

Laminated and Tempered Glass

Overview

Safety Glass is a generic term often used to describe glass that is stronger than standard glass, and which will not fracture into loose, sharp shards. For most new construction and renovation projects, tempered and laminated glass is used when these characteristics are required.

The use of glass is increasing in building interiors to introduce daylight deeper into a floor plate, provide views and visual connectivity, and to create sense of openness. If selected and detailed properly, tempered and laminated glass can achieve these goals without sacrificing safety, security, acoustical separation and other important design requirements.

Building codes, fire ratings and other requirements dictate the type of glass that must be used in many specific locations. In other locations, however, the designer or specifier must choose the type of glass based on performance characteristics.

Laminated Glass

Laminated glass is composed of a tear resistant plastic film (polyvinyl butyral or ethylene-vinyl acetate) laminated between two layers of glass under pressure and heat. Although the glass pieces are not stronger than standard glass, the composite multi-layer lamination results in a stronger unit. If broken laminated glass will shatter like standard glass, but the plastic film will hold the pieces of glass in the frame, reducing the chance of injury (figure 1).



Figure 1: shattered laminated glass

Laminated glass has better acoustical properties than standard or tempered glass due to the composite construction. Acoustical laminated units are available for increased performance. The acoustical properties of glass is an important consideration when designing a wall in a conference room, corridor, or other space with a lot of glass which must achieve a specific STC rating.

Additional advantages of laminated glass include:

- In thicker, multi-layer forms, laminated glass can be blast and bullet resistant.
- Laminated glass can be drilled, cut and otherwise modified in the shop or field, increasing fabrication flexibility.
- UV-absorbing additives in the plastic film can block up to 99% of UV transmission.

- Laminated glass does not have the optical distortion associated with heat treating.
- Laminated glass will remain in the frame when broken, unlike standard or tempered glass, providing a degree of security and separation.

A recognized standard for laminated glass is ASTM C1172¹

Standard Specification for Laminated Architectural Flat Glass, which includes requirements for quality, type classification and test methods for specific performance characteristics.

Tempered Glass

Tempered glass is made by heating and cooling glass in a tempering furnace, which introduces internal stresses. These stresses increase the strength of the glass and cause it to crumble into granular, less hazardous pieces when broken (figure 2). Additional advantages of tempered glass include:



Figure 2: shattered tempered glass

- Tempered glass is more impact resistant than standard or laminated glass.
- Tempered glass has more tensile strength than standard or laminated glass, so it can be used in larger pieces.
- Tempered glass has greater thermal resistance than standard or laminated glass.
- Tempered glass is not a composite product, so layers are not visible at exposed edges.

A recognized standard for tempered glass is ASTM C1048², *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass*, which includes requirements for quality, type classification and test methods for specific performance characteristics.

References

¹ASTM C1172 *Standard Specification for Laminated Architectural Flat Glass*

²ASTM *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass* <https://www.astm.org/Standards/C1048.htm>