

TEMPERED GLASS





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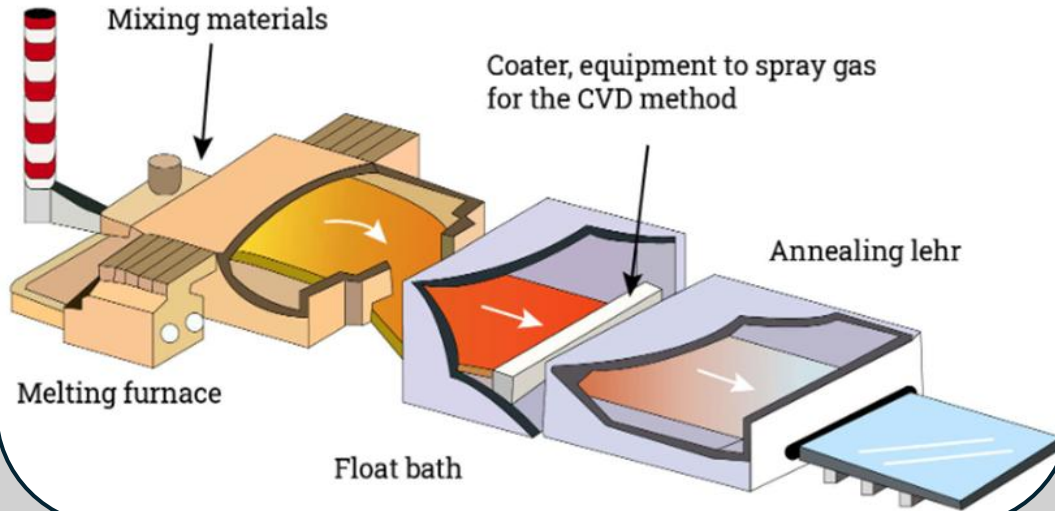
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Glass and Strength

The Glass Production Process



In the glass production line different processes considered to increase the strength and durability of the glass:

Annealing

The term "anneal" is mainly used to describe the glass-cooling process conducted at a fabricator's float plant. The glass is heated to the temperature of its stress relief point (annealing point) and then is slowly cooled down to the room temperature in a temperature- controlled kiln called annealing lehr.

Annealing process improves the glass' durability and helps to reduce internal stresses that could result in breakage. Annealed glass may also be referred to as non-tempered and/or float glass.

This type of glass can be edged and polished, custom-cut and drilled to create an array of products, including windows and cabinet doors. Glass improperly annealed, however, can crack or shatter.

Glass and Strength

Chemical Strengthening

In this process the soda-lime in glass is toughened through a sodium and potassium ion-exchange process in a salt bath. It is best suited for thin display applications (under 3mm) where optical distortions must be kept minimum. The process imparts a higher strength, durability, and MOR (Modulus of Rupture, which is resistance to breaking in bending) as well as maintaining higher surface quality .

Heat Strengthening (Tempering)

In this process the annealed glass goes through a furnace increasing its temperature up to 650-700 deg C then rapidly cooled down (quenching). This process leaves the outer surface of glass in a state of compression and the interior in a state of tension . The heat strengthening process is utilized when a full temper is not possible due to thickness, size, or low thermal expansion rate of the substrate. With heat-strengthened glass, the cooling process is slower which means the compression strength is lower. In the end, heat-strengthened glass is approximately twice as strong as annealed glass. For heat-strengthened glass, the requirement is a surface compression of 3,500 to 7,500 psi with no requirement for edge compression.



The Tempered Glass



Annealed glass
Breaks easily, typically in long, sharp shards



Heat-strengthened glass
Resistant to breakage; two times as strong as annealed glass;
Breaks in large shards

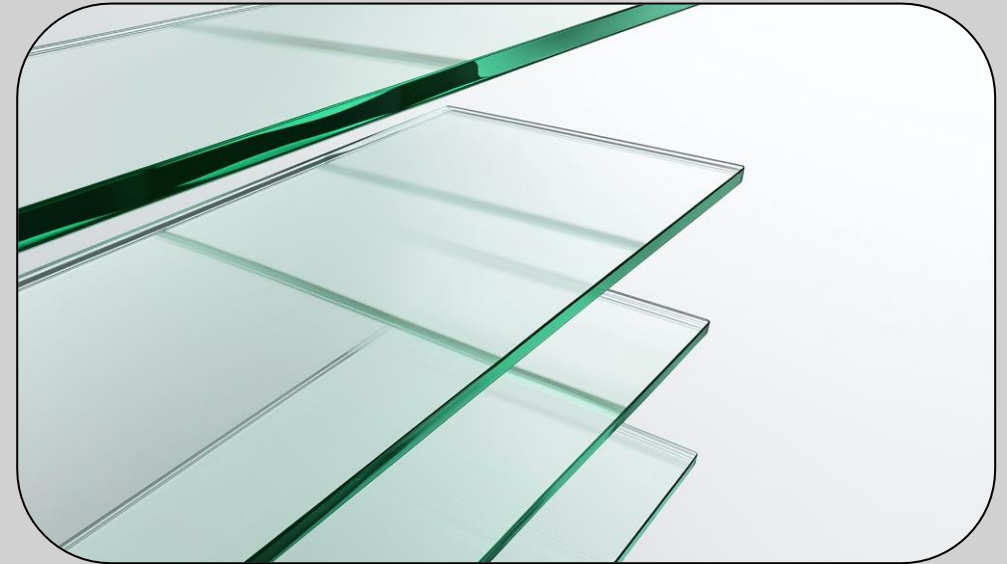
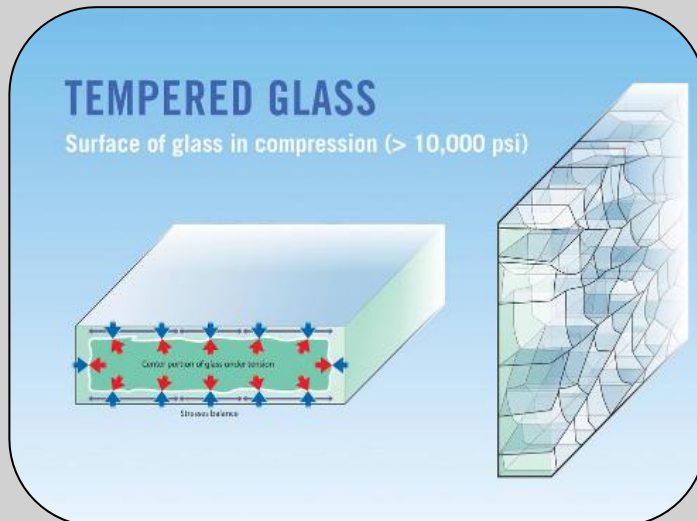


Fully tempered glass
Resistant to breakage; four times as strong as annealed glass;
shatters completely in small pieces, typically vacating the frame after impact

The same process of heat strengthening is applied for fully tempered or toughened glass. With tempered glass, the cooling process is accelerated to create higher surface compression (the dimension of force or energy per unit area) and/or edge compression in the glass. It is the air-quench temperature, volume, and other variables that create a surface compression of at least 10,000 pounds per square inch (psi). This is the process that makes the glass four to five times stronger and safer than annealed or untreated glass. Due to these mechanical stresses, tempered glass breaks into pebbles instead of shards with sharp edges, reducing the chance of injury.

Features

- **Strength:** 5x harder than ordinary float glass
- **Temperature tolerance:** It withstands abrupt temperature changes up to 220 centigrade degree.
- **Versatility:** Sizes are produced per costumer request before tempering process. Once tempered the glass cannot be cut down.
- **Safety:** If it breaks , the glass disintegrates into small pebbles instead of shards with sharp edges which greatly reduces the risk of injury.
- **Optical distortion :** The appearance, thickness deviation and transmittance are almost identical with ordinary annealed glass.



Applications



Also known as “safety glass”, tempered glass is often used in car windows, shower doors, glass tables, and other installations where increased safety standards are necessary. While the manufacturing process does make tempered glass more resistant to force, it is not shatterproof glass or unbreakable in any way. For this reason, it shouldn’t be used to prevent intruders, but it will stand up to more force than regular glass.

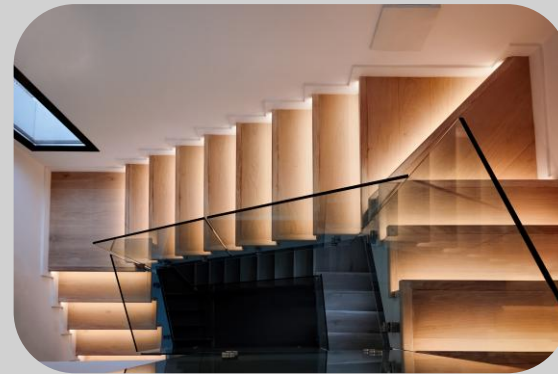
The tempering process also makes tempered glass more resistant to damage from higher temperatures. That’s why you may see tempered glass used in situations where high temperatures are likely to cause glass to break like in fireplace doors or kitchen appliances.

External & Internal use



External & Internal Use in Residential Spaces

In modern homes, glass is a key element in **enhancing aesthetics and functionality**. Tempered or heat-strengthened glass is often preferred for its safety and durability. Some common residential applications include:



- Shower Doors:** Tempered glass is used for shower enclosures to prevent breakage and reduce injury risks.
- Stair Railings:** Glass stair railings add a sleek, modern touch while maintaining safety and structural integrity.
- Fence Walls:** Glass fencing offers an unobstructed view, commonly used for pool enclosures and exterior barriers.
- Sliding Doors:** Glass sliding doors maximize natural light while providing a seamless transition between indoor and outdoor spaces.

External & Internal use

Commercial Usage

In commercial settings, glass plays an essential role in creating **spacious, well-lit, and visually appealing environments**. Some common applications include:

- Glass Facades:** Heat-strengthened or laminated glass is used in building exteriors to improve energy efficiency and aesthetics.
- Glass Doors:** Commercial doors made from tempered glass provide durability and safety while allowing visibility.
- Walls and Windows:** Large glass panels help create open and bright commercial interiors while maintaining insulation properties.
- Partitioning:** Glass partitions are widely used in offices to create private spaces while maintaining openness and natural light flow.



Glass Door & Store Front



Glass doors and storefronts are **crucial in retail and commercial buildings**, providing an elegant and professional look while ensuring safety. **Tempered glass** is commonly used for storefronts due to its **high strength, resistance to impact, and safety properties**.



It also withstands **temperature fluctuations**, making it ideal for different climate conditions.

Whether for residential, commercial, or retail applications, the right type of glass enhances **functionality, aesthetics, and safety**, making it an integral part of modern architecture.

TEMPERED GLASS OPTIONS

Tempered Low-E Float

Item	Thickness (mm)	Description	Performance data		Dimension
			VL	SHGC	
1	3.2	hard-coated	83%	0.74	custom-sized
2	4	hard-coated	83%	0.72	custom-sized
3	5	hard-coated	82%	0.70	custom-sized
4	6	hard-coated	82%	0.69	custom-sized

Tempered Clear Float

Item	Thickness (mm)	Dimension
1	3	custom-sized
2	4	custom-sized
3	5	custom-sized
4	6	custom-sized
5	8	custom-sized
6	10	custom-sized

Things to remember

While tempered glass is safer than conventional glass it can still break. Due to the balanced mechanical stress in the glass, any damage will cause the glass to shatter. Regardless of its high strength, tempered glass can break when exposed to certain conditions and it is especially vulnerable to damage along the edges. However, a concentrated impact with enough strength in the middle of the glass can also cause shattering.





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