Introduction to Glass

Saint-Gobain’s introduction to glazing know-how

Glass has existed for more than 5500 years since its discovery during early civilizations. The term “glass” was not used until the Roman empire who developed and perfected the technics of glass-making. Since Saint-Gobain’s creation in 1665, then known for the famous Hall of Mirrors at Louis XIV’s Versailles Palace, we have improved glass composition, in order to respond to different market needs.

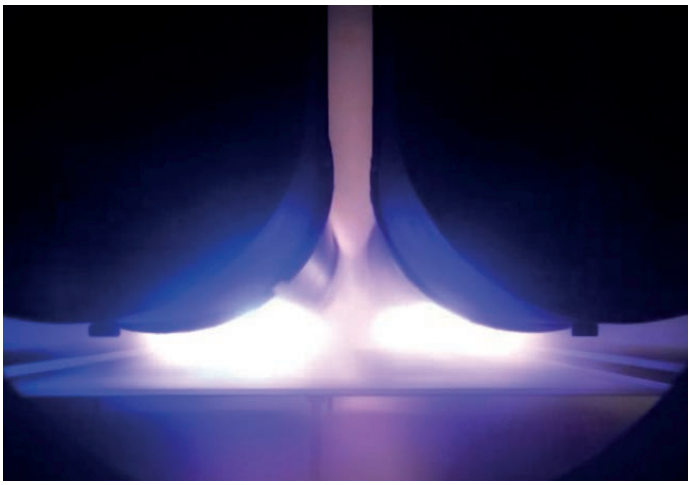
Today, we wish to share our knowledge with you.

Float glass

The flat glass used for Building and Automotive (Transport) applications is made thanks to a process called float glass.

It consists to melt raw materials: Silica, Lime, Soda, Oxide/aluminia/magnesia and nowadays recycling glass (cullet) at a very high temperature from 1000° to 2000°. Then, the glass is poured onto a tin bath. The glass, less dense than tin, "floats" on it and forms a ribbon.

The glass obtained is perfectly flat with a regular thickness, the glass ribbon is cut in large panes of 6 000 × 3 210 mm ready to be transformed by our Transport plant.



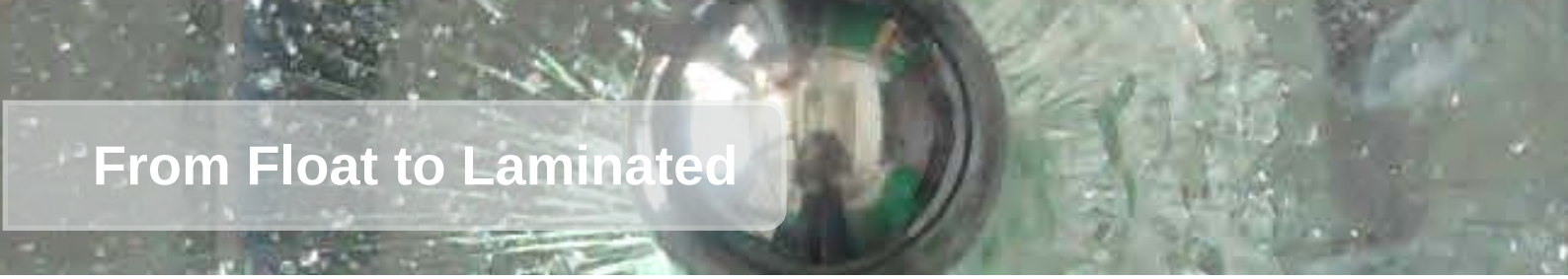
Coating process

Saint-Gobain develops in-house coatings to add functionalities on glass-like heating, Solar control, antireflection ...

The coated glass is obtained by Magnetron process: the glass is coated with nanometriclayers: an ionized gas is projected onto blocks of targeted raw material tearing off its molecules, which are deposited on the glass.

There is 2 kinds of coating :

Soft coat Ag-based to be protected as it can corrode (insulated glass for example)
Hard coats like Comfortsky & Reflexcontrol to be in contact with passengers.
These coatings are thin film(nm), invisible.



From Float to Laminated

Laminated Glass

Laminated glass was discovered in 1909 by French chemist Edouard Benedictus. It consists of two glass panes bonded together by an interlayer: PVB (Polybutyral de vinyl). In the event of breaking, the glass fragments are held in place by the interlayer.

Where to be placed on the vehicle?

Since the 1980 's the regulation requested that on-road vehicle's windshield has to be laminated. The regulation has evolved and some driver doors or side windows are allowed in laminated glass mainly for truck and rail vehicles.

The main benefits of laminated glass are

Safety and security
Repairable in case of crack (not in the driver area)
UV filter
Strong stress resistance
Ideal to add optical functions, thermal and acoustic insulation

From Float to Tempered

Tempered or Toughened glass

Is a safety glass processed by a controlled thermal treatment to increase its strength compared to normal glass (6 times more). After the thermal process, the outer surfaces are in compression, and the inner surfaces are into tension. In addition, this reduces the risk of injury because glass breaks into small, circular pieces instead of sharp, jagged shards.

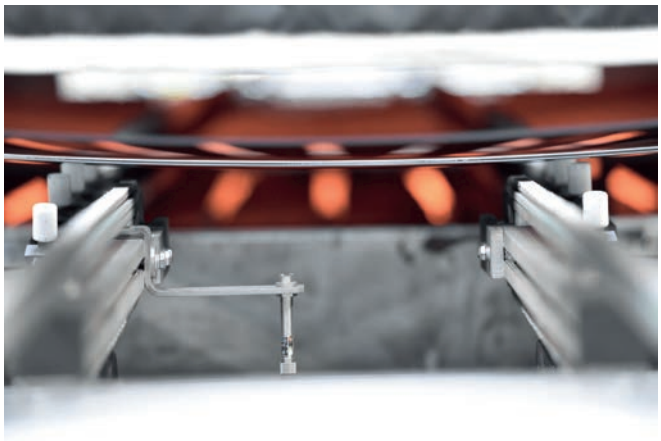
Where to be placed on the vehicle?

Tempered glass is used in every transport and off road vehicles, mainly for doors, side and driver windows, roof and backlight.

We supply zone tempered windshield as well for the agricultural market.

The main benefits of tempered glass are

tougher than ordinary glass
heat resistance
scratch resistant
easy to clean



Chemical Reinforcement

Chemical reinforcement is a technology that consists to strengthen the glass by a chemical process. Then the glass has to be laminated for final use.

How does it work? The glass is immersed in salt fusion baths, above 400° C, chemical exchange occurs between the KNO and Na NO salts. K+ takes the place of the smaller Na+, thus compressing the exterior faces of the glass, making it more resistant to mechanical stress or temperature differences between the edges and center of the glass.

Insulated Glass

Insulated glass (Double Glass Units)

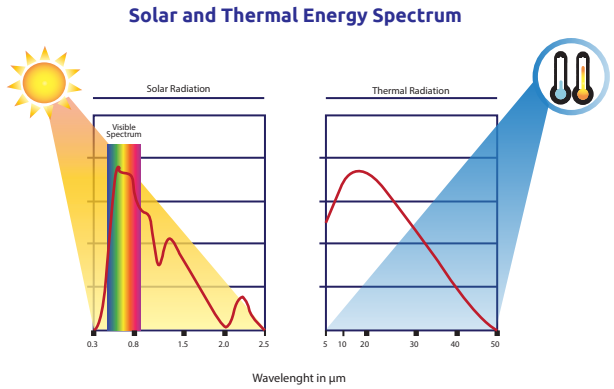
It consists of 2 sheets of glass separated by an air (or gas) gap and assembled together by a peripheral spacer to assure an optimal thermal and acoustic insulation.

Glazing Properties

Some basics about glass

Glazing is a unique material thanks to its incredible intrinsic properties :

Optical transparency (refractive index:1,5)
Mechanical resistance: heat, pressure, breakage and chemicals
Recyclable
Thermal insulation



Solar and Thermal Energy Behavior on Glass

Glass is well known for being transparent in the visible range (Visible Light:380 – 750 nm) of the electromagnetic spectrum (see picture on the left). However, its natural transparency continues with the longer wavelengths in the Infra-Red (IR) range (up to 2500 nm), allowing the transmission of a large part of the energy coming from the sun.

Not only the sun emits energy, every body emits some energy proportionally to its temperature (T) and its emissivity (ε) according to the Stefan-Boltzman law (E=εσT4). For objects and people at about room temperature this energy is radiated at a wavelength of about 10 microns (see picture on the right).

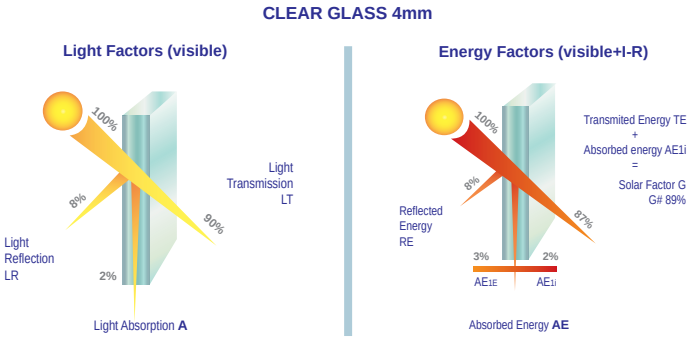
Glass and Solar Radiation

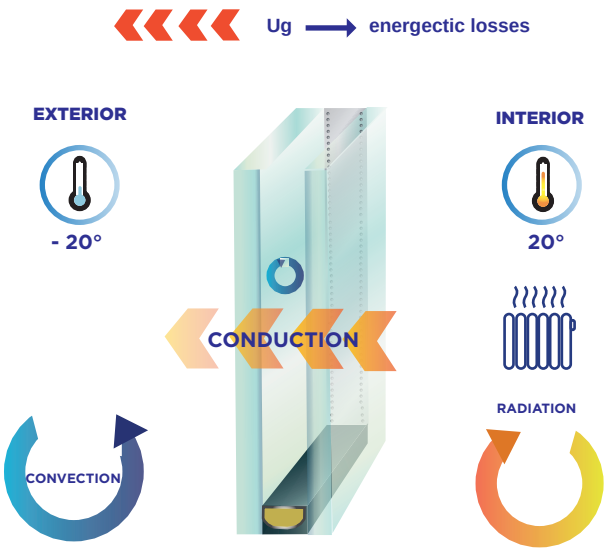
How to compare glazing efficiency against heat?

The best way to compare solar glazing efficency is to use the Solar factor G.

The Solar Factor G (ISO 9050) or Total Energy Transmittance is the % of total solar radiant heat energy transmitted into the vehicle through glass. So it takes into account both Transmitted Energy(TE) and Absorbed Energy (AE1) re-emitted by the glass absorption into the vehicle.

We have developed solar control glass to improve thermal comfort through the absorption or reflection of solar energy.





Glass Thermal Exchange

How to compare the insulation of a glass?

The amount of heat transferred through the glass pane is due to the difference of temperature between inside and outside.To compare the insulation of a glazing, we use the Ug factor : it is the heat loss through a glass measured in units of W/m2K The lower the Ug-value, the lower the heat loss! and the more the glass is insulated.The heat exchanged through a surface is made by conduction, convection and radiation.

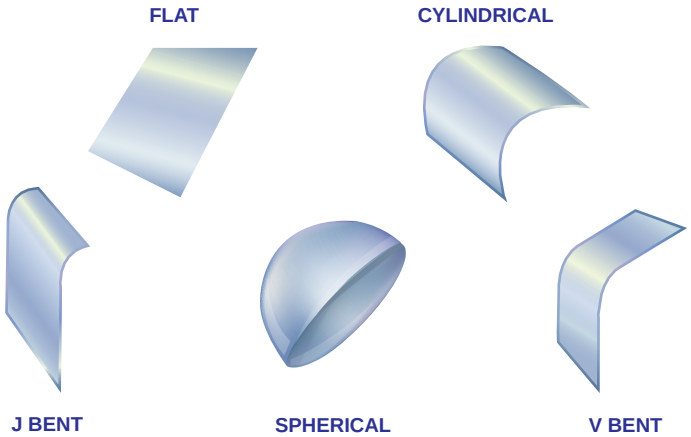
To reduce heat loss by convection and conduction, we increase the air gap and or replace the air in the unit cavity with a gas with lower thermal conductivity. To reduce heat loss by radiation we use glass with a low-emissivity or low-E coating.

Bending Abilities

Saint-Gobain Sekurit Transport has the capability to transform glazing on different bending shape and radii range.

The feasibility of each project must be carefully check as the glass surface, thickness have an impact on mechanical resistance .

We are also experts in cutting, drilling to assure cut outs, holes in glass.



Norms

Norms

The norms governing Transport vehicle glass are becoming ever stricter and more demanding.
For several years now, we benefited from our own test installations that are accredited.These tests and controls are carried out in accordance with established European and International norms and operators specifications .
Every Sekurit Transport plants are Iso certified and IRIS for rail .

- (AU) AS NSZ 2080
- (BE) L47/L48
- (BR) IMMETRO
- (CN) TB T1451 / CCE
- (DE) BN TL 918511
- (EU) EN15152 / UIC 651-566 / TSI ECE R43
- (FR) NFF15-818/NFF31-129/NFF31-250 / NFF31-314 / NFF01-492
- (IN) IS 2553
- (JP) JIS R 3213
- (KR) KSL 2004
- (RU) GOST 5727
- (SE) TB20/100
- (UK) GMRT 2100
- (USA) ANZI FRA

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