



# QUICK REFERENCE GUIDE TYPES OF GLASS



## Annealed



## Toughened



## Laminated



## Coated

**Annealed glass** is described as a glass-cooling process that includes no heat treatment. Used by glass fabricators and manufacturers, this glass is made by fusing silica, sodium carbonate, and calcium oxide together at high temperature. The glass is then cooled, shaped, and cooled further (a process called annealing) to stabilize and strengthen it. Glass that has not been annealed properly has higher chances of cracking, and if broken, will shatter into sharp shards and pieces.

**Uses:**

- Low-traffic areas
- Display counters
- Basement windows
- Furniture glass (e.g. cabinet doors, tabletops)

**Toughened glass**, also called tempered or safety glass, has been heat-treated to make it four times stronger than annealed glass. A fast cooling process called quenching puts the surface and edges of toughened glass into compression while the center remains in tension. The process changes a break characteristic so that when shattered, toughened glass forms into pebble-size pieces to reduce injury potential.

**Uses:**

- Shower doors
- Monitor screens
- Thermal or wind protected glass
- Exterior windows
- High-traffic areas
- Frameless glass doors

**Laminated glass** uses heat and pressure to sandwich layers of glass with a layer of resin called polyvinyl butyral (PVB), making it one of the strongest and most stable forms of glass concerning breakage. Laminates made with a stiff interlayer can also provide some load capacity after breakage. This glass can be curved or flat, the interlayers can be flexible or stiff, and cannot be cut from the outside. These factors make laminated glass an expensive option.

**Uses:**

- Skylights
- Shelving
- Retail windows/doors
- Automotive windshields
- Glass railings, floors, and stair treads

**Coated glass** has been treated to change surface properties for enhanced energy efficiency and comfort. This includes online or hard coating, where metallic oxide is poured onto the glass while on the float line. The process welds the coating to the glass, improving scratch resistance with a bluish tint. Another includes offline or soft coating, where silver, zinc, or tin is applied to pre-formed glass to improve solar control. Silver-coated glass is sealed from the outside to prevent getting oxidized.

**Uses:**

- Low-E glass
- Solar control
- Self-cleaning glass
- Insulated glass units



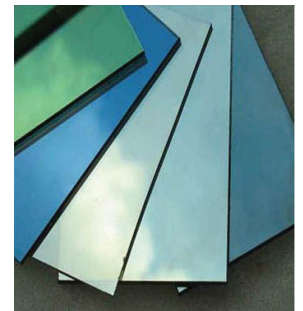
Broken shards of standard annealed glass.



Broken pieces of toughened or tempered safety glass.



Laminated glass stair treads.



Coated glass has been treated to change its surface properties.



## Mirrored



## Decorative



## Extra Clear



## Float

**Mirrored glass** can refer to reflective or true mirror finishes. When mirror or mirror-like properties are required, annealed glass is treated with a metallic substance, such as silver, reflective paint, or aluminum. Mirrored glass cannot be tempered but can be laminated to meet safety glazing requirements. Two-way mirror has been treated to be reflective on one side and clear on the other, which is often used in police stations. Mirrored glass helps enhance interior lighting and make a room appear more open.

### Uses:

- Mirrors
- Tabletops
- Two-way mirrors
- Decorative facades
- Sliding closet doors

**Decorative glass** has several variations, such as painted, textured, frosted, colored, and stained. The decoration can be functional, like for privacy, or aesthetic, for decor. Surface-applied treatments may be used to create the decoration. Colors are achieved by adding different metal oxides and chemical compounds to annealed glass during its production. Etched glass involves using acid or other abrasive products to apply patterns to glass after it has been manufactured. Sandblasting is a common method for etching.

### Uses:

- Shower doors
- Desks and tables
- Stairs and railings
- Decorative walls, doors, floors, and windows.

**Extra clear glass** is created by reducing the amount of iron used in the production process. Reducing the iron increases the glass' transparency by up to six percent and transmits almost 92% of natural light. The glass also imparts a very clear, crystal blue tint rather than the more common greenish tint. This makes extra clear glass the best for color matching. Finally, the glass can be further processed to create tempered, laminated, and frosted glass, as well as insulated glass units and ceramic printed glass.

### Uses:

- Solar panels
- Coated glass
- Color matching
- Ultra-clear glass
- Back-painted glass
- Showrooms, elevators, and museums

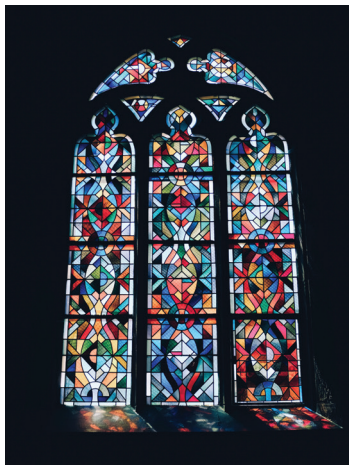
**Float glass** refers to a sheet of flat glass undergoing the manufacturing process. Molten glass is floated on a bed of metal, such as lead or tin, and then cooled. A standard sheet of float glass is annealed glass, for it has not been heat strengthened or tempered. Treatments during the float process or after cooling can change the glass properties. The float manufacturing process is one of the least expensive to produce and has been the most common way to make glass since the 1950s.

### Uses:

- Facades
- Glass doors
- Small windows
- Wall panels
- Showroom display cases



Mirrored glass has many residential and commercial uses.



Stained glass is a common type of decorative glass.



Extra clear glass has a crystal-blue tint and high transparency.



Edge detail of tempered clear float glass.



## Tinted



## Wired



## Ceramic Glass



## Obscured

**Tinted glass** is used to reduce solar gain, glare, and heat by absorbing energy from solar radiation. For true tinted glass, colored pigments like neutral gray, bronze, and blue-green are added during manufacturing to increase color density and thickness while reducing light transmittance. Since it absorbs heat, the glass is tempered to avoid thermal stress breakage. Tinted glass may also be achieved by applying surface-mounted films to in-place glazing, which also reduces solar gain and glare but without the inherent durability.

### Uses:

- Skylights
- Automotive windows
- Commercial buildings in hot and sunny climates
- Office cabins or conference rooms
- Office partitions, walls, and doors

**Wired glass** is a rolled glass that incorporates a welded wire net applied before the molten glass enters the rollers. An early form of safety glazing, the wires hold the glass in place in the event of breakage. Today's safety codes restrict wired glass use as a safety glass because if the glass breaks, the exposed wire could cause injury. Wired glass cannot be tempered but can be obscured.

**Diamond wired glass** is wired laminated glass with a diamond pattern. It is UL listed and fire-rated up to 90 minutes.

### Uses:

- Stairwell glass
- Fire-rated openings
- Along fire escape routes
- Schools, industrial buildings, and factories
- Patio or balcony enclosures

**Ceramic glass** is fire-resistant tempered glass that becomes partly crystalline in the additional heating process. The crystallization process makes the original glass stronger with higher thermal stability and high impact resistance. Depending on the heating process, the glass can withstand very high temperatures of up to 800 degrees Fahrenheit and has a fire rating of up to three hours. Ceramic glass can be tinted, clear, or mirrored, making it a safe, useful, and decorative glass.

### Uses:

- Glass floors
- Fire protection
- Cooktops and grills
- Smartphone screens
- Nuclear waste disposal

**Obscured glass** is a type of rolled glass that features a pattern imprinted onto the glass surface by the roller. The pattern may create a high or low level of light diffusion on the glass surface, creating levels of privacy. For the same reason, the glass is not completely transparent, and the level of transparency can also be customized to meet several uses. Some types of obscured glass cannot be tempered because of the pattern depth and is typically used for decorative purposes. Types include satin glass and frosted glass.

### Uses:

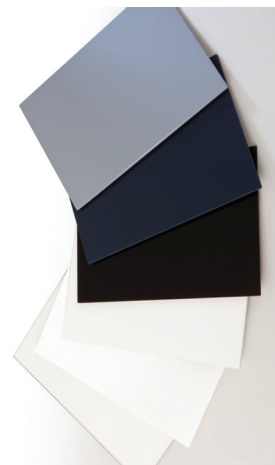
- Shower doors
- Privacy panels
- Bathroom windows
- Windows at street level



Tinted glass typically has a darker appearance.



Diamond and square patterns are most common in wired glass.



Ceramic glass varies in tint based on its desired purpose.



Obscured glass that has been imprinted with decoration.



## Bent



## Etched



## Flat



## Bullet-Resistant

**Bent glass**, also known as curved glass, is placed over a piece of metal that simulates the desired curve while the glass is still hot. Both the metal and the glass are placed in an oven to allow the glass to melt onto the metal. Bent glass can be tinted or clear and uncoated for transparency. The glass can also be bent into any shape up to 90-degree angles. It can also be any size and have unique details included.

### Uses:

- Showcases
- Revolving doors
- Room partitions
- Domes and ceilings
- Elevator glass panels

**Etched glass** is decorated with small cuts made by acid after the glass has been made. The acid generally consists of hydrofluoric acid. By using a mold, the acid can create any design on the glass, which is then sealed with molten glass until cooled. For a frosted look, the sandblasting technique is used by combining sand with air at a high speed. The mixture is aimed at the glass to shave away the desired pieces to create a design.

### Uses:

- Wall and partition decorations
- Designs on windows and doors
- Shower and bath enclosures

**Flat glass**, also called sheet glass or plate glass, can be tempered, treated, and coated. The glass is made with a combination of sand and other components that are melted and placed on a metal plane. The glass can be any thickness and size with the ability to be cut and finished for various purposes. As a result, flat glass is one of the most chosen types of glass. The glass can also be transformed into bent glass.

### Uses:

- Mirrors
- Solar panels
- Doors and walls
- Automotive glass
- Windows and windcreens

**Bullet-resistant glass** is the true meaning for what is considered “bullet-proof glass.” Tempered glass is combined with several layers of laminated glass and thermoplastic to help absorb a bullet’s energy, occasionally stopping it. When the glass shatters, fragments stay together because of the layers of thermoplastic sandwiched between the laminated glass.

### Uses:

- Security storefronts
- Security doors, windows, and partitions
- Military and private security vehicles



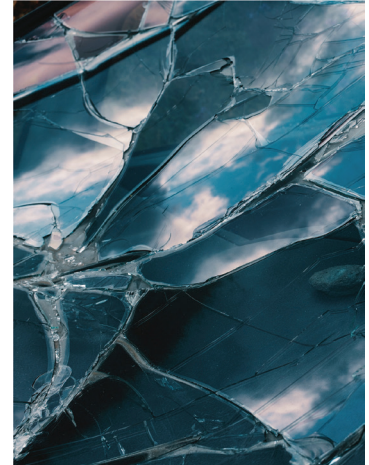
Bent glass is excellent for aquariums and other showrooms.



A partition is etched with very precise features.



Flat glass can be any thickness and size depending on its use.



The various layers in bullet-resistant glass prevents it from falling apart.



## Self-Cleaning

Self-cleaning glass has a coating that allows water to clean off dirt as it falls from glass without soap. While useful, the coating makes glass difficult to repair.

Hydrophilic glass makes water run as thin streams instead of single drops. The unique coating allows UV rays and water to clean grime off glass.

Hydrophobic glass also prevents most types of dirt to stick to glass. Water drops on the glass form into beads that clean off the dirt from under the surface.

### Uses:

- Automotive glass
- Outdoor windows



The way water droplets fall on glass determines what coating is used.



## Spandrel

Spandrel glass are glass panels that hide columns, floors, electrical wiring, plumbing, and more from a structural building. It also has both indoor and outdoor treatment, where the exterior side is heated-treated to avoid thermal stress breakage. The glass is also reflective and made to closely resemble wall properties for a sunny or cloudy day.

### Uses:

- Building exteriors
- Paired with curtain wall systems and structurally glazed designs



Spandrel glass makes buildings have a clean and finished exterior.



## Variable Transmittance

Variable transmittance glass, also known as smart glass or switchable glass, changes shades when exposed to heat or light. It can transform from light to dark or from opaque to transparent. This glass provides shade from strong sunlight and UV rays for buildings or homes, making it energy efficient from not using window film or shades.

### Uses:

- Doors and windows
- Residential buildings
- Commercial buildings
- Hospitals and health care centers



Heat and sunlight change this glass ceiling's tint.