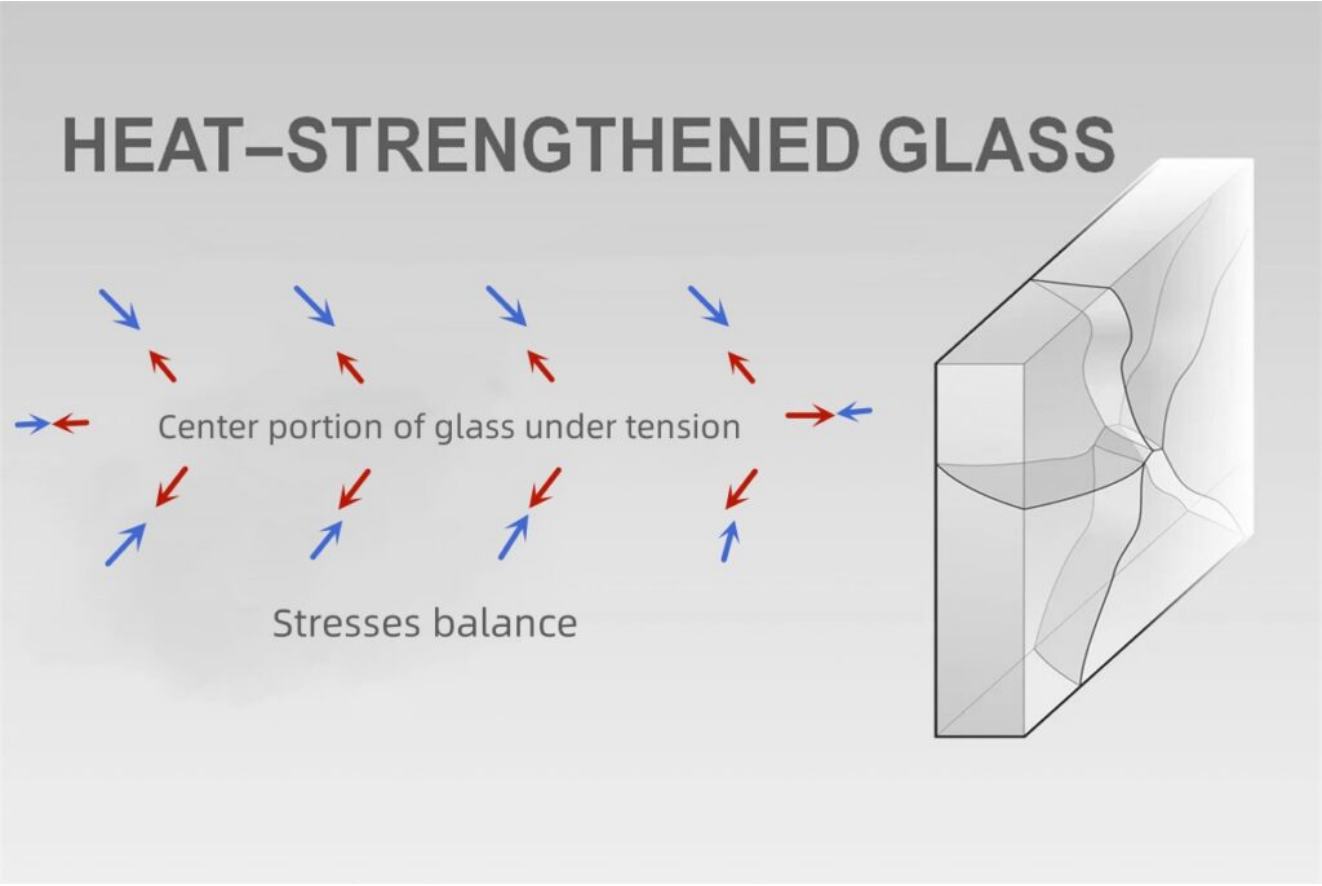
2024 Guide Book – Heat Strengthened Glass vs Toughened Glass, Which One is Better?

Heat strengthened glass vs toughened glass, which one to choose?

This has always been a topic of much debate. In reality, the main difference lies in their respective applications, so it’s not entirely accurate to say one is better or more recommended than the other.

We need to know as following

1- What is heat strengthened glass vs toughened glass?



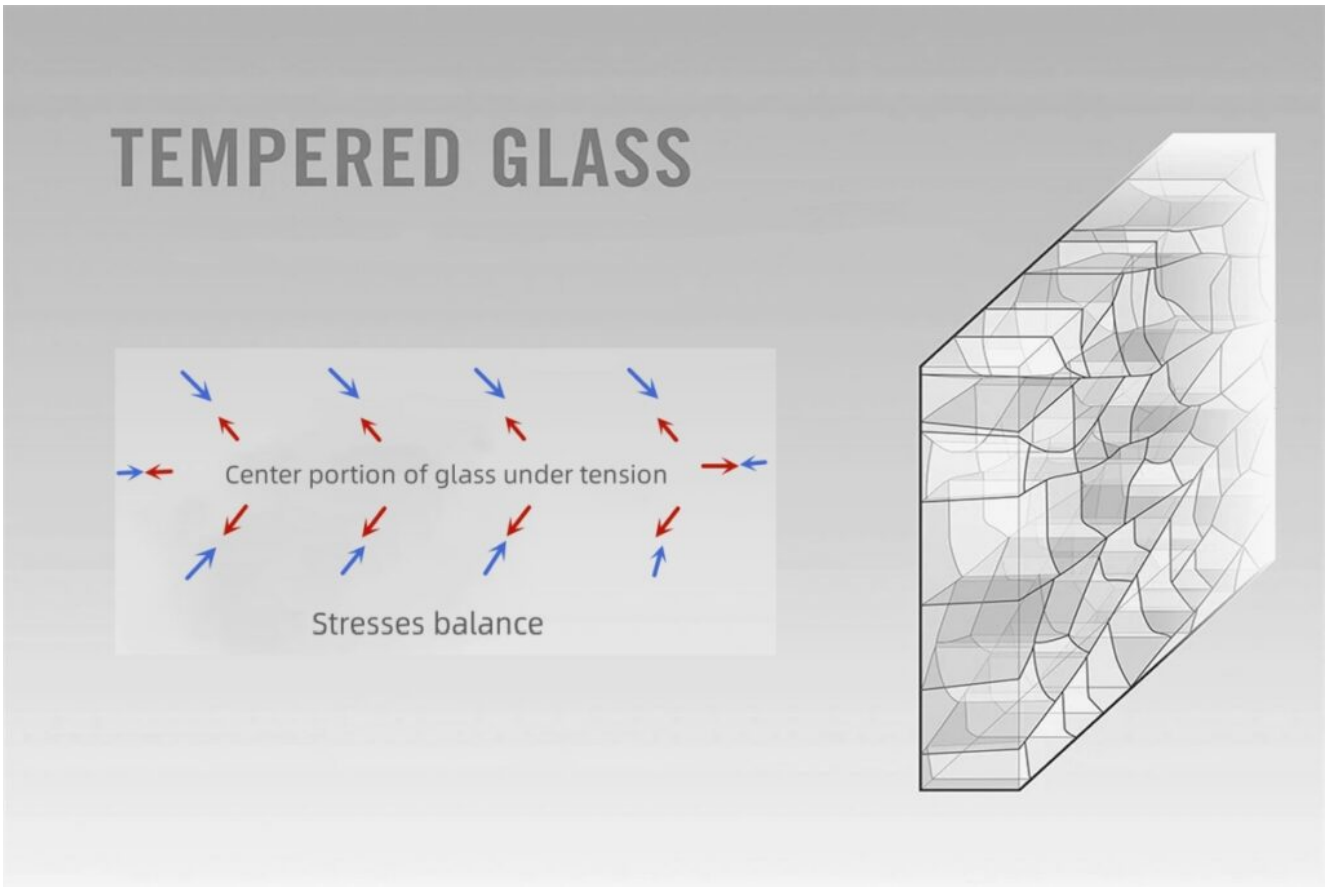
Heat strengthened glass

Heat strengthened glass, also known as semi tempered glass or TVG, is a variety that lies between annealed glass and fully tempered glass. It combines some advantages of tempered glass,

such as being stronger than ordinary float glass, with strength approximately twice that of annealed glass.

At the same time, it avoids some of the less desirable characteristics of tempered glass, such as poor flatness, susceptibility to spontaneous breakage, and shattering into small pieces upon breakage.

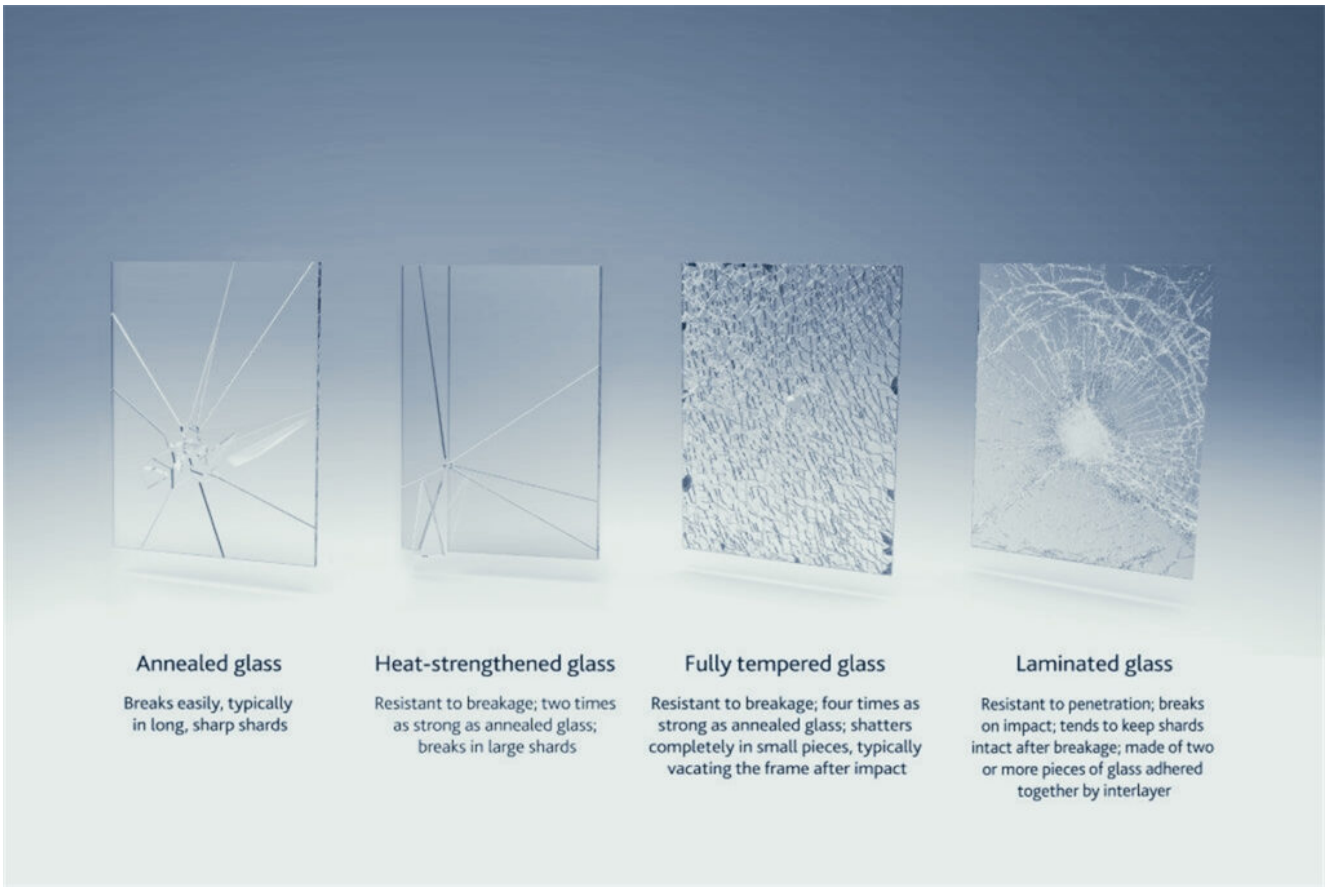
When semi-tempered glass breaks, it radiates cracks from the source of the fracture without significant tangential crack propagation, so it generally remains intact without collapsing after breaking.



Toughened glass

Tempered glass is annealed glass that has undergone a process of heating and rapid cooling, resulting in the formation of strong compressive stresses on its surface, which significantly increases its mechanical strength. This is what is referred to as tempered glass.

Its strength is **4-5 times** more than that of float glass. Tempered glass also has good thermal stability, with the ability to withstand temperature differences of approximately 180°C after tempering. However, the disadvantages of tempered glass include a tendency to spontaneously shatter and reduced flatness.



The comparison of different glass types

2- More Difference?

TVG glass – Heat-strengthened glass

Monolithic semi-tempered glass (heat-strengthened glass, HS glass) does not qualify as safety glass because, when it breaks, it forms large shards and radial cracks. Although most fragments do not have sharp edges, they can still cause injury. Therefore, it should not be used for skylights or in situations where there is a risk of human impact.

TVG glass is annealed glass that has been subjected to high temperatures and rapid cooling, resulting in a surface compressive stress of less than **69 MPa**. This process significantly increases the mechanical strength of the glass, making it semi-tempered glass.

ESG glass – Fully tempered glass

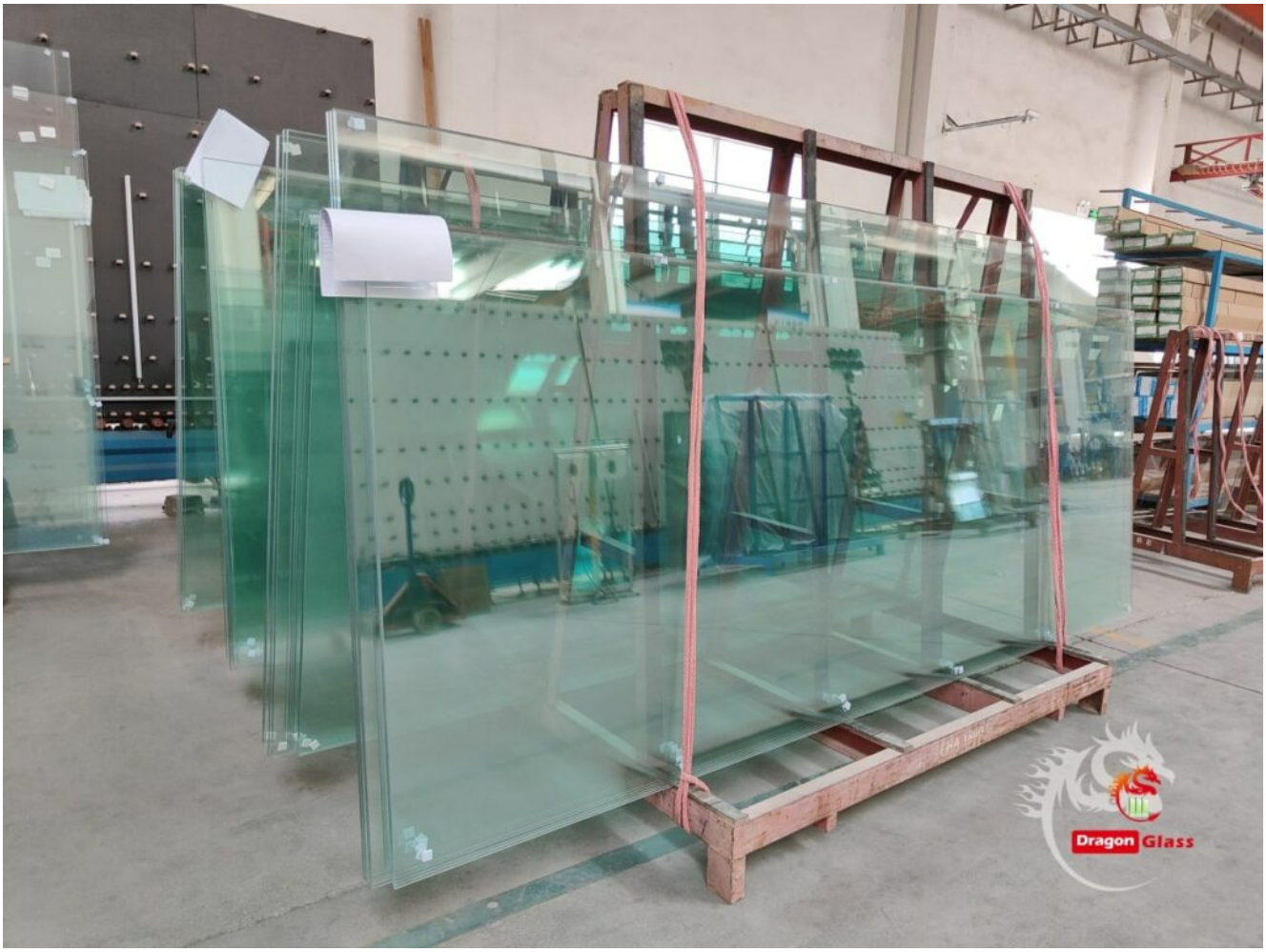
Fully tempered glass qualifies as safety glass because, when it breaks, it shatters into small, blunt-edged pieces that are unlikely to cause significant injury. This provides a certain degree of protection for users and during project installations.

The surface stress of tempered glass ranges from **69 to 168 MPa**. Its characteristics include breaking into small, blunt fragments upon shattering, which minimizes the risk of serious injury to humans.

3- Characteristics of heat strengthened glass and toughened glass

Fully tempered glass

- It offers higher thermal and mechanical strength compared to annealed or heat-strengthened glass.
- The mechanical and thermal strength is approximately 4 times that of annealed glass.
- Tempered glass retains the normal characteristics of annealed glass, including chemical resistance, hardness, expansion, and deflection. However, it does not retain the normal strength and fracture characteristics.
- Due to inclusions or tiny impurities in the glass (such as nickel sulfide), or if the edges are mechanically processed after tempering, the glass may be prone to **spontaneous breakage**.



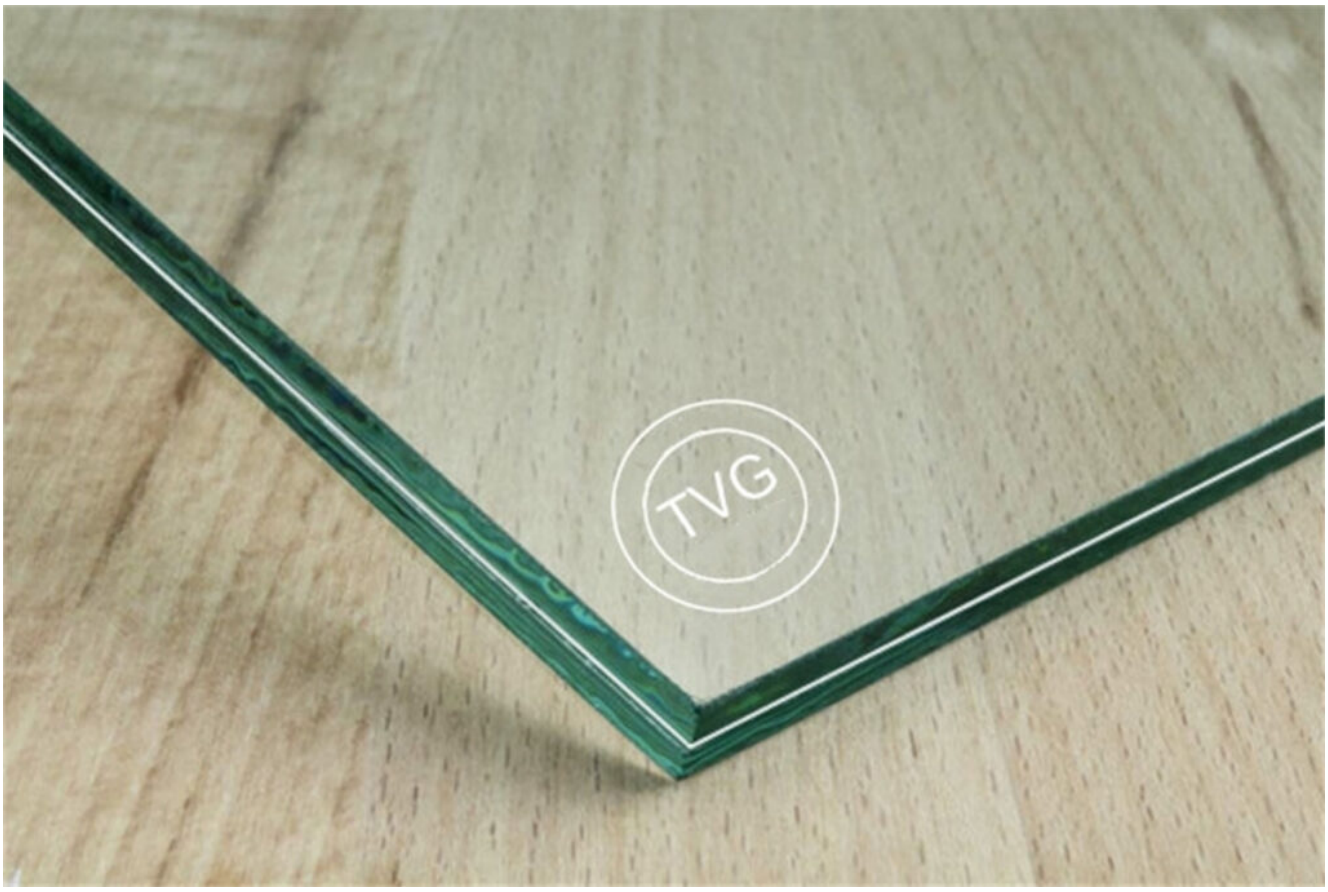
Tempered glass delivery in Dragon Glass workshop

Semi tempered glass

- Compared to annealed glass, it has **higher mechanical and thermal strength** while maintaining all other normal characteristics associated with the specific glass substrate (chemical resistance, hardness, expansion, and deflection). Its thermal and mechanical strength is twice that of annealed glass of the same thickness.
- It exhibits a **large fragment breakage** pattern similar to that of annealed glass. The shape and size of the fragments depend on the applied load, the point of

fracture, the temperature of the glass, and other factors.

- Spontaneous breakage due to mechanical processing or other edge treatments is rare.



HS laminated glass

4-Standards for heat strengthened glass vs toughened glass

The production in Dragon Glass is very strict, we always follow the below standards in our glass processing to ensure

quality and fast delivery:

- **ASTM C1048**
- **CE- EN12150**
- **SGCC- ANSI Z97.1**
- **AS/NZS 2208:1996**

Certificate for tempered glass and heat strengthened glass

5-Applications for heat strengthened glass vs toughened glass

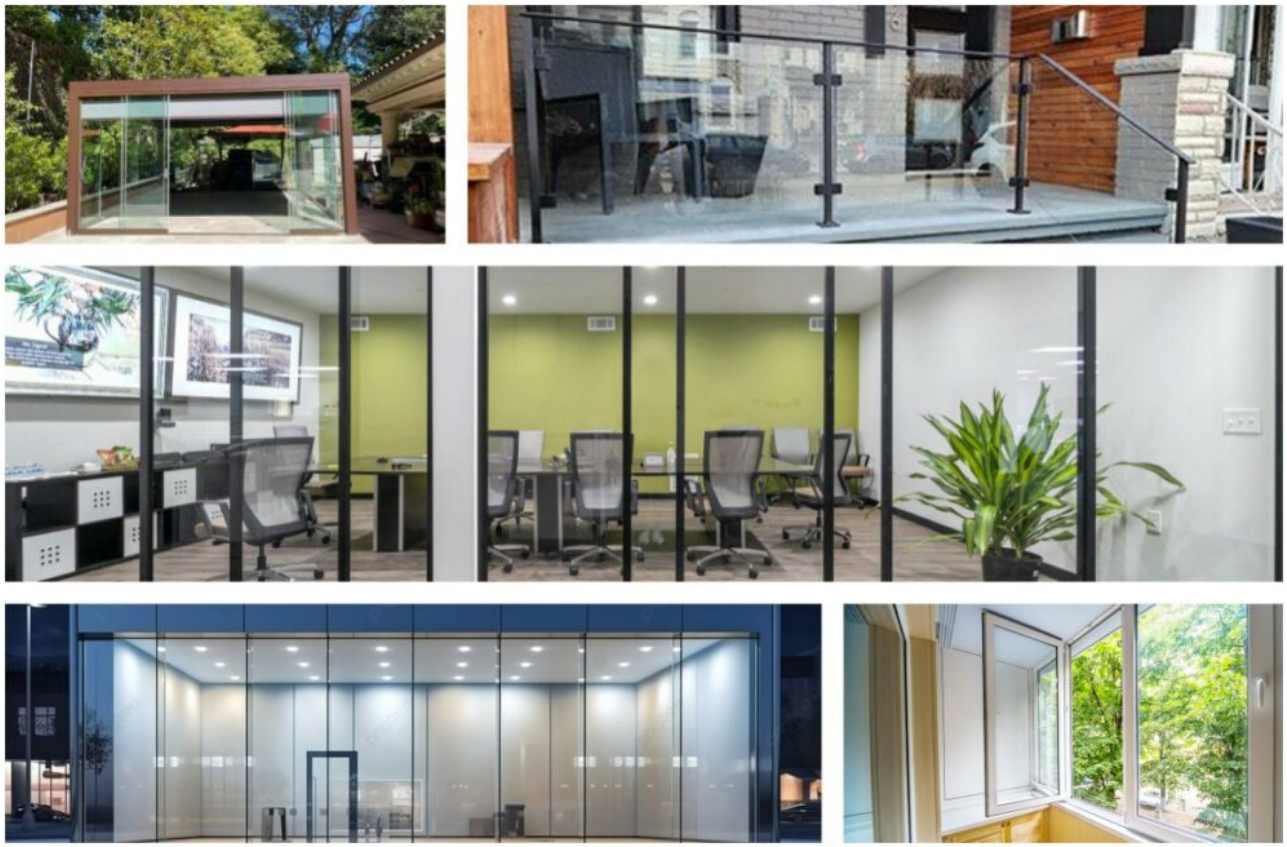
Heat strengthened glass

The heat strengthened glass can not be used for monolithic, which is often combined with laminated glass or IGU, because it’s not safety glass, and easily hurts the user, this kind of glass is widely used in canopies, skylights, roofs, curtain wall systems because they have a good anti-impact performance and remove the self explosion, the most important is save the budget.

Applications for TVG VSG glass, TVG IGU glass

Fully tempered glass

Fully tempered glass can be monolithic, because its safety glass, which is widely used for different projects, can cover the semi tempered glass, such as railings, facades, partition walls, doors, and windows.



Applications for fully tempered glass, ESG glass

In conclusions

Whether you choose semi-tempered glass or fully tempered glass depends on the specifics of your project and order, as different projects, budgets, and ideas are constantly changing.

Dragon Glass, as a professional glass factory, recommends that you communicate with us or discuss with your designer which type of glass is suitable for you.

Of course, if you have any technical or installation questions regarding glass, you can also contact us at any time. Our professional team will provide you with prompt feedback to ensure your satisfaction.

Call or email us now!