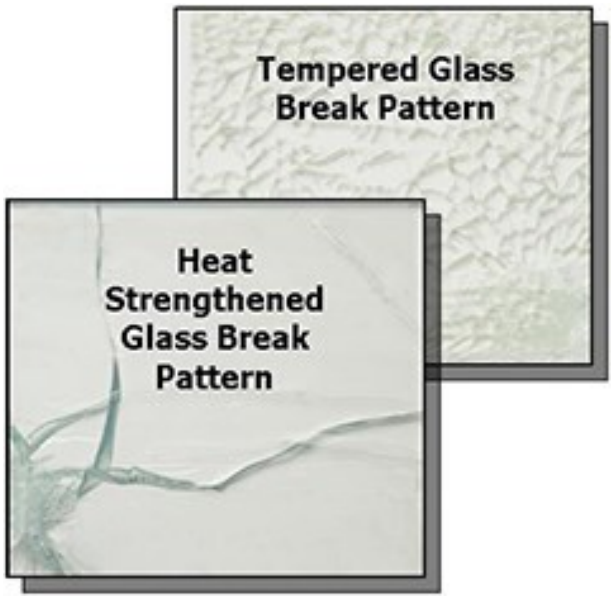
ABRISA TECHNOLOGIES
HEF® PHOTONICS

Your Total Solution Partner

Application Note

Benefits of Heat Tempering vs. Heat Strengthening of Glass

There are two types of heat-treated glass, Heat-Strengthened and Fully Heat Tempered. Both of these processes have specification requirements, tolerances, and testing procedures which are defined by ASTM International document C-1048-04.



For heat-strengthened glass the requirement is a surface compression of 3,500 to 7,500 psi with no requirement for edge compression. Fully tempered glass will have either a minimum surface compression of 69 MPa (10,000 psi) or an edge compression of not less than 67 MPa (9,700 psi).

Heat Tempering

- When glass is tempered, it is heated beyond its softening point of 600ºC, then the glass is cooled rapidly creating a higher surface compression and edge compression in the glass. The air-quench temperature, volume, and other variables cause a surface compression of at least 10,000 psi or 69 MPa.
- This tempering process will make the glass up to 4X stronger and safer than annealed or untreated glass. Tempered glass is also less likely to experience breakage through thermal shock.

Heat Strengthening/Tempering Process

The tempering process may cause some optical distortion, as the original flatness of the annealed glass substrate is slightly modified. This modification is known as “glass bow/warp” and is caused by the glass traveling horizontally over the rollers in the tempering oven. This distortion will fall within specified tolerance levels and standards for the process and is not considered to be a defect of the glass. See ASTM C-1048-4 for further details.

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Benefits of Heat Tempering vs. Heat Strengthening of Glass

Heat Strengthening:

Heat-strengthened glass undergoes a slower cooling process than tempered glass resulting in a lower compression strength. Heat-strengthened glass is approximately 2X stronger than annealed, or untreated glass. Heat-strengthened glass provides a better surface quality as compared to tempered glass, as it is less prone to cosmetic defects potentially incurred during the strengthening process. See ASTM C-1048-4 for further details.

Benefits & Characteristics of Heat Strengthened (Low Tempered) Glass:

- Provides a high mechanical and thermal strength in comparison to annealed glass while maintaining all other normal properties associated with the particular glass substrate (chemical resistance, hardness, expansion and deflection), offering twice the thermal and mechanical strength of the same thickness of annealed glass.
- Has a break pattern of large pieces, very similar to that of annealed glass. The shape and size is dependent upon the applied load, the origin of the break, the temperature of the glass, etc.
- Is rarely prone to spontaneous breakage due to machining or other edge treatments.

Abrisa Technologies offers a variety of coated and un-coated tempered and strengthened solutions on glass with thicknesses of 3mm to 19mm. For thinner glass, alternative strengthening options such as chemical strengthening and lamination are available.

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Benefits of Heat Tempering vs. Heat Strengthening of Glass

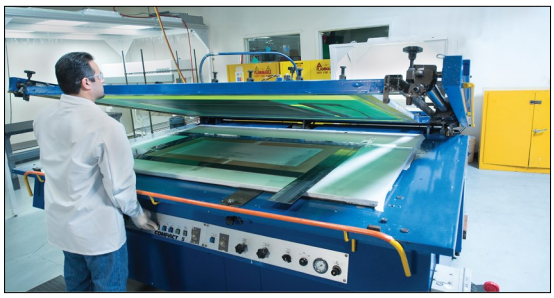
Glass Fabrication

Coating Deposition

CNC Machining

Strengthening - Chemical & Heat

Screen Printing of Graphics



Abrisa Technologies, a member of HEF Photonics, is a globally recognized technology glass fabrication and optical thin film coating company with expertise in high volume manufacturing and engineering capabilities, delivering Total Solutions that provide excellent performance, fitness-for-use and economies of scale.

Our US based, state-of-the-art ISO 9001:2015 and ITAR registered facilities include Abrisa Industrial Glass in Santa Paula, CA and ZC&R Coatings for Optics in Torrance CA. These two divisions produce solutions from cut-to-order coated glass components to custom complex and ready-to-install fabricated, strengthened, optically coated, electronically enabled and branded sub-assemblies.

Our Total Solutions serve a variety of markets including Micro-Electronics, Defense and Avionics, Display, Industrial Automation, Optical Sensors, Imaging, Photonics, Medical & Dental, Life Science and more.

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