EXTRALUM

Technical Bulletin.

Float Glass Overview

Introduction.

Float glass is a sheet of glass made by floating molten glass in a pool of molten tin. This method provides glass with a uniform thickness and a very flat surface, making it the most widely used kind of glass in construction. It is also called flat glass, however, not all flat glass is made using the float system.

Glass is made using some of earth's most abundant raw materials, such as silica sand, limestone, soda ash, dolomite and glass cullet.

The float glass manufacturing process is the most common flat glass production method in the world.

The float glass manufacturing process method had been an industrial revolution in this sector. This method was developed by the Pilkington company in 1959 and today, practically all the glass used in construction is manufactured by float process.

It is called float because the manufacturing process that consists of melting the vitreous component in a melting furnace and then passing it to a chamber in which there is a molten tin bath, so that the glass floats on it, spreads and moves horizontally. When leaving the chamber, it goes through an annealing furnace and, finally, it is cut.

Composition.

Base glass, also called soda-lime glass, is made up of:

- Silica (SiO2), 69% to 74%
- Sodium Oxide (Na2O), 12% to 16%
- Calcium oxide (CaO), stabilizer from 5% to 12%
- Magnesium oxide (MgO) up to 6%
- Aluminum oxide (Al2O3) up to 3%

In addition to these components, flat glass can also contain small amounts of other substances.

Mechanical Properties.

Over time, glass can be subjected to different types of mechanical stress: traction, compression, torsion, impact and penetration.
The behavior of glass under these stresses depends on several factors, among which are the stiffness of the bonds between molecules and, mainly, the state of its surface.

- **Compression resistance : 800 - 1000 MPa**

The compression strength defines the ability of a material to resist a load applied vertically to its Surface.

- **Modulus of elasticity : 70 000 MPa**

The modulus of elasticity is either determined from the elastic elongation of a thin bar, or from bending a bar with a round or rectangular cross section.

- **Bending strength : 45 MPa**

The bending strength of a material is a measure of its resistance during deflection. It is determined by bending tests on glass plate using the double ring method according to DIN EN 1288-5. The main characteristics of glass are transparency, heat resistance, pressure and breakage resistance and chemical resistance.

- **Density : 2500 kg/m3**

A 4mm thick pane of glass weighs 10kg/m2.

- **Hardness : 470 HK**

The hardness of float glass is established according to Knoop. The basis is the test method given in DIN 52333 (ISO 9385).

Acoustic Properties.

Float glass does not have acoustic reduction capacity on its own, it occurs when processes are added to it and will depend on the rest of the building elements contained in the room.
The sound attenuation of any material depends on its mass, stiffness and damping characteristics. With a single glass pane the only effective way to increase its performance is to increase the thickness, because stiffness and damping cannot be changed. The sound transmission loss for a single glass pane, measured over a range of frequencies, varies depending on glass thickness.

Thicker glass tends to provide greater sound reduction even though it may transmit more sound at specific frequencies.

Optical Properties.

The following parameters are used to describe the optical behavior of a float glass:

Refractive Index

When a beam of light hits a glass surface, part of the beam is reflected, and part is transmitted.

Absorption

When light travels through a glass, the intensity of the light is typically reduced. This value depends on the composition and thickness of the glass as well as the wavelength of incident light.

Transmission/Transmittance

Any light that is not absorbed by a glass or reflected at its surface will be transmitted through the glass. It is often very important to know exactly how much light will pass through a glass at specified wavelengths. Often, glasses are discussed in terms of their transmittance or transmission. The same information is provided by both of these terms, but transmission is reported with ranges from 0 % to 100 % and transmittance from 0 to 1.

Types of Float Glass

The **clear float glass offers** high visible light transmission. Clear glass absorbs a very low percentage of solar energy and, at the same time, allows more natural light to enter.

Extra clear float glass is characterized by a low content of iron oxides, which gives it a higher light transmission than normal float glass.

Tinted float glass is produced by adding a colorant during float glass production. In addition to its aesthetic function, stained glass is designed to reduce sun heat input and glare, which, from a human point of view, increases the level of comfort and reduces the cost of cooling (air conditioning). Color is characterized by greater absorption of solar heat.

Reflective glass absorbs and reflects a higher proportion of solar energy more efficiently than colored glass. The mirror appearance of reflective glass is achieved by applying a metallic coating during or after the glass manufacturing process.

There are two types of coated glass, hard coat (pyrolytic) and soft coat.

- **PYROLYTIC** - a metallic layer is applied by pyrolysis during the manufacturing process. The advantage of this product is its resistance. It can be handled like a standard glass.
- **Soft Coat** - The term soft coat is because the reflective layer is more susceptible to damage from contact with other surfaces.

Modern solar control glass reduces unwanted solar energy input while allowing maximum light transmission for virtually any application.

This technology incorporates invisible layers of special materials that produce a double effect: they allow sunlight to pass through the glass and the heat source is reflected to the outside. In other words, on a hot day the glass will reflect part of the heat to keep the room at the internal temperature, and on a cold day the heat will remain inside the room.

THE HEAT WILL BE REFLECTED TO THE SOURCE OF ORIGIN

Solar control glass units are usually provided with double glazing and therefore act as thermal insulation.

Float Glass Transformations.

Float glass can improve its performance by adding strength, thermal reduction and other characteristics, with the addition of specific processes as required. Some of those processes are:

FUERTEX® Safety Tempered Glass

Tempered (thermal process) on a glass provides greater resistance to impacts, deflections and load capacity of up to 7 times more than normal float glass.

VILAX® Laminated Security Glass

It consists of the union of several sheets of glass by means of an intermediate film of polyvinyl butyral (PVB). This interlayer gives the glass additional security against breakage, since the pieces of glass are attached to it. Anti-theft and bulletproof glass belong to this type of glass.

Insulated Glass Unit (IGU)

Composed of two glasses, separated from each other by an air chamber that gives it the capacity of thermal insulation, offers a series of advantages, among which the reduction of up to 70% in air conditioning energy consumption stands out.

Impact resistance.

Normal Float Glass.

Normal float glass does not withstand great stress due to the impact of an object. When broken, it breaks into large, sharp pieces

Thermal Break.

Glass that has not been heat treated (tempered or heat strengthened) may experience thermal breakage. This risk is greater when the central area of the glass is heated more than the edges. The degree to which the central area of the glass is heated depends on the solar absorption of the glass.

The risk of thermal breakage is also influenced by the conditions of the glass edges and the type of frame:

- Glass with polished edges have the highest resistance.
- Glasses that have not been heat treated and damaged edges due to improper handling or installation have a high risk of thermal breakage.

The optimum thermal resistance condition is: Heat treated glass with polished have the highest resistance.

Risk Control.

Normal float glass, that is, without any additional process, does not offer any protection or risk control against vandalism or accidents.
Therefore, it is recommended to consider safer options, such as Fuertex® or Vilax® glass, depending on the application.

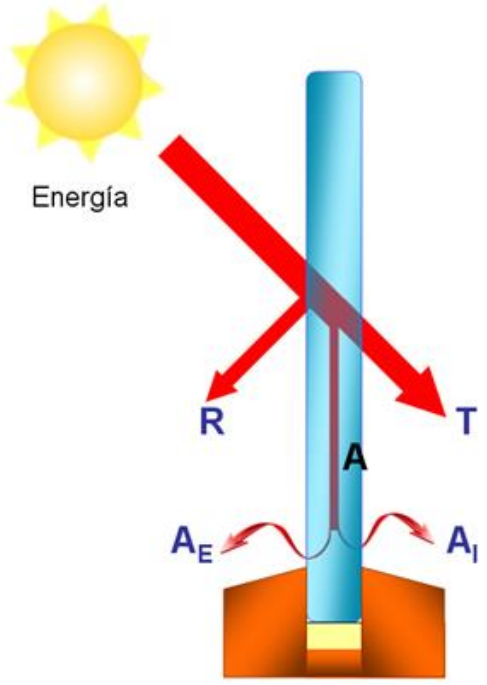
Some very important considerations before choosing the right safety glass are:

- Use FUERTEX® tempered glass if greater impact resistance and less risk of cuts or injuries are required
- Use VILAX® laminated glass if less risk of cut is required and greater difficulty to pass through the glass, for security reasons (such as on car windshields, railings, ceilings, etc.), or to make it difficult to enter the room (anti-theft device).

Solar Control Performance Data.

The data that can be used when comparing the performance of solar control glasses are:

- **Solar Heat Gain Coefficient (SHGC):** is the fraction of solar radiation admitted through the glass -- either transmitted directly and/or absorbed, and subsequently released as heat inside a home. The lower the SHGC, the less solar heat it transmits and the greater its shading ability.



SHGC = T + AI

- **Shading coefficient (SC):** is an alternative measure of the heat gain through glass from solar radiation. SC is an older term being replaced by solar heat gain coefficient (SHGC). A lower shading coefficient indicates lower solar heat gain. For reference, 1/8" (3.1 mm) clear glass has a value of 1.00.

Selection criteria.

Glass selection is not always an easy task. Even when the primary objective is solar control, there are other basic selection criteria that must be considered to achieve the best application.

- Orientation of the facade. This will determine the amount of solar radiation to which the glass will be exposed.
- Natural elements of shade, such as trees that can reduce direct sunlight on the glass.
- Taking advantage of natural light. Some solar control glasses reduce heat input but also significantly reduce visible light input.
- Security requirements.
- Reference frame of the facade. Determined by an urban environment where horizontal and vertical straight lines prevail or by a rural environment with predominance of the landscape.

Glass is nowadays a used and versatile construction material, which must be chosen responsibly considering the information previously exposed. Extralum offers many options that are tailored to the needs of each job and that are durable and efficient combined with proper installation and continuous maintenance.