

# GLASS TYPES



## Introduction

This fact sheet provides a basic outline of the various types of glass used in the commercial and residential building industry and explains the main differences in the various types of glass used in the industry.

## Annealed or Float Glass

Annealed glass is the basic flat glass product that is the first result of the float process.

The float glass process is renowned for flatness and optical clarity. It is available as clear, tinted, high performance tinted, ultra clear low iron glass and Low E pyrolytic coated glass. It is used in some end products — often in double-glazed windows, for example. It is also the starting material that is turned into more advanced products through further processing such as laminating, toughening, coating, etc.

Annealed float glass is not a safety glass and when broken it tends to break into large, sharp, jagged shards.

## Insulating Glass or Double Glazing

Two or more panels of glass are bonded to a perimeter spacer, either a metal or thermoplastic spacer, (TPS). A gas, normally air or argon, fills the sealed space between the glass panes. Their primary benefit is insulation and solar control. Most types of glass can be incorporated into an insulating glass unit.

## Toughened Glass (Tempered Glass)

Toughened glass is treated to be far stronger and more resistant to breakage than simple annealed glass, and to break in a more predictable way when it does break, thus providing a major safety advantage when compared to annealed glass in almost all of its applications.

Toughened glass is made from annealed glass treated with a thermal tempering process.

A sheet of annealed glass is heated above its "annealing point" of 600 °C; its surfaces are then rapidly cooled.

The different cooling rates between the surface and the inside of the glass produces different physical properties, resulting in compressive stresses in the surface balanced by tensile stresses in the body of the glass.

These counteracting stresses give toughened glass its increased mechanical resistance to breakage, and when it does break, causes it to produce regular, small fragments. Toughened glass also has an increased resistance to breakage as a result of stresses caused by different temperatures within a pane.

Toughened glass has extremely broad application in products both for buildings and for automobiles and transport, as well as other areas. Car side and rear windows, glass portions of building façades, glass sliding doors, partitions in houses and offices, glass furniture such as table tops, and many other products typically use toughened glass. Products made from toughened glass often also incorporate other technologies, especially in the building and automotive and transport sectors. Toughened glass cannot be cut after it has been toughened.

## Heat Strengthened Glass

Heat strengthened glass is treated to be more resistant to breakage than simple annealed glass. It undergoes a similar process to toughened glass but the resultant surface compression is not high enough to result in the production of small pieces when the glass is broken.

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It is normally used in applications that are subject to thermal stress or require increased strength. Heat strengthened glass cannot be cut after it has been strengthened.

## Chemically Strengthened Glass

Chemically strengthened glass is a specialty product produced by a chemical interchange on the surface of the glass. It is designed to increase the strength of the glass. When broken it still shatters in long sharp, pointed splinters similar to float (annealed) glass. For this reason, it is not considered a safety glass and must be laminated if a safety glass is required. Chemically strengthened glass is typically six to eight times the strength of annealed glass.

The glass is chemically strengthened by submerging the glass in a bath containing a potassium salt (typically potassium nitrate) at 450 °C (842 °F). This causes sodium ions in the glass surface to be replaced by potassium ions from the bath solution.

Unlike toughened glass, chemically strengthened glass may be cut after strengthening, but loses its added strength within the region of approximately 20 mm of the cut. Similarly, when the surface of chemically strengthened glass is deeply scratched, this area loses its additional strength.

## Laminated Glass

Laminated glass is made by combining two or more layers of glass with one or more "interlayers" of polymeric material (special plastic) bonded between the glass layers. While the most common form of laminated glass is a safety glass, this is not always the case. A laminated glass may not be a safety glass but still provide some functional properties such as for decorative applications.

Laminated glass is produced using one of two methods.

The most common method to produce both laminated glass and laminated safety glass is to use a polymer film (Poly Vinyl Butyral or PVB) sandwiched between layers of glass and processed using heat and pressure to bond the glass together. On occasion, other polymers such as Ethyl Vinyl Acetate (EVA) or Polyurethane (PU), Polycarbonates, PET films or ionomers are used.

Laminated glass offers many advantages. Safety, security and glass shard retention are the best-known of these. Rather than shattering on impact, laminated glass is held together by the interlayer, reducing the safety hazard associated with shattered glass fragments, as well as, to some degree, the security risks associated with easy penetration. The interlayer also provides a way to apply several other technologies and benefits, such as colouring, sound dampening, resistance to fire, ultraviolet filtering, solar control and other technologies that can be embedded in or with the interlayer.

Laminated glass is used extensively in building and housing products and in the auto-motive and transport industries. Most building façades and most car windscreens, for example, are made with laminated glass, usually with other technologies also incorporated.

## Coated Glass

Surface coatings can be applied to glass to modify its appearance and give it many of the advanced characteristics and functions available in today's flat glass products, such as low maintenance, special reflection, transmission or absorption properties, scratch resistance, corrosion resistance, etc.

Coatings can be applied by controlled exposure of the glass surface to chemical vapours, which bind to the glass forming a permanent coating.

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The coating process can be applied while the glass is still in the float line with the glass still warm, producing what is known as "hard-coated" glass.

Alternatively, in the "off-line" or "vacuum" coating process, the coating is applied to the cold glass surface in a vacuum vessel, producing what is known as "soft-coated" glass.

Coated glasses can be toughened, laminated or incorporated into an insulating glass unit.

## Security Glass

Security glass is designed to resist physical attack, ballistic and bomb blasts. These products are specialist laminates that use multiple layers of glass and rigid interlayers depending on the resistance required.

Security glass is commonly used in buildings and transport such as prisons, banks and armoured vehicles.

## Screen Printed Glass

Ceramic frit (paint) is screen printed and permanently fused to the toughened glass surface to create a full coloured or patterned decorative finish. Commonly used in spandrel and roof panels and splash backs.

## Mirrored Glass

To produce mirrored glass, a metal coating is applied to one side of the glass. The coating is generally made of silver, aluminium, gold or chrome.

For simple mirrored glass, a fully reflective metal coating is applied and then sealed with a protective paint layer and is available in several tints. It can also include a plastic backing for safety.

To produce "one-way" mirrors, a much thinner metal coating is used, with no additional sealing or otherwise opaque layer. This type of mirror relies on lighting conditions to be effective.

## Patterned Glass (often called figured or obscure glass)

Patterned glass is flat glass whose surfaces display a regular pattern. The most common method for producing patterned glass is to pass heated glass (usually just after it exits the furnace where it is made) between rollers whose surfaces contain the negative relief of the desired pattern(s). Patterned glass can be produced as toughened or laminated safety glass.

Patterned glass is mostly used in internal decoration and internal architecture. Today, it is typically used for functional reasons, where light but not transparency is desired, and the patterns are accordingly subtle. However, it has also at times been fashionable as a design feature in itself, in such cases often displaying more prominent patterns.

Slump glass or kiln formed patterned glass is gaining more prominence in to-day's architecture and is made by heating glass to be shaped over a mould and may be available as a toughened safety glass.

## Self Cleaning Glass

Used for exteriors. The glass incorporates a pyrolytic coating that dissolves dirt (photo active) and sheds water (hydrophilic) using natural UV light and rain.

## Fire Rated Glass

Glass that can withstand the infiltration of flames and/or smoke for a period of time. There are a number of different types and make up combinations to suit varying degrees of protection required.