Specialty Glass Materials
Products & Specifications
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Specialty Glass Materials
Products & Specifications

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.

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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.
**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:**

<table>
<thead>
<tr>
<th>Property</th>
<th>Measurement</th>
<th>Dragontrail</th>
<th>Soda Lime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>2.48</td>
<td>2.50</td>
</tr>
<tr>
<td>Young’s Modulus</td>
<td>GPa</td>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>Shear Modulus</td>
<td>GPa</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Poisson’s Ratio</td>
<td></td>
<td>0.23</td>
<td>0.21</td>
</tr>
<tr>
<td>Vickers Hardness Before CT</td>
<td></td>
<td>595</td>
<td>533</td>
</tr>
<tr>
<td>Vickers Hardness After CT</td>
<td></td>
<td>673</td>
<td>580</td>
</tr>
<tr>
<td><strong>Thermal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTE</td>
<td><a href="50~200%C2%B0C">10⁻⁷</a> °C</td>
<td>98</td>
<td>85</td>
</tr>
<tr>
<td>Tg</td>
<td>°C</td>
<td>604</td>
<td>550</td>
</tr>
<tr>
<td>Softening Point</td>
<td>°C</td>
<td>831</td>
<td>733</td>
</tr>
<tr>
<td>Annealing Point</td>
<td>°C</td>
<td>606</td>
<td>554</td>
</tr>
<tr>
<td>Strain Point</td>
<td>°C</td>
<td>556</td>
<td>511</td>
</tr>
<tr>
<td><strong>Optical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refraction Index</td>
<td>Nd</td>
<td>1.51</td>
<td>1.52</td>
</tr>
<tr>
<td>Photoelastic Constant</td>
<td>Nm/cm Mpa</td>
<td>28.3</td>
<td>25.6</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume Resistivity</td>
<td>Log (Ω · cm)</td>
<td>8.4</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Asahi Glass Corporation (AGC) Dragontrail™ (cont.)

C/S Characteristics

Optical Transmittance

Three-Point Bending Result
Corning® Gorilla® Glass

Is an environmentally friendly alkali-aluminosilicate thin sheet glass. Its superior composition allows a deeper layer of chemical strengthening than is possible with most other chemically strengthened glasses, making it durable and damage resistant.

Benefits:
- Glass designed for a high degree of chemical strengthening
  - High compression
  - Deep compression layer
- High retained strength after use
- High resistance to scratch damage
- Pristine surface quality

Applications:
- Ideal protective cover for electronic displays in:
  - Handheld devices and instrumentation
  - Laptops and tablet computer screens
  - Mobile devices including smart phones
- Touchscreen devices
- Optical components
- High strength glass articles

Dimensions:
- Available thicknesses 0.55 mm - 2.0 mm
- Non-standard sizes may also be available upon request
- Available in Gen 5 - 49.21 x 35.43” (1250 x 900mm) sheets

Viscosity:
- Softening Point (107.6 poises) 852˚C
- Annealing Point (1013.2 poises) 613˚C
- Strain Point (1014.7 poises) 563˚C

Properties:
- Density 2.44 g/cm³
- Young’s Modulus 71.7 GPa
- Poisson’s Ratio 0.21
- Shear Modulus 29.7 GPa
- Vickers Hardness (200 g load) Un-strengthened 625 kgf/mm²
  Strengthened 674 kgf/mm²
- Fracture Toughness 0.7 MPa m0.5
- Coefficient of Expansion 84.5 x 10⁻⁷/˚C (0˚C - 300˚C)

Chemical Strengthening:
- Compressive Stress Capable ≥800 MPa
- Depth of Layer Capable ≥40μm

Optical:
- Refractive Index (633nm) Core Glass 1.5094
  Compression layer 1.5116

Chemical Durability: Durability is measured via weight loss per surface area after immersion. Values are highly dependent upon actual testing conditions. Data is reported for Code 2318 glass. Unless otherwise noted, concentrations refer to weight percent.
Corning Gorilla Glass (cont.)

Electrical: Characteristics:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Dielectric Constant</th>
<th>Loss Tangent</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>7.38</td>
<td>0.013</td>
</tr>
<tr>
<td>490</td>
<td>7.26</td>
<td>0.013</td>
</tr>
<tr>
<td>912</td>
<td>7.30</td>
<td>0.014</td>
</tr>
<tr>
<td>1977</td>
<td>7.22</td>
<td>0.015</td>
</tr>
<tr>
<td>2986</td>
<td>7.19</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Has Greater Design Strength:

Corning Gorilla Glass exhibits tighter strength distribution.

Greater Retained Strength:

Scratches are Less Visible:

Corning Gorilla Glass suppresses damage zone and lateral cracking that make scratches less visible.

Devices benefit from a greater retained strength.
SCHOTT Xensation™

SCHOTT Xensation™ is a high-quality alumino-silicate 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 alumino-silicate 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:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Conductivity λ(25 °C)</td>
<td>0.96 W/(m•K)</td>
</tr>
<tr>
<td>Specific Heat Capacity C_p(20 °C; 100 °C)</td>
<td>0.84 KJ/(Kg•K)</td>
</tr>
<tr>
<td>Coefficient of Mean Linear Thermal Expansion α (20 °C; 300 °C)</td>
<td>8.8 × 10⁻⁶ K⁻¹¹</td>
</tr>
<tr>
<td>Transformation Point Tg</td>
<td>615 °C</td>
</tr>
<tr>
<td>Annealing Point (10¹³ dPas)</td>
<td>635 °C</td>
</tr>
<tr>
<td>Softening Point (10⁷.6 dPas)</td>
<td>880 °C</td>
</tr>
<tr>
<td>Working Point (10⁶ dPas)</td>
<td>1265 °C</td>
</tr>
</tbody>
</table>

*cooled according to DIN

Chemical Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrolytic Resistance</td>
<td>DIN ISO 719 Class HGB 1</td>
</tr>
<tr>
<td>Acid Resistance</td>
<td>DIN 12116 Class S 4</td>
</tr>
<tr>
<td>Alkali Resistance</td>
<td>DIN ISO 695 Class A 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refractive Index at nD</td>
<td>588 nm (nD) 633 nm 780 nm</td>
</tr>
<tr>
<td>Core Glass</td>
<td>1.508 1.506 1.502</td>
</tr>
<tr>
<td>Compression Layer</td>
<td>KNO₃ pure 1.516 1.514 1.510</td>
</tr>
<tr>
<td>Transmittance τ (Glass Thickness 0.7mm)</td>
<td>840 nm &gt; 91.5 %</td>
</tr>
<tr>
<td>580 nm</td>
<td>&gt; 91.5 %</td>
</tr>
<tr>
<td>380 nm</td>
<td>&gt; 90 %</td>
</tr>
<tr>
<td>Photoelastic Constant</td>
<td>29.2 nm/cm/MPa</td>
</tr>
</tbody>
</table>

Electrical Properties:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Dielectric Constant ε</th>
<th>Loss Tangent tanδ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>7.74</td>
<td>0.011</td>
</tr>
<tr>
<td>54</td>
<td>7.49</td>
<td>0.008</td>
</tr>
<tr>
<td>480</td>
<td>7.40</td>
<td>0.009</td>
</tr>
<tr>
<td>825</td>
<td>7.38</td>
<td>0.010</td>
</tr>
<tr>
<td>912</td>
<td>7.38</td>
<td>0.010</td>
</tr>
<tr>
<td>1977</td>
<td>7.35</td>
<td>0.012</td>
</tr>
<tr>
<td>2170</td>
<td>7.35</td>
<td>0.012</td>
</tr>
<tr>
<td>2986</td>
<td>7.34</td>
<td>0.012</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Resistivity ρ₀ (Ω•cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 °C</td>
<td>1.5 × 10⁶</td>
</tr>
<tr>
<td>350 °C</td>
<td>8.9 × 10⁷</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>2.477 g/cm³</td>
</tr>
<tr>
<td>Young’s Modulus E</td>
<td>74 kN/mm²</td>
</tr>
<tr>
<td>Poisson’s Ratio</td>
<td>0.215</td>
</tr>
<tr>
<td>Shear Modulus</td>
<td>30 kN/mm²</td>
</tr>
<tr>
<td>Knoop Hardness HK 0.1/20</td>
<td>534</td>
</tr>
<tr>
<td>Non-strengthened</td>
<td>639</td>
</tr>
<tr>
<td>Strengthened</td>
<td>681</td>
</tr>
<tr>
<td>Vickers Hardness HV 0.2/20</td>
<td>617</td>
</tr>
<tr>
<td>Non-strengthened</td>
<td>681</td>
</tr>
</tbody>
</table>

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

Mechanical Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Stress</td>
<td>capable &gt; 900 MPa</td>
</tr>
<tr>
<td>Depth of Layer</td>
<td>capable &gt; 50 µm</td>
</tr>
<tr>
<td>4-Point Bending Strength</td>
<td>cap. &gt; 800 MPa</td>
</tr>
</tbody>
</table>

Chemical Strengthening:

*cooled according to DIN
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 10^10 Pa (10.4 x 10^6 psi)
- Modulus of Rigidity (Shear) 3.0 x 10^10 Pa (4.3 x 10^6 psi)
- Bulk Modulus 4.3 x 10^10 Pa (6.18 x 10^6 psi)
- Poisson's Ratio 0.23
- Specific Gravity 2.53
- Density 2530 kg/m^3 (158 lb/ft^3)
- Coefficient of Thermal Stress 0.62 mPa/°C (50 psi/°F)
- Thermal Conductivity 0.937 W/m/°C (6.5 btu.in/hr.°F.ft^2)
- Specific Heat 0.21
- Coefficient of Linear Expansion 8.9 x 10^-6 strain/°C (4.9 x 10^-6 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.
**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.

<table>
<thead>
<tr>
<th>Grey Glass Name</th>
<th>Transmission Percent</th>
<th>Color Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray 62</td>
<td>62%</td>
<td>Lightest grey</td>
</tr>
<tr>
<td>Gray 57</td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td>Gray 31</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>Gray 14</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>Gray 9</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Gray 8</td>
<td>8%</td>
<td>Darkest grey – nearly black</td>
</tr>
</tbody>
</table>

**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.
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/m³ (158 lb/ft³)
- Modulus of Elasticity (Young's): 7.2 x 10¹⁰ Pa (10.4 x 10⁶ psi)
- Modulus of Rigidity (Shear): 3.0 x 10¹⁰ Pa (4.3 x 10⁶ psi)
- Bulk Modulus: 4.3 x 10¹⁰ Pa (6.18 x 10⁵ 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/m²°C (6.5 btu.in/hr.°F.ft²)
- Specific Heat: 0.21
- Coefficient of Linear Expansion: 8.9 x 10⁻⁶ strain/°C (4.9 x 10⁻⁶ strain/°F)
- Hardness (Moh’s Scale): 5 to 6
- Refractive Index (Sodium D line):
  - (1 μm): 1.523
  - (2 μm): 1.511
  - (1 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)
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")

Web: www.abrisatechnologies.com - E-mail: info@abrisatechnologies.com - Tel: (877) 622-7472

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Soda-Lime
Patterned Glass for Diffusion & Light Control

Abris 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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum Size</th>
<th>Thickness</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solite® (Softening)</td>
<td>48” x 102” (1219 x 2590mm)</td>
<td>1/8”, 3/16” and 5/32” or 4mm and 5mm</td>
<td>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.</td>
</tr>
<tr>
<td>Industrex® (Diffusion)</td>
<td>60” x 132” (524 x 3352.8mm)</td>
<td>5/32” and 3/16” (4mm and 5mm)</td>
<td>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.</td>
</tr>
<tr>
<td>Pattern 62™ (Obscures)</td>
<td>60” x 132” (524 x 3352.8mm)</td>
<td>1/8, 5/32” and 3/16” (4mm and 5mm)</td>
<td>Acts as a diffuser and can be used to project an obscure or uneven pattern. Can be backlit to diffuse light.</td>
</tr>
<tr>
<td>Skytex (Linear)</td>
<td>85” x 65” (2159 x 1652mm)</td>
<td>5/32” (4mm)</td>
<td>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.</td>
</tr>
</tbody>
</table>

Blue color of glass is for viewing purposes only — glass is actually clear.
### Frosted Glass (Sandblasted)

- **Maximum Size:** 60’ x 132’ (1524 x 3352.8 mm)
- **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’ (304.8 mm)
- **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.

### White Flashed Opal

- **Maximum Size:** 32.5” x 27.875” (825.5 x 708 mm)
- **Thickness:** 3 mm and 6 mm
- **Features:**
  - Colorless base soda lime glass which is fused to a thin white flashed layer.
  - Creates an ambience in diffused lighting similar to daylight with very little shadow. (skylight effect)
  - Average transmission of approx. 35%. Scratch-resistant, non-deforming, and non-combustible.

### Mislite

- **Maximum Size:** 72’ x 42’ (1828.8 x 1066.8 mm)
- **Thickness:** 1/8” (3 mm)
- **Features:**
  - Figured glass that is translucent yet provided obscurity for decorative purposes.

### Croco Droplet

- **Maximum Size:** 85” x 65” (2159 x 1651 mm)
- **Thickness:** 1/4” (6 mm)
- **Features:**
  - Decorative Glass — see image

### Ice Block

- **Maximum Size:** 89” x 52” (2260.6 x 1330.8 mm)
- **Thickness:** 5/32” (4 mm)
- **Features:**
  - Decorative glass. Can be heat strengthened

### Rain

- **Maximum Size:** 84” x 60” (2133.6 x 1524 mm)
- **Thickness:** 3/16” (5 mm)
- **Features:**
  - Decorative glass. Can be heat strengthened.

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Blue color of glass is for viewing purposes only — glass is actually clear.

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Web: www.abrisatechnologies.com - E-mail: info@abrisatechnologies.com - Tel: (877) 622-7472
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/ft²°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”)
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 (SP) filter

Physical Properties:

Optical Properties:
- Refractive index at sodium D Line (ND) 1.5184
- CIE Iilluminate “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^{-6}/°C 4.8 x 10^{-6}/°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”)
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/cm³ 137.3 lb/ft³
- Young’s Modulus E 64 kN/mm² 9.28 Mpsi
- Poisson’s Ratio μ 0.2
- Knoop Hardness HK0.1/20 480
- Bending strength σ 25 MPa 3.63 x 10³ psi

Viscosity:
- Working Point (10⁴ poises) 1270°C 2318°F
- Softening Point (10⁷.6 poises) 820°C 1508°F
- Annealing Point (10¹³ poises) 560°C 1040°F
- Strain Point (10¹⁴.5 poises) 518°C 964°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F) 3.25 x 10⁻⁶/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)
Borosilicate
SCHOTT Borofloat® 33 - Multi-Functional Float Glass (cont.)
Borosilicate
SCHOTT Supremax® Rolled Borosilicate

Description:
SCHOTT Supremax® Rolled Borosilicate is almost identical in its properties to Borofloat® 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® 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) \( \rho \) 2.2 g/cm\(^3\) 137.3 lb/ft\(^3\)
- Young’s Modulus \( E \) 64 kN/mm\(^2\) 9.28 Mpsi
- Poisson’s Ratio \( \mu \) 0.2
- Knoop Hardness HK\(_{0.1/20}\) 480
- Bending strength \( \sigma \) 25 MPa 3.63 x 10\(^3\) psi

Viscosity:
- Working Point (10\(^4\) poises) 1270°C 2318°F
- Softening Point (10\(^7.6\) poises) 820°C 1508°F
- Annealing Point (10\(^13\) poises) 560°C 1040°F
- Strain Point (10\(^14.5\) poises) 518°C 964°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F) 3.25 x 10\(^{-6}\)/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:
- Log10 Volume Resistivity:
  - (250°C, 482°F) 8.0
  - (350°C, 932°F) 6.5

Dimensions:
- Thicknesses: 28.6mm – 66.7mm
  (1 ⅛” – 2 ⅝”)
- Sizes: Up to 90” x 67” (2286 x 1701.8”)
Borosilicate
SCHOTT Supremax® Rolled Borosilicate (cont.)

Spectral Transmittance
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) \( \rho \) 2.51 g/cm\(^3\) 156.7 lb/ft\(^3\)
- Young’s Modulus \( \varepsilon \) 72.9 kN/mm\(^2\) 10.6 Mpsi
- Poisson’s Ratio \( \mu \) 0.208
- Knoop Hardness HK\(_{0.120}\) 590
- Bending strength \( \sigma \) 30.1 kN/mm\(^2\) 4.4 Mpsi

Viscosity:
- Softening Point (10\(^{7.6}\) poises) 736°C 1357°F
- Annealing Point (10\(^{13}\) poises) 557°C 1035°F
- Strain Point (10\(^{14.5}\) poises) 529°C 984°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F) 7.2 x 10\(^{-6}\)/K

Optical:
- Index of Refraction @ \( n_e \) 546nm 1.5255
- \( n_d \) 588nm 1.5231

Electrical:
- Log10 Volume Resistivity: (250°C, 482°F) 1.6 x 10\(^8\)
- (350°C, 932°F) 3.5 x 10\(^6\)

Dimensions:
- Thicknesses: 0.030mm – 1.1mm
- Sizes: Up to 17" x 14" (431.8 x 355.6mm)
Borosilicate
SCHOTT D263® Colorless Thin Glass (cont.)
Borosilicate
SCHOTT Duran® Lab Glass (Tubed)

Description:
SCHOTT Duran® is general-purpose borosilicate glass tubing. Duran® has identical chemical and thermal properties as Schott’s Borofloat® 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) \( \rho \) 2.2 g/cm\(^3\) 137.3 lb/ft\(^3\)
- Young’s Modulus \( E \) 64 kN/mm\(^2\) 9.28 Mpsi
- Poisson’s Ratio \( \mu \) 0.2 0.2
- Knoop Hardness HK\(_{0.1/20}\) 480 480
- Bending strength \( \sigma \) 25 MPa 3.63 x 10\(^3\) psi

Viscosity:
- Working Point (10\(^4\) poises) 1260°C 2300°F
- Softening Point (10\(^7.6\) poises) 825°C 1517°F
- Annealing Point (10\(^13\) poises) 560°C 1040°F
- Strain Point (10\(^14.5\) poises) 518°C 964°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F) 3.25 x 10\(^{-6}\)/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:
- Log10 Volume Resistivity: (250°C, 482°F) 8.0
  (350°C, 932°F) 6.5

Dimensions:
- Smallest size: Outer Diameter: 3mm (0.118″)
  Wall Thickness: 0.7mm (0.028″)
  Length: 17mm (0.669″)
- Largest size: Outer Diameter: 325mm (12.795″)
  Wall Thickness: 10mm (0.394″)
  Length: 150mm (5.9″)
Transmission

![Transmission Graph](image-url)
Ceramic/Glass
SCHOTT Robax® Transparent Ceramic

Description:
SCHOTT Robax® 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® an excellent choice for windows in heating devices. Robax® 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) \( \rho \) 2.58 g/cm³ 161.1 lb/ft³
- Young’s Modulus \( \varepsilon \) 92 Gpa 13 Mpsi
- Poisson’s Ratio \( \mu \) 0.25 0.25

Thermal Expansion:
- 20 – 700°C (68 – 1292°F) \((0 +/-.5) \times 10^{-6}/K\)

Maximum Operating Temperatures:

Usage Temp: Usage Time:
560°C 5000 hours
610°C 1000 hours
660°C 100 hours
710°C 10 hours
760°C 5 hours

Dimensions:
- Thicknesses: 3mm – 5mm
- Sizes: Up to 62” x 33” (1574.8 x 838.2”)
Ceramic/Glass
SCHOTT Pyran® Fire Rated Ceramic

Description:
SCHOTT Pyran® is a transparent glass ceramic that is fire-protection rated. It works with fire rated frames of the same rating. Pyran® 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

<table>
<thead>
<tr>
<th>Rating in minutes</th>
<th>Location</th>
<th>Max. exposed area of glazing (in²)</th>
<th>Max. width of exposed glazing (in)</th>
<th>Max. height of exposed glazing (in)</th>
<th>Min. depth of groove (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 90 min</td>
<td>Other than Doors</td>
<td>3,422 (23.7 ft²)</td>
<td>76</td>
<td>76</td>
<td>5/8</td>
</tr>
</tbody>
</table>

Transmission Properties:
Visible spectrum: ~80% transmission

Dimensions:
- Thicknesses: 5mm (3/16”)
- Sizes: Up to 77” x 43” (1955.8 x 1092.2mm)
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^3, 137.4 lb/ft^3
- 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^2
- Shear Modulus: 31.4 GPa, 4.55 Mpsi

Viscosity:
- Softening Point (10^7.6 poises): 1585°C, 2885°F
- Annealing Point (10^13 poises): 1042°C, 1908°F
- Strain Point (10^14.5 poises): 893°C, 1639°F

Thermal Expansion:
- 0 – 200°C (32 – 392°F): 5.7 x 10^-7/°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”)

Web: www.abrisatechnologies.com - E-mail: info@abrisatechnologies.com - Tel: (877) 622-7472
Quartz/Fused Silica
GE 124 Fused Silica

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) $\rho$: 2.21 g/cm$^3$, 38.0 lb/ft$^3$
- Young’s Modulus $E$: 70 kN/mm$^2$, 10.5 Mpsi
- Poisson’s Ratio $\mu$: 0.17
- Knoop Hardness $HK_{0.1/20}$: 600 kg/mm$^2$, 600 kg/mm$^2$

Viscosity:
- Softening Point ($10^7$ poises): 1683°C, 3061°F
- Annealing Point ($10^{13}$ poises): 1214°C, 2217°F
- Strain Point ($10^{14.5}$ poises): 1122°C, 2052°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F): $5.5 \times 10^{-7}$/°C

Optical:
- Index of Refraction: 1.4585

Electrical:
- Log10 Volume Resistivity:
  - (250°C, 482°F): $7 \times 10^7$
  - (350°C, 662°F): $7 \times 10^7$

Dimensions:
- Thicknesses: Up to 4” thick (101.6mm)
- Sizes: Up to 36” (914.4mm) diameter
Borosilicate
Corning® Eagle XG® LCD Glass

Description:
Corning® Eagle XG® 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/cm³ 148.5 lb/ft³
- 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 (10⁴ poises) 1293°C 2359°F
- Softening Point (10⁷.6 poises) 971°C 1780°F
- Annealing Point (10¹³ poises) 722°C 1332°F
- Strain Point (10¹⁴.5 poises) 669°C 1236°F

Thermal Expansion:
- 0 – 300°C (32 – 572°F) 31.7 x 10⁻⁷/°C 17.7 x 10⁻⁷/°F
- Room Temperature to Setting Point 25 – 675°C (77 – 1247°F) 35.5 x 10⁻⁷/°C 19.7 x 10⁻⁷/°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/mm²)

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)
Borosilicate
Corning® Eagle XG® LCD Glass (cont.)

Transmittance

![UV Transmission Graph](image1)

![Optical Transmission Graph](image2)

- UV Transmission
- Optical Transmission
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
- (877) 622-7472
**Specialty Glass**

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

**Description:**
SCHOTT offers B 270® i 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® i 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) $\rho$: 2.55 g/cm³, 159.2 lb/ft³
- Young’s Modulus $E$: 71.5 kN/mm², 10.4 Mpsi
- Poisson’s Ratio $\mu$: 0.219
- Knoop Hardness HK: 542
- Bending strength $\sigma$: 29.3 kN/mm², 4.2 Mpsi

**Viscosity:**
- Softening Point ($10^7.6$ poises): 724°C, 1335°F
- Annealing Point ($10^{13}$ poises): 541°C, 1006°F
- Strain Point ($10^{14.5}$ poises): 511°C, 991°F

**Thermal Expansion:**
- 0 – 300°C (32 – 572°F): 9.4 x $10^{-6}$/K

**Optical:**
- Index of Refraction @ 546nm: 1.5252
- Index of Refraction @ 588nm: 1.5231

**Electrical:**
- Log10 Volume Resistivity:
  - (250°C, 482°F): $1 \times 10^9$ ohm·cm
  - (350°C, 662°F): $1.6 \times 10^7$ 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 the earliest low dispersion glasses.
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
- (877) 622-7472
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 ± 0.2mm. The visual light transmission in the case of standard illuminant A is on average $\tau_{vA} = 35 \%$ (± 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 $\lambda = 800$nm, the proportion of the directed transmission increases relatively sharply and where $\lambda = 2000$ 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°C = 1.06 W/(m • K)
Transformation temperature $T_g = 521^\circ$C
Mean linear thermal coefficient of expansion $\alpha$ (20-300°C): $9.5 \cdot 10^{-6}$ K$^{-1}$

Mechanical Properties:
Compressive strength 800-930 N/mm$^2$
Bending tensile strength 30 N/mm$^2$ (characteristic value)
Density $\vartheta = 2.6 \text{g/cm}^2$
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)
Corning® Willow® Glass

Corning® Willow® Glass will help enable thin, light and cost-efficient applications including today’s slim displays and the smart surfaces of the future.

The thinness, strength and flexibility of the glass has the potential to enable displays to be “wrapped” around a device or structure. As well, Corning Willow Glass can be processed at temperatures up to 500° C. High temperature processing capability is essential for today’s high end displays, and is a processing condition that cannot be supported with polymer films.

Corning Willow Glass will enable the industry to pursue high-temperature, continuous “roll-to-roll” processes – similar to how newsprint is produced - that have been impossible until now.

It will support thinner backplanes and color filters for both Organic Light Emitting Diodes (OLED) and liquid crystal displays (LCD) in high performance, portable devices such as smart phones, tablets, and notebook computers.

This new, ultra-slim flexible glass will also help develop conformable, or curved, displays for immersive viewing or mounting on non-flat surfaces.

Willow Glass is formulated to perform exceptionally well for electronic components such as touch sensors, as well as leveraging glass’s natural hermetic properties as a seal for OLED displays and other moisture and oxygen sensitive technologies.

The Future is Flexible: Corning® Willow® Glass

- At roughly the same thickness as a sheet of copy paper, Corning® Willow® Glass is thin enough to be flexible while retaining its superior glass attributes. Willow glass provides the inherent benefits of glass in a mechanically bendable form-factor, enabling cost-effective device processing.
- Willow Glass can be used in displays to make thinner and lighter portable devices such as smartphones, and tablets, without sacrificing device performance or reliability.
- Corning’s patented edge tabs enable practical use of Willow Glass in roll-to-roll processing.

### Specifications

<table>
<thead>
<tr>
<th></th>
<th>Sheets</th>
<th>Rolls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes</td>
<td>Up to 1100mm x 1200 mm</td>
<td>Up to 1.3m wide and 200 m long</td>
</tr>
<tr>
<td>Composition</td>
<td>Alkali-free borosilicate</td>
<td>Alkali-free borosilicate</td>
</tr>
<tr>
<td>Thickness</td>
<td>100µm and 200µm</td>
<td>100µm and 200µm</td>
</tr>
</tbody>
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**Applications:**
- OLED and LCD Displays
- Curved (conformable) Displays
- Touch Sensors

Web: www.abrisatechnologies.com - E-mail: info@abrisatechnologies.com - Tel: (877-622-7472)
Specialty Glass Materials
Products & Specifications

Corning® Willow® Glass

Cont.

Sample Characteristics

<table>
<thead>
<tr>
<th>Bulk Properties</th>
<th>Metric Unit</th>
<th>Nominal Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>g/cc</td>
<td>2.3 - 2.5</td>
</tr>
<tr>
<td>CTE (0º to 300ºC)</td>
<td>Ppm/ºC</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Young’s Modulus</td>
<td>GPa</td>
<td>70 - 80</td>
</tr>
<tr>
<td>Poisson Ratio</td>
<td>-</td>
<td>0.20 - 0.25</td>
</tr>
<tr>
<td>Strain Point</td>
<td>ºC</td>
<td>650 - 750</td>
</tr>
<tr>
<td>Annealing Point</td>
<td>ºC</td>
<td>700 - 750</td>
</tr>
<tr>
<td>Dielectric Constant (k=E₀/E)</td>
<td>-</td>
<td>5 - 6</td>
</tr>
<tr>
<td>Surface Roughness</td>
<td>Ra (nm)</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td></td>
<td>Rpv (nm)</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Minimum Bend Radius</td>
<td>mm</td>
<td>100µm = 185mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm = 370mm</td>
</tr>
</tbody>
</table>

Bend radius can be affected by handling.