reduce light transmission (transfer) as well as for decorative applications. Generally used for windows, grey glass can be used to prevent fading of furnishings, carpeting, clothing, artwork, etc. It is also used to add a level of privacy. Grey glass is suitable for commercial and home use.

### Features & Benefits:

- Increased privacy due to darker tint
- May provide cooler indoor temperature if used as a window
- May reduce glare
- Has a reduced opacity

### Common Uses:

- Glass shelving or table tops
- Partitions
- Bathrooms (showers)
- Doors & windows
- Storefronts & exteriors



Grey glass can be specified in various transmission ranges depending upon the amount of visible light desired to be passed or restricted. The lower the transmission value, the darker the tint and the least amount of transmission. Even though the grey glass may be nearly black in color, it remains transparent. The darkest or grey 8 which allows for only 8% transmission is ideal for privacy applications.

Abrisa Technologies currently offers 6 transmission ranges as noted in the chart below.

Grey Glass Name	Transmission Percent	Color Density
Gray 62	62%	Lightest grey
Gray 57	57%	
Gray 31	31%	
Gray 14	14%	
Gray 9	9%	
Gray 8	8%	Darkest grey – nearly black

### Dimensions of Standard Products:

Abrisa Technologies stocks grey glass in thicknesses from 3mm to 6mm (1/8" to 15/64") and in sheet sizes up to 96" x 65" (2438.4mm x 1651mm). Contact us for non-standard requirements.

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## Soda-Lime Low Iron

### Description:

Low iron soda lime is created by using high quality grades of silica sand that are virtually free of iron oxides. This results in a transparent, water white” glass that has higher transmission characteristics compared to normal soda lime. The difference is usually 2-3% at thicknesses 10mm and up to 8% greater transmission for thicker low iron glass. Even higher transmission (up to 98-99% total transmission) can be achieved by specifying an anti-reflective thin film coating. (Refer to our Thin Film Coating Brochure)

### Features:

- Higher light transmission
- Can be chemically strengthened
- Good flatness
- No green tint

### Applications:

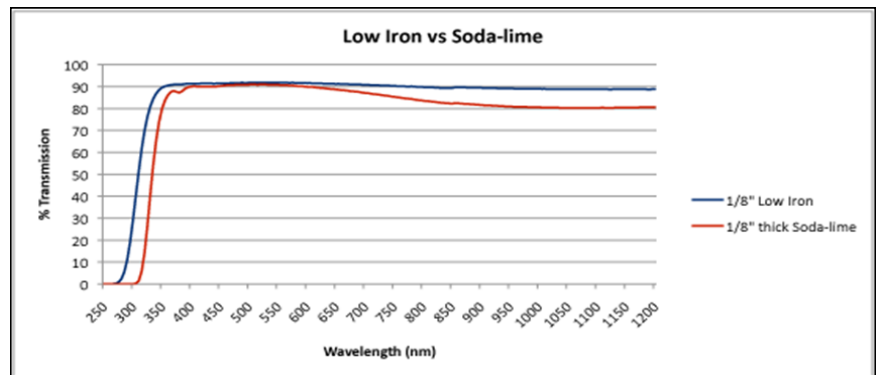
- Port projection
- Display
- Lighting
- Optical

### Physical Properties:

- |                                      |                                  |                                     |
|--------------------------------------|----------------------------------|-------------------------------------|
| • Density                            | 2530 kg/m <sup>3</sup>           | (158 lb/ft <sup>3</sup> )           |
| • Modulus of Elasticity (Young's)    | 7.2 x 10 <sup>10</sup> Pa        | (10.4 x 10 <sup>6</sup> psi)        |
| • Modulus of Rigidity (Shear)        | 3.0 x 10 <sup>10</sup> Pa        | (4.3 x 10 <sup>6</sup> psi)         |
| • Bulk Modulus                       | 4.3 x 10 <sup>10</sup> Pa        | (6.18 x 10 <sup>6</sup> psi)        |
| • Poisson's Ration                   | 0.23                             |                                     |
| • Specific Gravity                   | 2.53                             |                                     |
| • Coefficient of Thermal Stress      | 0.62 mPa/°C                      | (50 psi/°F)                         |
| • Thermal Conductivity               | 0.937 W.m/m <sup>2</sup> °C      | (6.5 btu.in/hr.°F.ft <sup>2</sup> ) |
| • Specific Heat                      | 0.21                             |                                     |
| • Coefficient of Linear Expansion    | 8.9 x 10 <sup>-6</sup> strain/°C | (4.9 x 10 <sup>-6</sup> strain/°F)  |
| • Hardness (Moh's Scale)             | 5 to 6                           |                                     |
| • Refractive Index (Sodium D line)   | 1.523                            |                                     |
| • (1 μm)                             | 1.511                            |                                     |
| • (2 μm)                             | 1.499                            |                                     |
| • Softening Point                    | 726°C                            | 1340°F                              |
| • Annealing Point                    | 546°C                            | 1015°F                              |
| • Strain Point                       | 514°C                            | 957°F                               |
| • Emissivity (Hemispherical) at 75°F | 0.84                             |                                     |

### Dimensions:

- Thicknesses: 1mm - 12mm thick
- Sizes: Up to 130" x 96"  
(3302 x 2438.4mm)



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## Soda-Lime Anti-Glare Etched Glass

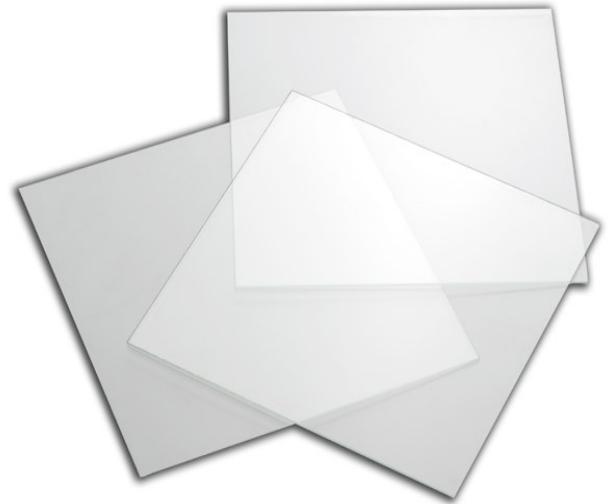
Anti-glare glass breaks up incident light reflected images, allowing the user to focus on the display image versus the reflected images. Unlike anti-reflection coated or untreated surfaces, anti-glare etched glass does not become highly reflective as a result of oily finger prints.

Abrisa Technologies anti-glare glass is manufactured by a controlled acid etch process yielding uniform diffused surfaces for anti-glare, high resolution, anti-Newton ring applications.

Varying levels of diffusion specified as gloss yield different levels of reduced glare. A lower gloss reading denotes a more diffuse panel. The more diffuse the panel surface, the more glare reduction it provides. However, an inverse relationship exists between the degree of diffusion and the panel's resolution.

Anti-glare glass can be laminated, tempered or chemically strengthened. Sizes, thicknesses and gloss levels as listed are typically in stock and can be readily shaped to your specifications.

Custom thickness, sizes and gloss ranges from 50° to 120° are available upon request.



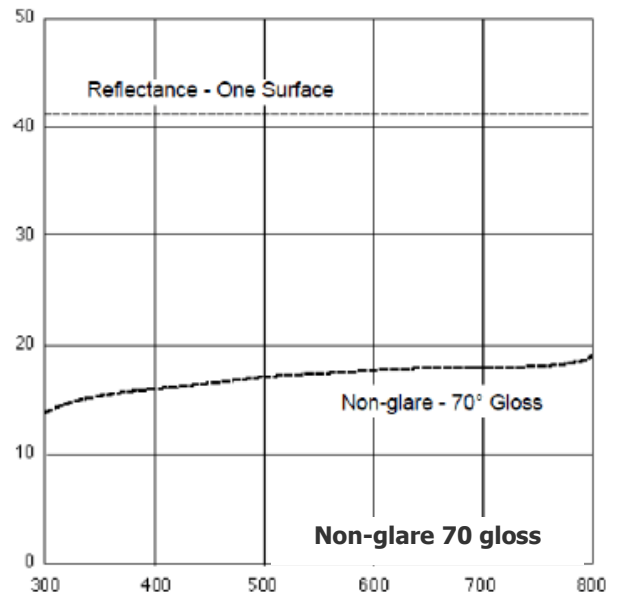
### Features:

- Glare Reduction
- High Resolution
- Superior Durability
- Anti-Newton Ring

### Typical Applications :

- Monitor Face Plates
- Electronic Displays
- Medical Instruments
- Video Game Screens
- Touch Panels
- LED Displays
- Outdoor Electronic Monitors & Systems

- Gloss: 60 - 130 (US Gloss, measured at 60° by a BYK Gardner Glossmeter, model 4501)
- Thickness: 0.7mm - 4.75mm
- Sheet Size: Up to 62" x 39" (1574.8 x 990.6")





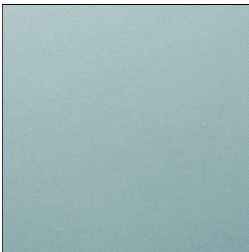
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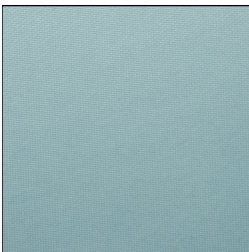
## Soda-Lime Patterned Glass for Diffusion & Light Control

Abrisa Technologies offers a number of patterned glass products and hexagon louvers for diffusion and light control. These products can be fabricated onto virtually any shape, and can be drilled, sandblasted, screen printed, polished, UV coated, dichroic coated, heat tempered (to increase thermal shock resistance and mechanical strength), to meet your application-specific criteria.



### Solite® (Softening)

**Maximum Size:** 48" x 102" (1219 x 2590mm)  
**Thickness:** 1/8", 3/16" and 5/32" or 4mm and 5mm  
**Features:** Stipple effect provides obscurity while retaining high transmission values. Low iron optically clear glass offering maximum transmission and minimal absorption. Does not yellow over time, retains optical clarity



### Industrex® (Diffusion)

**Maximum Size:** 60" x 132" (524 x 3352.8mm)  
**Thickness:** 5/32" and 3/16" (4mm and 5mm)  
**Features:** Provides obscurity while retaining a high level of transmission. Low iron optically clear glass offering maximum transmission and minimal absorption. Does not yellow over time, retains optical clarity.



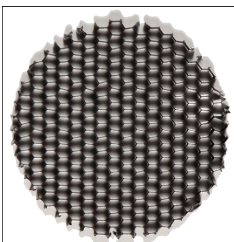
### Skytex (Linear)

**Maximum Size:** 85" x 65" (2159 x 1652mm)  
**Thickness:** 5/32" (4mm)  
**Features:** Ribbed linear diffusion glass used to spread light horizontally or vertically. Ideal for diffusing and elongating a beam of light to structures such as columns. Has a 1/8" wide linear fluted pattern on one surface with a 55 degree spread either horizontally or vertically.



### Frosted Glass (Sandblasted)

**Maximum Size:** 60" x 132" (1524 x 3352.8mm)  
**Thickness:** 3.3 mm Std.  
**Features:** Used to soften a beam of light. Available in soda lime or low iron soda lime, and sandblasted in any shape, size, or thickness.



### Hexagon Louver

**Maximum Size:** 12" x 12" (304.8mm)  
**Thickness:** 1/8" (3 mm)  
**Features:** Used in conjunction with a standard diffusion, colored and dichroic products to reduce glare brightness from a variety of light sources. Made from low density, high strength material originally used for structural use in the aircraft industry. Available in aluminum color or black and can withstand temperatures up to 350°F.

# Specialty Glass Materials Products & Specifications

11/22

## Soda-Lime

### Low Emissivity (Low-E) Glass

#### Description:

Low Emissivity (Low-E) glass provides excellent performance in situations where temperature separation is desired. Low-E is used to help meet energy efficiency requirements by blocking UV light and providing heat insulation. This is done with a special thin-film metallic or oxide coating which prevents the passage of short-wave solar energy and also prevents long-wave energy produced by heating systems and lighting from escaping.

#### Features:

- Higher window U-value
- Increased insulation performance
- Energy savings
- Decreases color fade on interior furniture by blocking UV light

#### Applications:

- Architecture
- Grocery store refrigerators
- Deli food windows

#### Physical Properties:

- |   |      |
|---|------|
| • Visible Light Transmission            | 76%  |
| • SHGC (Solar Heat Gain Coefficient)    | 0.71 |
| • LSG (Laminated Safety Glass)          | 1.07 |
| • U-Factor (Btu/hr/ft <sup>2</sup> /°F) |      |
| • Air                                   | 0.35 |
| • Argon                                 | 0.31 |
| • Indoor glass temp (°F)                |      |
| • Winter                                | 52   |
| • Summer                                | 99   |
| • UV Transmission                       | 49%  |

#### Dimensions:

- Thicknesses: 3.2 mm, 5.0mm
- Sizes: Up to 96" x 60" (2438.4 x 1524")  
Up to 130" x 72" (3302 x 1828.8")

# Specialty Glass Materials Products & Specifications

11/22

## Soda-Lime

### Heat Absorbing Float Glass

#### Product Description

Heat Absorbing Float Glass (HAFG) provides superior performance in reducing solar heat gain while maintaining desirable high visible light transmission. The light blue/green color subdues brightness while providing the highest visible light transmittance (77% for 6.0 mm thickness) of all tinted glass substrates currently available.

#### Features:

- Absorbs IR

#### Applications:

- Short pass (SWP) filter

#### Physical Properties:

#### Optical Properties:

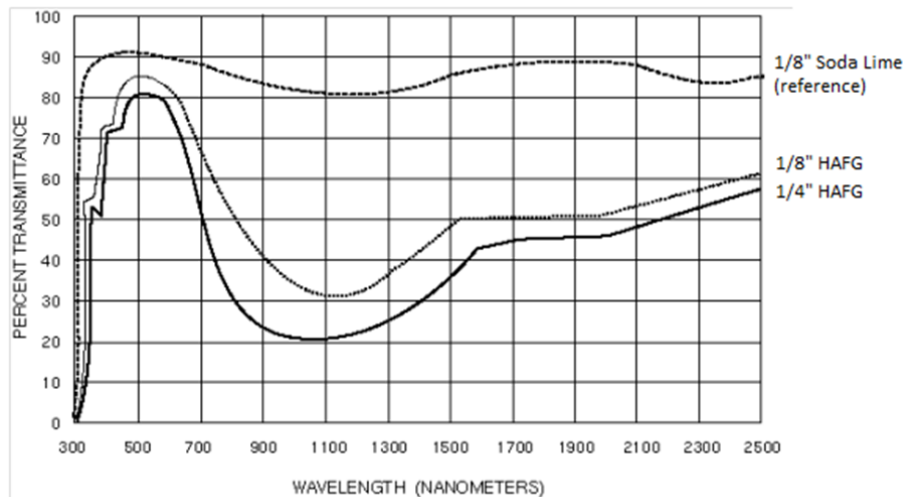
- |  |                  |
|--|------------------|
| • Refractive index at sodium D Line (ND)           | 1.5184           |
| • CIE Illuminate "C" data chromaticity coordinates | x=0.301, y=0.323 |
| • Dominant wavelength                              | 501 nm           |
| • Excitation purity                                | 2.9%             |

#### Thermal Properties:

- |   |                            |                            |
|---|----------------------------|----------------------------|
| • Expansion coefficient (25°C to 300°C)     | 8.6 x 10 <sup>-6</sup> /°C | 4.8 x 10 <sup>-6</sup> /°F |
| • Specific Heat at 0° - 100°C (32° - 212°F) | 0.205                      |                            |
| • Softening point                           | 719°C                      | 1327°F                     |
| • Annealing point                           | 540°C                      | 1004°F                     |
| • Strain point                              | 503°C                      | 937°F                      |

#### Dimensions:

- Thicknesses: 1/8" & 1/4" (3.175mm & 6.35mm)
- Sizes: Up to 60" x 84" (1524 x 2133.6")



# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

### SCHOTT Borofloat® 33 - Multi-Functional Float Glass

#### Description:

SCHOTT Borofloat® 33 is a versatile borosilicate glass with excellent light transmission, thermal properties, and chemical resistance. Its unique properties make it desirable in many different applications, from high temperature lighting windows, view ports in extreme conditions, to the medical and semiconductor industry. Borofloat wafers are an excellent substrate for MEMS (micro-electro-mechanical systems), as its coefficient of thermal expansion is very similar to silicon and allows for anodic bonding between the two. The low density of Borofloat also makes it an excellent choice for lighter weight laminated glass systems such as (bulletproof glass).

#### Features:

- Excellent flatness and surface quality
- Very good optical properties
- Low thermal expansion
- High chemical durability
- Low density

#### Applications:

- High temperature windows for lighting
- Optical windows, filters, and mirrors
- MEMS devices
- Chemically resistant view ports
- Bulletproof glass systems

#### Physical Properties:

##### Mechanical:

• Density (25°C) ρ	2.2 g/cm <sup>3</sup>	137.3 lb/ft <sup>3</sup>
• Young's Modulus E	64 kN/mm <sup>2</sup>	9.28 Mpsi
• Poisson's Ratio μ	0.2	
• Knoop Hardness HK <sub>0.1/20</sub>	480	
• Bending strength σ	25 MPa	3.63 x 10 <sup>3</sup> psi

##### Viscosity:

• Working Point (10 <sup>4</sup> poises)	1270°C	2318°F
• Softening Point (10 <sup>7.6</sup> poises)	820°C	1508°F
• Annealing Point (10 <sup>13</sup> poises)	560°C	1040°F
• Strain Point (10 <sup>14.5</sup> poises)	518°C	964°F

##### Thermal Expansion:

• 0 – 300°C (32 – 572°F)	3.25 x 10 <sup>-6</sup> /K
--------------------------	----------------------------

##### Optical:

• Index of Refraction @	435.8nm	1.4802
	479.9nm	1.4768
	546.1nm	1.4731
	589.3nm	1.4713
	643.8nm	1.4695
	656.3nm	1.4692

##### Electrical:

• Log10 Volume Resistivity: (250°C, 482°F)	8.0
(350°C, 932°F)	6.5

##### Dimensions:

- Thicknesses: 0.7mm – 25.4mm
- Sizes: Up to 90" x 67" (2286 x 1701.8mm)

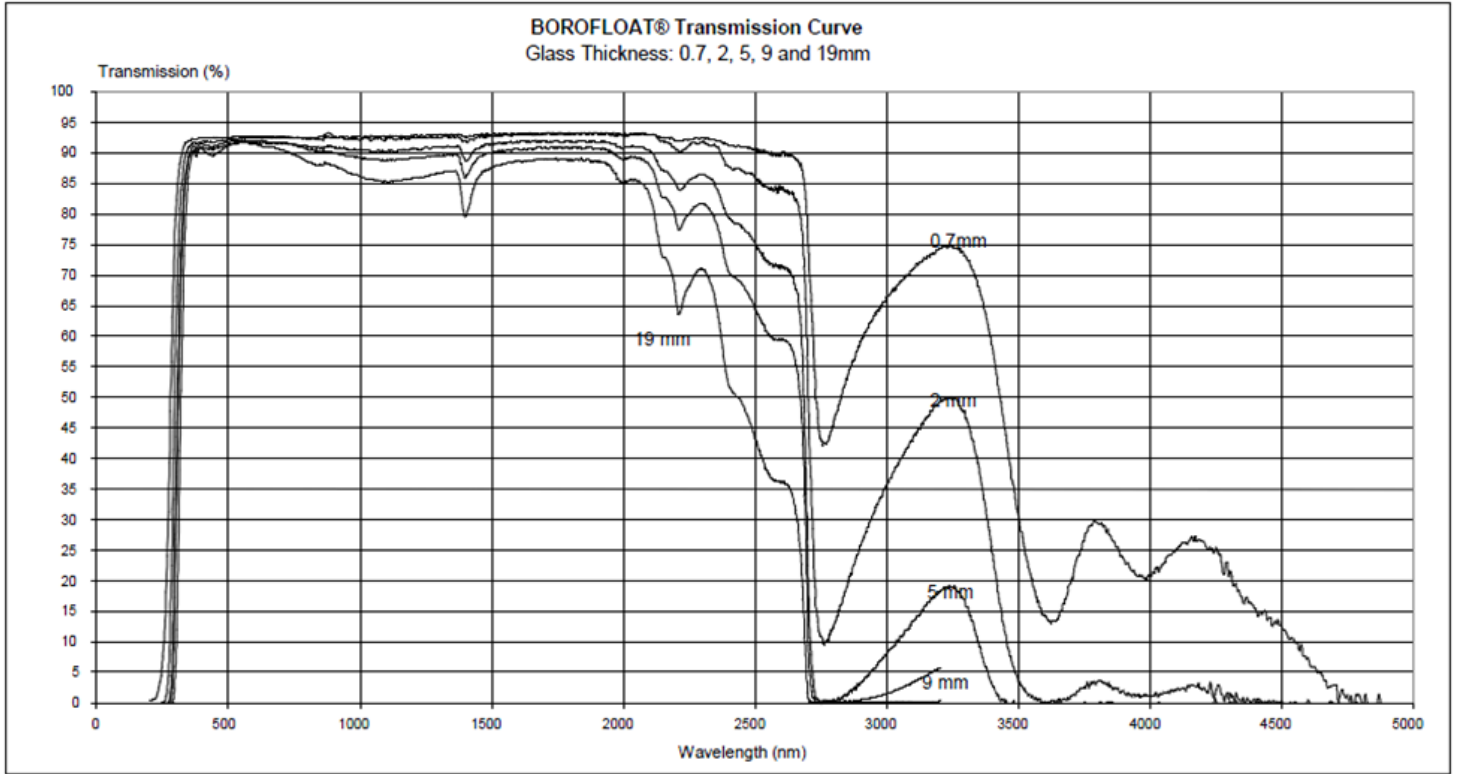


# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

SCHOTT Borofloat<sup>®</sup> 33 - Multi-Functional Float Glass (*cont.*)



# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

### SCHOTT Supremax<sup>®</sup> Rolled Borosilicate

#### Description:

SCHOTT Supremax<sup>®</sup> Rolled Borosilicate is almost identical in its properties to Borofloat<sup>®</sup> 33, it has slightly lower surface quality due to the rolled process. It is a versatile borosilicate glass with excellent thermal properties, chemical resistance, and good light transmission material for its thickness. Supremax<sup>®</sup> Rolled Borosilicate also maintains a low density and therefore higher transmissivity compared to that of soda lime glass.

#### Features:

- Large thickness range
- Very good optical properties
- Low thermal expansion
- High chemical durability
- Low density

#### Applications:

- High temperature windows for lighting
- Optical windows, filters, and mirrors
- Chemically resistant view ports
- Bulletproof glass systems

#### Physical Properties:

##### Mechanical:

- |                                       |                       |                            |
|---------------------------------------|-----------------------|----------------------------|
| • Density (25°C) ρ                    | 2.2 g/cm <sup>3</sup> | 137.3 lb/ft <sup>3</sup>   |
| • Young's Modulus E                   | 64 kN/mm <sup>2</sup> | 9.28 Mpsi                  |
| • Poisson's Ratio μ                   | 0.2                   |                            |
| • Knoop Hardness HK <sub>0.1/20</sub> | 480                   |                            |
| • Bending strength σ                  | 25 MPa                | 3.63 x 10 <sup>3</sup> psi |

##### Viscosity:

- |  |        |        |
|--|--------|--------|
| • Working Point (10 <sup>4</sup> poises)     | 1270°C | 2318°F |
| • Softening Point (10 <sup>7.6</sup> poises) | 820°C  | 1508°F |
| • Annealing Point (10 <sup>13</sup> poises)  | 560°C  | 1040°F |
| • Strain Point (10 <sup>14.5</sup> poises)   | 518°C  | 964°F  |

##### Thermal Expansion:

- 0 – 300°C (32 – 572°F) 3.25 x 10<sup>-6</sup>/K

##### Optical:

- |                         |           |        |
|-------------------------|-----------|--------|
| • Index of Refraction @ | 435.8nm   | 1.4802 |
|                         | 479.9nm   | 1.4768 |
|                         | 546.1nm   | 1.4731 |
|                         | 589.3nm   | 1.4713 |
|                         | 643.8nm   | 1.4695 |
|                         | 656.3.3nm | 1.4692 |

##### Electrical:

- Log<sub>10</sub> Volume Resistivity: (250°C, 482°F) 8.0
- (350°C, 932°F) 6.5

##### Dimensions:

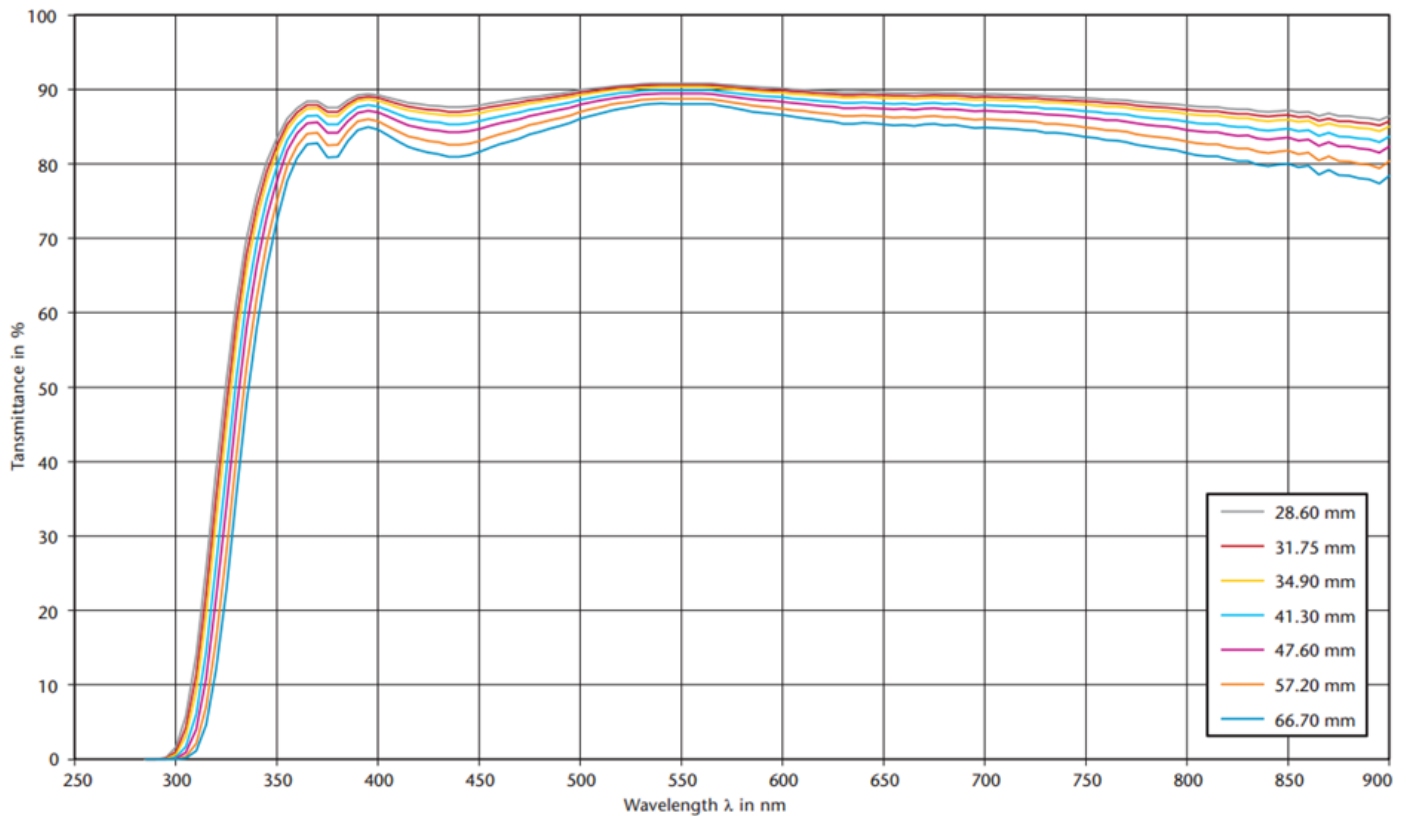
- Thicknesses: 28.6mm – 66.7mm  
(1 1/8" – 2 5/8")
- Sizes: Up to 90" x 67" (2286 x 1701.8")

**Specialty Glass Materials  
Products & Specifications**

11/22

**Borosilicate**

SCHOTT Supremax<sup>®</sup> Rolled Borosilicate (*cont.*)



*Spectral Transmittance*

# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

### SCHOTT D263® Colorless Thin Glass

#### Description:

SCHOTT D263® is a thin borosilicate glass with low alkali content produced with extremely pure raw materials making it highly chemical resistant. It is produced in a special draw process that results in excellent surface quality that can be coated without any post-process surface work. The combination of these traits makes D263® highly versatile.

#### Features:

- Extremely flat surfaces
- Wide range of thicknesses (0.030mm – 1.1mm)
- Very good substrate for optical coatings
- Excellent transmission over a large spectrum
- Low level mobility of alkali ions
- Coefficient of thermal expansion close to ceramic
- High chemical resistance
- Smooth fire polished surface

#### Applications:

- Liquid crystal displays (LCD's)
- Touch screens
- Optoelectronics (opto-caps in laser diodes)
- Solar cells

#### Physical Properties:

##### Mechanical:

• Density (25°C) ρ	2.51 g/cm <sup>3</sup>	156.7 lb/ft <sup>3</sup>
• Young's Modulus E	72.9 kN/mm <sup>2</sup>	10.6 Mpsi
• Poisson's Ratio μ	0.208	
• Knoop Hardness HK <sub>0.1/20</sub>	590	
• Bending strength σ	30.1 kN/mm <sup>2</sup>	4.4 Mpsi

##### Viscosity:

• Softening Point (10 <sup>7.6</sup> poises)	736°C	1357°F
• Annealing Point (10 <sup>13</sup> poises)	557°C	1035°F
• Strain Point (10 <sup>14.5</sup> poises)	529°C	984°F

##### Thermal Expansion:

• 0 – 300°C (32 – 572°F)	7.2 x 10 <sup>-6</sup> /K
--------------------------	---------------------------

##### Optical:

• Index of Refraction @	n <sub>e</sub> 546nm	1.5255
	n <sub>d</sub> 588nm	1.5231

##### Electrical:

• Log10 Volume Resistivity:(250°C, 482°F)	1.6 x 10 <sup>8</sup>
(350°C, 932°F)	3.5 x 10 <sup>6</sup>

##### Dimensions:

- Thicknesses: 0.030mm – 1.1m
- Sizes: Up to 17" x 14" (431.8 x 355.6mm)



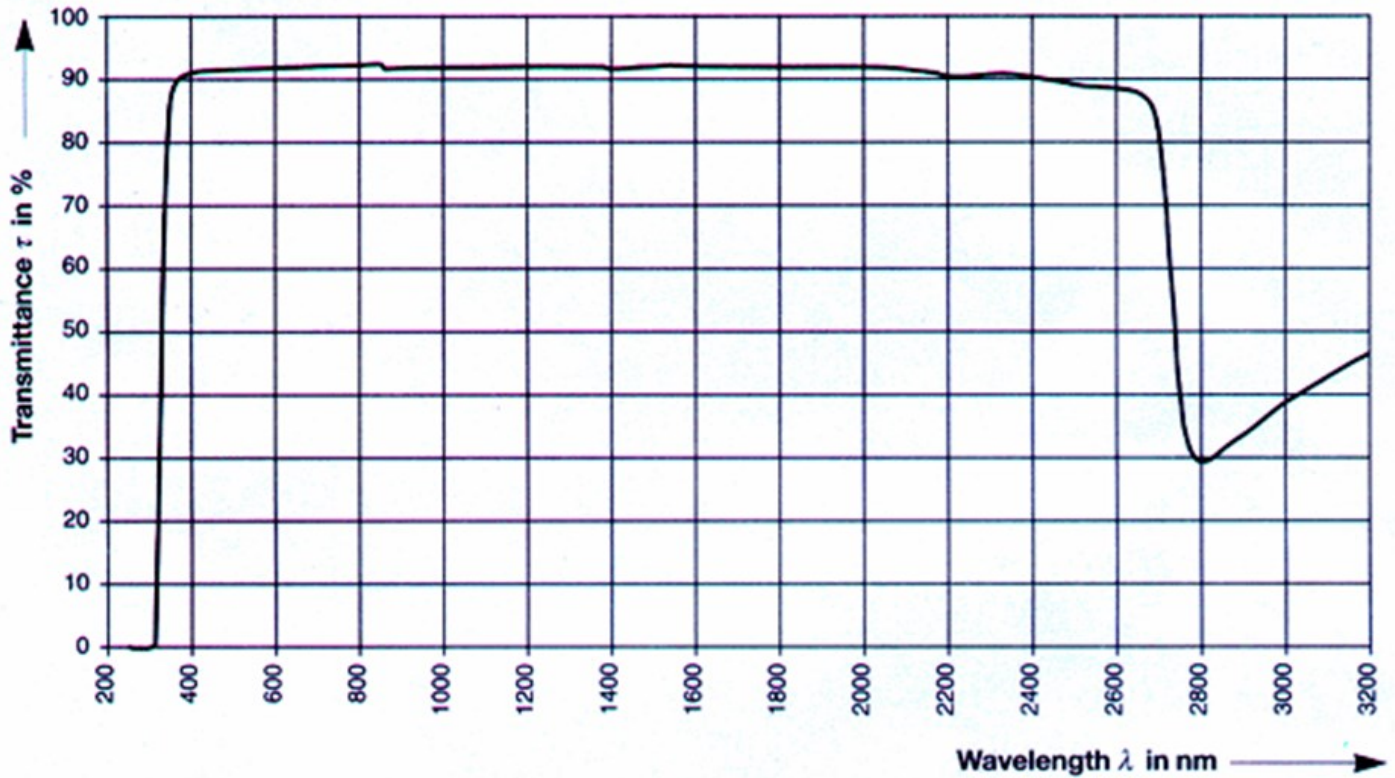


# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

SCHOTT D263<sup>®</sup> Colorless Thin Glass (*cont.*)



# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

### SCHOTT Duran<sup>®</sup> Lab Glass (Tubed)

#### Description:

SCHOTT Duran<sup>®</sup> is general-purpose borosilicate glass tubing. Duran<sup>®</sup> has identical chemical and thermal properties as Schott's Borofloat<sup>®</sup> 33, as it is made from the same material. Duran's high resistance to chemicals and heat makes it ideal for laboratory glassware.

#### Features:

- Excellent thermal properties
- Highly resistant to chemicals
- Very good transmission properties

#### Applications:

- Lab glassware
- Pipelines
- Chemical industry
- Flameproof tubes
- Flowmeters

#### Physical Properties:

##### Mechanical:

• Density (25°C) ρ	2.2 g/cm <sup>3</sup>	137.3 lb/ft <sup>3</sup>
• Young's Modulus E	64 kN/mm <sup>2</sup>	9.28 Mpsi
• Poisson's Ratio μ	0.2	0.2
• Knoop Hardness HK <sub>0.1/20</sub>	480	480
• Bending strength σ	25 MPa	3.63 x 10 <sup>3</sup> psi

##### Viscosity:

• Working Point (10 <sup>4</sup> poises)	1260°C	2300°F
• Softening Point (10 <sup>7.6</sup> poises)	825°C	1517°F
• Annealing Point (10 <sup>13</sup> poises)	560°C	1040°F
• Strain Point (10 <sup>14.5</sup> poises)	518°C	964°F

##### Thermal Expansion:

• 0 – 300°C (32 – 572°F)	3.25 x 10 <sup>-6</sup> /K
--------------------------	----------------------------

##### Optical:

• Index of Refraction @	435.8nm	1.4802
	479.9nm	1.4768
	546.1nm	1.4731
	589.3nm	1.4713
	643.8nm	1.4695
	656.3.3nm	1.4692

##### Electrical:

• Log <sub>10</sub> Volume Resistivity: (250°C, 482°F)	8.0
(350°C, 932°F)	6.5

##### Dimensions:

	<b>Outer Diameter:</b>	<b>Wall Thickness:</b>	<b>Length:</b>
• Smallest size:	3mm (0.118")	0.7mm (0.028")	17mm (0.669")
• Largest size:	325mm (12.795")	10mm (0.394")	150mm (5.9")

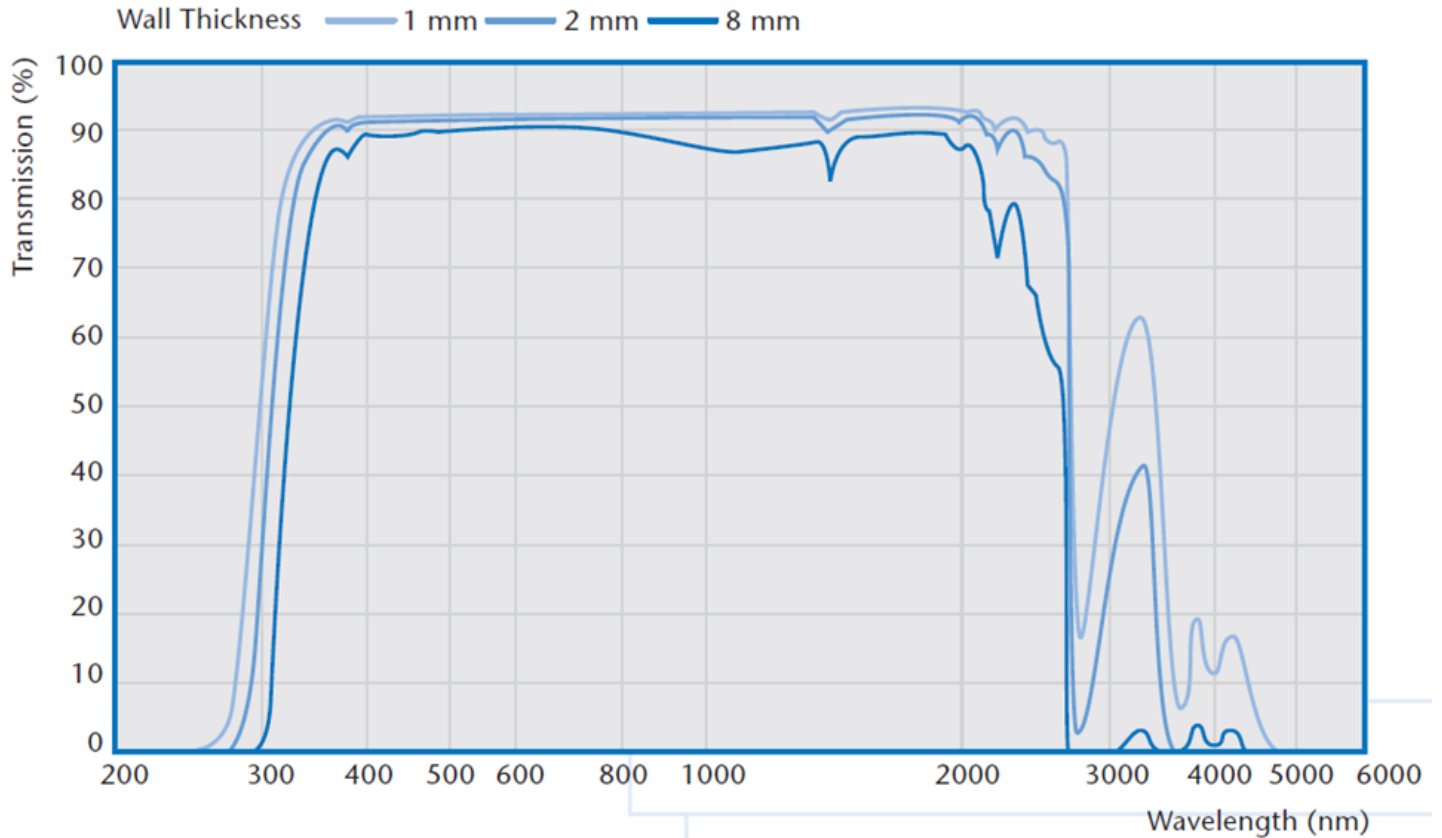
# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

SCHOTT Duran<sup>®</sup> Lab Glass -Tubed (cont.)

## Transmission



# Specialty Glass Materials Products & Specifications

11/22

## Ceramic/Glass

### SCHOTT Robax<sup>®</sup> Transparent Ceramic

#### Description:

SCHOTT Robax<sup>®</sup> is a transparent ceramic glass that is extremely heat resistant. The combination of good optical transmission (including infrared, which we perceive as heat) and low thermal expansion make Robax<sup>®</sup> an excellent choice for windows in heating devices. Robax<sup>®</sup> also has good UV blocking characteristics. The most common uses are fireplaces, stoves, and other types of heating systems.

#### Features:

- High resistance to heat (up to 700°C)
- Good transmission
- Excellent resistance to thermal shock
- Blocks UV

#### Applications:

- Windows in room heaters and stoves
- Cover panels for heating radiators
- UV blocking shields
- Cover panels for high powered flood lights
- Cover panels for IR drying appliances

#### Physical Properties:

#### Mechanical:

- |                     |                        |                          |
|---------------------|------------------------|--------------------------|
| • Density (25°C) ρ  | 2.58 g/cm <sup>3</sup> | 161.1 lb/ft <sup>3</sup> |
| • Young's Modulus E | 92 Gpa                 | 13 Mpsi                  |
| • Poisson's Ratio μ | 0.25                   | 0.25                     |

#### Thermal Expansion:

- 20 – 700°C (68 – 1292°F) (0 +/- 0.5) x 10<sup>-6</sup>/K

#### Maximum Operating Temperatures:

#### Usage Temp:

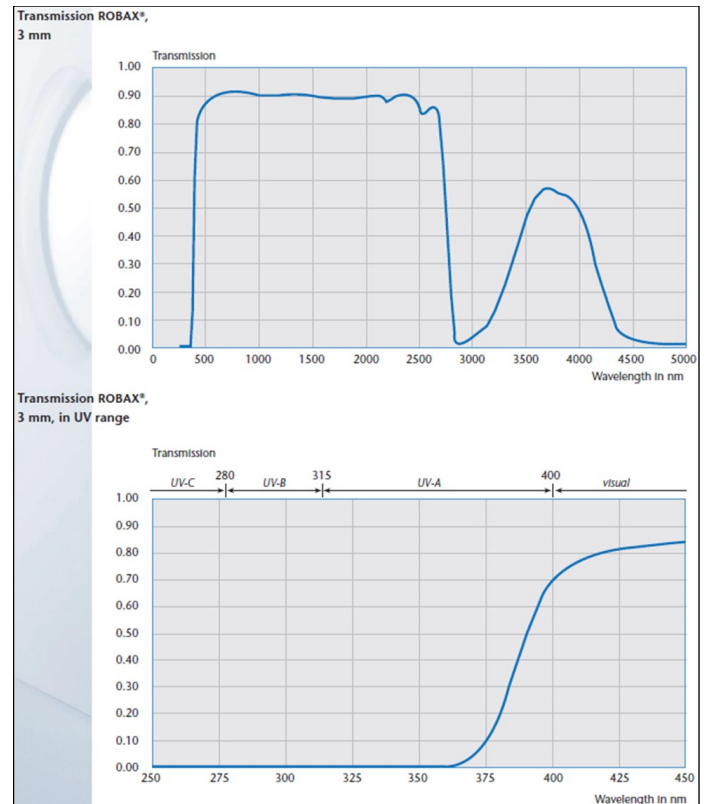
560°C  
610°C  
660°C  
710°C  
760°C

#### Usage Time:

5000 hours  
1000 hours  
100 hours  
10 hours  
5 hours

#### Dimensions:

- Thicknesses: 3mm – 5mm
- Sizes: Up to 62" x 33" (1574.8 x 838.2")



# Specialty Glass Materials Products & Specifications

11/22

## Ceramic/Glass

### SCHOTT Pyran<sup>®</sup> Fire Rated Ceramic

#### Description:

SCHOTT Pyran<sup>®</sup> is a transparent glass ceramic that is fire-protection rated. It works with fire rated frames of the same rating. Pyran<sup>®</sup> fits applications with non-impact, safety rated requirements of up to 90 minutes.

#### Features:

- Fire rated up to 90 minutes
- Environmentally friendly
- Transparent and wireless

#### Applications

- Safety rated windows
- Insulated glazing units

Rating in minutes	Location	Max. exposed area of glazing (in <sup>2</sup> )	Max. width of exposed glazing (in)	Max. height of exposed glazing (in)	Min. depth of groove (in)
Up to 90 min	Other than Doors	3,422 (23.7 ft <sup>2</sup> )	76	76	5/8

#### Transmission Properties:

Visible spectrum: ~80% transmission

#### Dimensions:

- Thicknesses: 5mm (3/16")
- Sizes: Up to 77" x 43" (1955.8 x 1092.2mm)

# Specialty Glass Materials Products & Specifications

11/22

## Quartz/Fused Silica

### Corning® 7980 Fused Silica

#### Description:

Corning® 7980 is a very pure, non-crystalline silica glass. It features very low thermal expansion and excellent optical qualities, including very high transmission in the UV spectrum.

#### Features:

- Excellent optical properties
- Low thermal expansion
- High UV transmission

#### Applications:

- Optical windows
- High temperature view ports

#### Physical Properties:

##### Mechanical:

• Density (25°C) ρ	2.201 g/cm <sup>3</sup>	137.4 lb/ft <sup>3</sup>
• Young's Modulus E	72.7 GPa	10.5 Mpsi
• Poisson's Ratio μ	0.16	0.16
• Knoop Hardness HK0.1/20	522 kg/mm <sup>2</sup>	
• Shear Modulus	31.4 GPa	4.55 Mpsi

##### Viscosity:

• Softening Point (10 <sup>7.6</sup> poises)	1585°C	2885°F
• Annealing Point (10 <sup>13</sup> poises)	1042°C	1908°F
• Strain Point (10 <sup>14.5</sup> poises)	893°C	1639°F

##### Thermal Expansion:

• 0 – 200°C (32 – 392°F)	5.7 x 10 <sup>-7</sup> /°C
--------------------------	----------------------------

##### Optical:

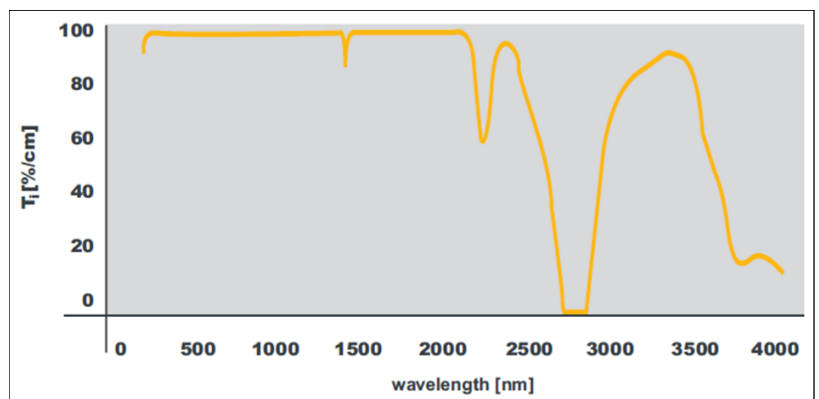
• Index of Refraction @ 589.3nm	1.45840
---------------------------------	---------

##### Electrical:

• Log10 Volume Resistivity: (250°C, 482°F)	11.8 ohm*cm
--	-------------

##### Dimensions:

- Thicknesses: 1.6mm
- Sizes: Up to 6.5" x 6.5"  
(165.1 x 165.1")





# Specialty Glass Materials Products & Specifications

11/22

## Quartz/Fused Silica GE 124 Fused Quartz

### Description:

GE 124 is a very pure fused quartz, made from crystalline silica. GE 124 is very similar to fused silica, with the exception of less transmission in the UV spectrum and much lower OH content. Other features besides its purity include excellent thermal properties and high resistance to chemicals.

### Features:

- Excellent Thermal Properties
- Stain (chemical) Resistant
- Very Good Optical Transmission

### Applications:

- Water Carriers
- Flanges
- Optical Plates
- Test Plates
- Pressure Windows

### Physical Properties:

#### Mechanical:

- |                                       |                        |                         |
|---------------------------------------|------------------------|-------------------------|
| • Density (25°C) ρ                    | 2.21 g/cm <sup>3</sup> | 38.0 lb/ft <sup>3</sup> |
| • Young's Modulus E                   | 70 kN/mm <sup>2</sup>  | 10.5 Mpsi               |
| • Poisson's Ratio μ                   | 0.17                   | 0.17                    |
| • Knoop Hardness HK <sub>0.1/20</sub> | 600 kg/mm <sup>2</sup> | 600 kg/mm <sup>2</sup>  |

#### Viscosity:

- |  |        |        |
|--|--------|--------|
| • Softening Point (10 <sup>7.6</sup> poises) | 1683°C | 3061°F |
| • Annealing Point (10 <sup>13</sup> poises)  | 1214°C | 2217°F |
| • Strain Point (10 <sup>14.5</sup> poises)   | 1122°C | 2052°F |

#### Thermal Expansion:

- |                          |                            |
|--------------------------|----------------------------|
| • 0 – 300°C (32 – 572°F) | 5.5 x 10 <sup>-7</sup> /°C |
|--------------------------|----------------------------|

#### Optical:

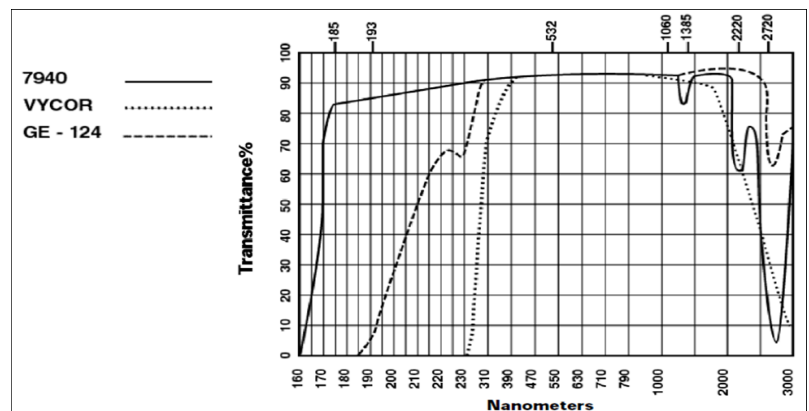
- |                       |        |
|-----------------------|--------|
| • Index of Refraction | 1.4585 |
|-----------------------|--------|

#### Electrical:

- |   |                     |
|---|---------------------|
| • Log <sub>10</sub> Volume Resistivity: |                     |
| • (250°C, 482°F)                        |                     |
| • (350°C, 662°F)                        | 7 x 10 <sup>7</sup> |

#### Dimensions:

- |                |                              |
|----------------|------------------------------|
| • Thicknesses: | Up to 4" thick (101.6mm)     |
| • Sizes:       | Up to 36" (914.4mm) diameter |



# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

### Corning<sup>®</sup> Eagle XG<sup>®</sup> LCD Glass

#### Description:

Corning<sup>®</sup> Eagle XG<sup>®</sup> is a borosilicate glass specifically designed for high performance LCD's. It is considered environmentally friendly as it contains no heavy metals (arsenic, antimony, barium, or halides). The glass also features high surface quality, excellent thermal properties, low density, and high resistance to chemicals.

#### Features:

- Environmentally friendly (free of heavy metals)
- Excellent surface quality
- Good thermal properties
- Low density
- Chemical durability

#### Applications:

- Liquid crystal displays (LCDs)
- Lightweight optical windows

#### Physical Properties:

##### Mechanical:

• Density (20 °C, 68 °F)	2.38 g/cm <sup>3</sup>	148.5 lb/ft <sup>3</sup>
• Young's Modulus	73.6 GPa	10.7Mpsi
• Poisson's Ratio	0.23	0.23
• Shear Modulus	0.1 GPa	4.4 Mpsi
• Vickers Hardness (200 gm load, 25 sec dwell)	640	

##### Viscosity:

• Working Point (10 <sup>4</sup> poises)	1293°C	2359°F
• Softening Point (10 <sup>7.6</sup> poises)	971°C	1780°F
• Annealing Point (10 <sup>13</sup> poises)	722°C	1332°F
• Strain Point (10 <sup>14.5</sup> poises)	669°C	1236°F

##### Thermal Expansion:

• 0 – 300°C (32 – 572°F)	31.7 x 10 <sup>-7</sup> /°C	17.7 x 10 <sup>-7</sup> /°F
• Room Temperature to Setting Point 25 – 675°C (77 – 1247°F)	35.5 x 10 <sup>-7</sup> /°C	19.7 x 10 <sup>-7</sup> /°F

##### Optical:

• Index of Refraction @	435.8nm	1.5198
	467.8nm	1.5169
	480.0nm	1.5160
	508.6nm	1.5141
	546.1nm	1.5119
	589.3nm	1.5099
	643.8nm	1.5078
• Birefringence Constant:	(331 nm/cm)/(kg/mm <sup>2</sup> )	

##### Electrical:

• Log10 Volume Resistivity:	(250°C, 482°F)	12.9
	(500°C, 932°F)	8.8

##### Dimensions:

- Thicknesses: .0433", .0275" (0.7mm, 1.1mm)
- Sizes: Up to 61" x 52" (1549.4 x 1320.8mm)

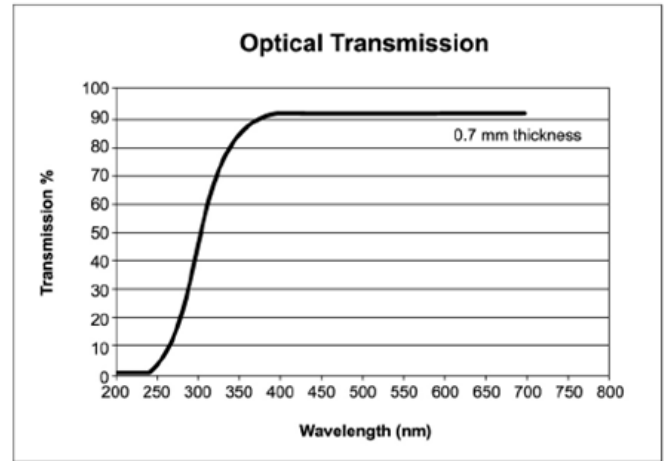
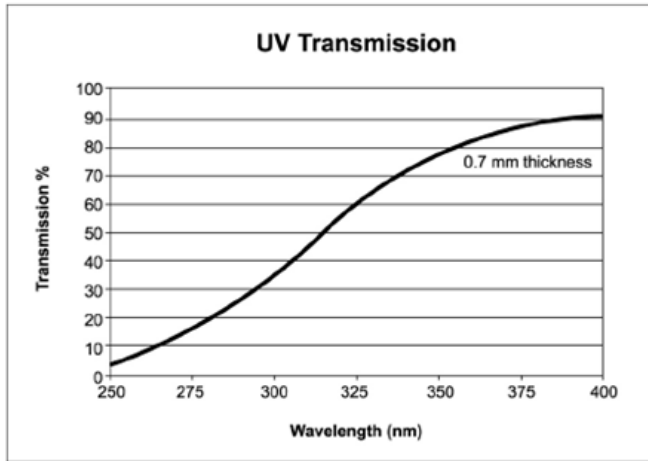
# Specialty Glass Materials Products & Specifications

11/22

## Borosilicate

Corning<sup>®</sup> Eagle XG<sup>®</sup> LCD Glass (*cont.*)

### Transmittance





HEF<sup>®</sup> PHOTONICS

Your Total Solution Partner

## Specialty Glass Materials Products & Specifications

11/22

### Specialty Glass

#### Laminated Glass — Safety Glass

##### Description:

Laminated glass is created by layering two or more pieces of glass together with a transpassive interlayer, such as PVB (polyvinyl butyral). When broken the interlayer holds the glass together, providing increased strength and safety. Laminated glass is used in automobiles, architecture, and bulletproofing. Abrisa can fabricate the laminated glass to custom sizes for a wide variety of applications including automobile and vehicular displays where passenger safety is as critical as the optical performance of the cover glass.

For more information about this product please contact us at:

- [info@abrisatechnologies.com](mailto:info@abrisatechnologies.com)
- (877) 622-7472

# Specialty Glass Materials Products & Specifications

11/22

## Specialty Glass

### SCHOTT Superwhite B 270® Flat Glass (ultra-white crown glass)

#### Description:

SCHOTT offers B 270® crown glass in sheet glass form to meet a wide variety of different market demands, especially suitable for Biotech applications. It is manufactured using a special up-draw process developed by SCHOTT.

B 270® is highly resistant to solar radiation and offers high transmittance in the visible wavelength range. It also has a fire-polished surface and offers high chemical stability.

#### Features:

- High transmission
- Excellent surface quality
- Can be thermally or chemically strengthened

#### Applications:

- Large area LCD covers
- Cover panes for copying machines
- Front covers for oscillograph tubes
- Optical elements for light sensors
- Signal optics

#### Physical Properties:

##### Mechanical:

• Density (25°C) ρ	2.55 g/cm <sup>3</sup>	159.2 lb/ft <sup>3</sup>
• Young's Modulus E	71.5 kN/mm <sup>2</sup>	10.4 Mpsi
• Poisson's Ratio μ	0.219	0.219
• Knoop Hardness HK <sub>0.1/20</sub>	542	542
• Bending strength σ	29.3 kN/mm <sup>2</sup>	4.2 Mpsi

##### Viscosity:

• Softening Point (10 <sup>7.6</sup> poises)	724°C	1335°F
• Annealing Point (10 <sup>13</sup> poises)	541°C	1006°F
• Strain Point (10 <sup>14.5</sup> poises)	511°C	991°F

##### Thermal Expansion:

• 0 – 300°C (32 – 572°F)	9.4 x 10 <sup>-6</sup> /K
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##### Optical:

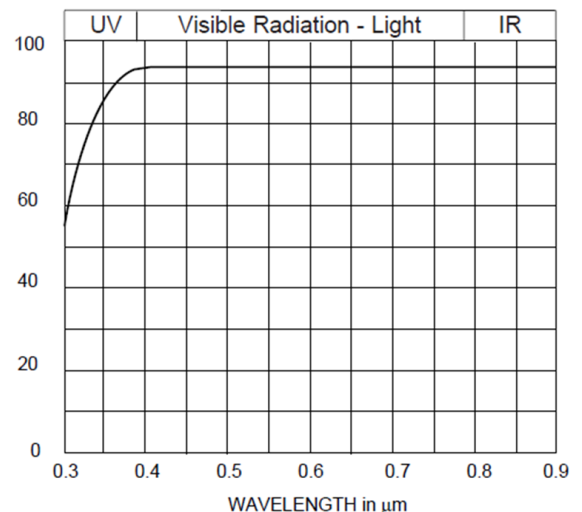
• Index of Refraction @	546nm	1.5252
	588nm	1.5231

##### Electrical:

• Log <sub>10</sub> Volume Resistivity:	
(250°C, 482°F)	1 x 10 <sup>9</sup> ohm*cm
(350°C, 662°F)	1.6 x 10 <sup>7</sup> ohm*cm

##### Dimensions:

- Thicknesses: 0.9mm – 10mm
- Sizes: Up to 66" x 28" (1676.4 x 711.2mm)



\* **Crown glass** is a type of optical glass used in lenses and other optical components. It has relatively low refractive index (≈1.52) and low dispersion (with Abbe numbers around 60). Crown glass is produced from alkali-lime (RCH) silicates containing approximately 10% potassium oxide and is one of



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### Specialty Glass Weld Shield

#### Description:

Weld shield is a leaded glass specifically designed for welding masks and other eye protection equipment. The glass blocks out harmful ultraviolet light and can cause "arc eye". It is available in different shades for varying degrees of protection, and can be cut to size as ordered.

For more information about this product please contact us at:

- [info@abrisatechnologies.com](mailto:info@abrisatechnologies.com)
- (877) 622-7472



## Specialty Glass Materials Products & Specifications

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### Specialty Glass White Flashed Opal

#### Description:

White Flashed Opal consists of a colorless base soda-lime glass which is fused to a thin white flashed layer. Using white flashed opal one can create an ambiance in diffused lighting similar to daylight with very little shadow. Flashed opal is perfect for creating a pleasant atmosphere in professional or residential areas.

#### Features:

- Average transmission of approximately 35%
- Can be heat strengthened or tempered
- Helps create a similar effect as a skylight
- Scratch resistant, non-deforming, and non-combustible
- Readily available off the shelf in (MR11) - 1.370" diameter and (MR16) - 1.965" diameter sizes

#### Dimensions:

- Thicknesses: 2.7mm to 3.3mm & 4.0mm to 6.0mm
- Sizes: 55" x 67" Max (1397 x 1701.8mm)

#### Transmission:

The transmission properties of White Flashed Opal glass are for the most part dependent solely upon the white layer, the thickness of which varies over the manufacturing width and is generally in the order of  $0.45 \pm 0.2\text{mm}$ . The visual light transmission in the case of standard illuminant A is on average  $\tau_{vA} = 35\% (\pm 10\%)$ .

#### Light Diffusion:

In the visible spectrum of the DESAG, White Flashed Opal glass provides almost ideal diffusion. In the near infrared range a directed component is superimposed which appears on the diffusion indicatrix as a small "nose". From  $\lambda = 800\text{nm}$ , the proportion of the directed transmission increases relatively sharply and where  $\lambda = 2000\text{nm}$ , values of 50 % may be reached.

#### Chemical Properties:

White Flashed Opal glass is largely insensitive to the action of water acids, alkalis, and salt solutions (with the exception of hydrofluoric acid).

#### Electrical Properties:

Specific electrical resistivity  $> 10_{10} \Omega \cdot \text{cm}$

#### Thermal Properties:

Thermal conductivity at  $90^\circ\text{C} = 1.06 \text{ W}/(\text{m} \cdot \text{K})$

Transformation temperature  $T_g = 521^\circ\text{C}$

Mean linear thermal coefficient of expansion  $\alpha (20\text{-}300^\circ\text{C}): 9.5 \cdot 10_{-6} \text{ K}_{-1}$

#### Mechanical Properties:

Compressive strength  $800\text{-}930 \text{ N}/\text{mm}_2$

Bending tensile strength  $30 \text{ N}/\text{mm}_2$  (characteristic value)

Density  $\rho = 2.6 \text{ g}/\text{cm}_2$

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### Specialty Glass

#### X-Ray Glass or Radiation Shielding Glass

##### Description:

X-Ray leaded glass is a radiation shielding glass that contains a high content of heavy metallic oxides. Most notably the lead oxide (PbO) provides the protective qualities against X-rays and Y-rays for use in the medical and technical fields. Despite the high metallic oxide content, Radiation Shielding Glass features high optical transmission, making it a perfect fit for view windows for X-ray rooms.

##### Features:

- Protection from X-rays and Y-rays
- Good optical transmission

##### Applications:

- Control windows for X-ray rooms
- Protection windows in materials testing houses, baggage control units, and laboratories

##### Physical Properties:

- Optical Transmission in Visible Spectrum: 86-88%

##### Dimensions:

- Thicknesses: 8 mm
- Sizes: Up to 31" x 29" (787.4 x 736.6mm)

# Specialty Glass Materials

## Glass Fabrication



## Coating Deposition



## CNC Machining



## Strengthening - Chemical & Heat



## Screen Printing of Graphics



Abrisa Technologies, a member of HEF Photonics, is a globally recognized technology glass fabrication and optical thin film coating company with expertise in high volume manufacturing and engineering capabilities, delivering Total Solutions that provide excellent performance, fitness-for-use and economies of scale.

Our US based, state-of-the-art ISO 9001:2015 and ITAR registered facilities include Abrisa Industrial Glass in Santa Paula, CA and ZC&R Coatings for Optics in Torrance CA. These two divisions produce solutions from cut-to-order coated glass components to custom complex and ready-to-install fabricated, strengthened, optically coated, electronically enabled and branded sub-assemblies.

Our Total Solutions serve a variety of markets including Micro-Electronics, Defense and Avionics, Display, Industrial Automation, Optical Sensors, Imaging, Photonics, Medical & Dental, Life Science and more.



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