



IGC Fire Heat Treated Glass Datasheet

Toughened Glass

Toughened or tempered glass is a type of safety glass processed by controlled thermal or chemical treatments to increase its strength compared with normal glass. Tempering puts the outer surfaces into compression and the inner surfaces into tension. Such stresses cause the glass, when broken, to crumble into small granular chunks instead of splintering into jagged shards as plate glass (aka: annealed glass) creates. The granular chunks are less likely to cause injury.

Toughened glass is physically and thermally stronger than regular glass. The greater contraction of the inner layer during manufacturing induces compressive stresses in the surface of the glass balanced by tensile stresses in the body of the glass. For glass to be considered toughened, this compressive stress on the surface of the glass should be a minimum of 69 megapascals (10,000 psi). For it to be considered safety glass, the surface compressive stress should exceed 100 megapascals (15,000 psi). The greater the surface stress, the smaller the glass particles will be when broken.

It is this compressive stress that gives the toughened glass increased strength. This is because any surface flaws tend to be pressed closed by the retained compressive forces, while the core layer remains relatively free of the defects which could cause a crack to begin.

Any cutting or grinding must be done prior to tempering. Cutting, grinding, and sharp impacts after tempering will cause the glass to fracture.

Heat Strengthened Glass

The term "toughened glass" is generally used to describe fully toughened glass but is sometimes used to describe heat-strengthened glass as both types undergo a thermal "toughening" process".

There are two main types of heat-treated glass: heat-strengthened and fully toughened. Heat-strengthened glass is twice as strong as annealed glass while fully tempered glass has typically four to six times the strength of annealed glass and withstands heating in microwave ovens. The difference is the residual stress in the edge and glass surface. Fully toughened glass is generally rated above 65 megapascals (9,400 psi) in pressure-resistance, while heat-strengthened glass is between 40 and 55 megapascals (5,800 and 8,000 psi)



Heat Soaked Glass

Following the toughening process, glass is heated to a temperature of about 290C for a minimum of 2 hours of the heat-soak period, and then cooled slowly. This process allows any inclusions to revert to their original form and thus regain their stability. The advantage in using this process is that the heat-soak test removes over 95% of the problem without affecting the properties of the glass. The idea behind heat soaking is to allow the glass to break in the factory before installation to minimize the risks of accidents and injury. The amount and size of these inclusions vary from glass to glass.

Heat soaking of toughened glass has been carried out in respect to the draft of European Standard EN 14179. Effective Heat-soak testing has been proposed and applied for toughened glass to avoid spontaneous failure in buildings.

Contact IGC for more information.

**Overall glass makeup thickness and weight depends on glass processor*

**Maximum sizes available on request*

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