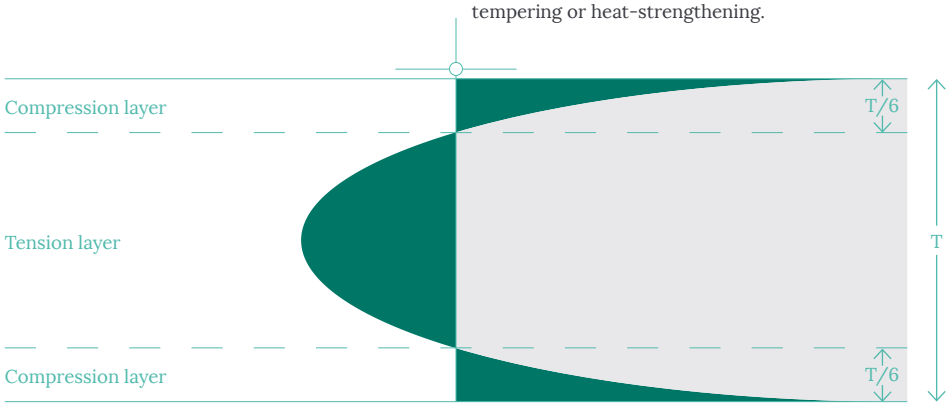
PREL-GARD

Tempered Safety Glass

DESCRIPTION

Glass, by its very nature, is considered a fragile material because there is always a certain number of virtually invisible surface imperfections. The most common imperfection is micro-cracking. When subjected to stress, the cracks open, expand and eventually cause the glass to break.

To overcome this drawback, glass is subjected to a special heat-treating process that locks the surface into a state of compression, which helps prevent cracking. This process makes the glass more resistant to thermal and mechanical stress and creates a unique breakage pattern. There are two types of treatments available: full-tempering or heat-strengthening.



Residual tension in thermally tempered glass.

TEMPERED GLASS

Heat treating consists in heating the glass to just below the softening point (1,200 °F/620 °C) and then cooling it rapidly and uniformly. During the cooling process, the surface layers of the glass harden and contract, while the central core, which is still warm, stays viscous and follows the movement of the contraction. As the core cools and hardens, the rigid surface layers lock it in, compressing the surface of the glass. When the core is completely cooled, the surface of the glass is locked in a state of compression and the central core in a state of tension. As a result, surface scratches or cracks will be subjected to compression, which will cause them to close. The glass is therefore stronger.

The mechanical strength and thermal endurance of Prel-Gard tempered glass is four to five times higher than that of annealed glass. To be considered tempered, the compression of the treated glass surfaces must be greater than 10,000 PSI (pounds per square inch).

Thermally tempered glass shatters into a multitude of small fragments when broken. Cutting or edging the glass after tempering would destroy it, therefore, these processes are carried out prior to tempering.

Prel-Gard tempered glass meets the requirements of the following standards: ASTM 1036-91, ASTM 1048-92, ANSI Z97.1 1984, CAN/CGSB 12.1 M90, CPSC 16 CFR-1201.

Applications

- Railings, glass doors and partitions, shower doors and enclosures
- Insulated glass units and spandrel glass
- Skylights, roof windows, store fronts
- Printed and silkscreened glass

HEAT-STRENGTHENED GLASS

Heat-strengthened glass has lower surface and edge compression levels than tempered glass. This lower compression level creates a glass that is two times stronger than annealed (not heat-treated) glass of the same thickness, size and type. The breakage pattern (shape and size) varies according to the level of compression obtained in the heat-treatment process. Heat-treated glass with low compression levels will break into large fragments, much like annealed glass. The higher the compression, the smaller the fragments are likely to be.

Prel-Gard heat-strengthened glass reaches a compression level of 3,500 to 7,500 PSI and is a suitable option for most applications. In the event of breakage, the fragments are relatively large.

Heat-strengthened glass that is ⅛" (3 mm), 5⁄32" (4 mm), 3⁄16" (5 mm) and ¼" (6 mm) thick can be produced by most horizontal equipment. It is difficult to produce the recommended compression range with glass that is 5⁄16" (8 mm), ⅜" (10 mm) et ½" (12 mm) thick. Thicker glass, between ⅝" (15 mm) and ¾" (19 mm), cannot be heat-strengthened with conventional equipment because the glass remains too hot when it comes out of the oven.

Prel-Gard heat-strengthened glass does not meet safety standards and cannot be considered a safety glass.

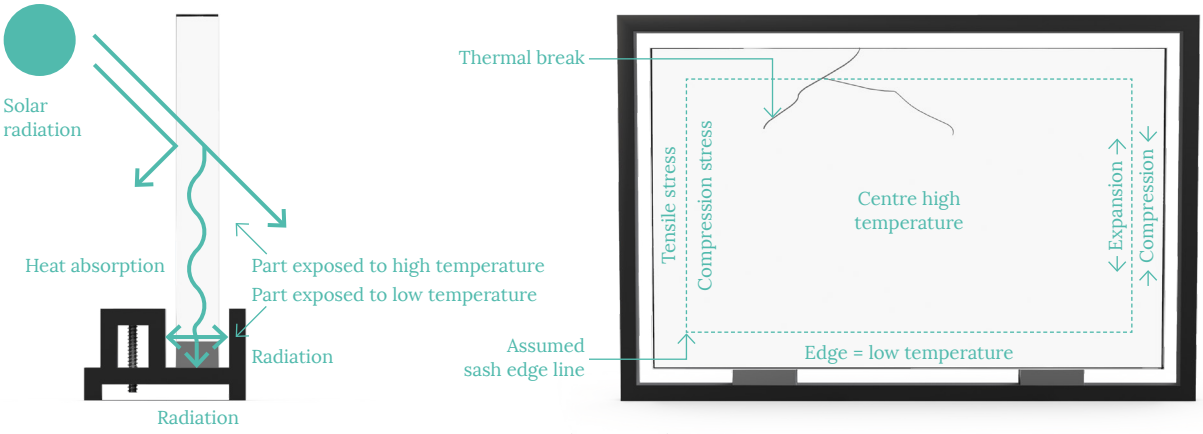
Applications

- Insulated glass units

THERMAL BREAKS

Glazing that absorbs solar radiation is liable to break due to thermal shock. **Thermal shock** occurs when the difference in thermal expansion between one section of glazing and another is too great (see diagram below).

The centre of the glass is more exposed to the sun and heats up much more rapidly than the part of the glass that is shaded or enclosed within the frame. The resulting solar-induced thermal stress can, if the critical limit is reached, cause the glass to break.



Thermal break in glass.

Various factorscan cause thermal breaks, including:

- The geographical position of the building, facade orientation, window placement (vertical or slope)
- Interior factors, such as air conditioning
- Glass-related factors, e.g. tinting
- Shading patterns

Thermal tempering and heat strengthening protect against thermal breaks.

HEAT TREATMENT DEFECTS

Heat treatment – tempering or strengthening – can cause certain defects. Although all precautions are taken to keep these defects to a minimum, they can never be completely eliminated. At this time, only certain defects are regulated by standards. The three main defects are roll wave distortion, bowing and warping, and strain patterns.

ROLL WAVE DISTORTION

During the tempering or heat-strengthening process, glass softens in a hot oven. Ceramic rollers in the oven keep the glass in constant motion and the glass takes on the wave-like shape of the moving rollers, causing a slight distortion. There is no industry standard for allowable distortion levels, but Prelco has set its own standard. We accept a maximum level of 0.003" (0.076 mm) in the centre of the glass and a maximum of 0.008" (0.20 mm) at the extremities of the unit (a 10" (254 mm) strip) for outdoor glass that is at least ¼" (6mm) thick. Furthermore, we use a zebra board to inspect for distortion as soon as the glass leaves the oven.

BOW/WARP

Heat-treating glass also affects the overall flatness of a glass unit. Depending on certain characteristics including size, thickness and glass type, the glass may curve or warp. The ASTM C1048 standard sets out what is tolerated in terms of this type of defect.

STRAIN PATTERN

During the tempering process, glass is heated close to its softening point and then cooled rapidly with air jets. The jets do not cool the glass surface evenly, which can create a pattern of marks that are visible under certain angles and light conditions. The intensity of the marks depends on the type and thickness of the glass used, they will, for example, be more visible on thick glass with a reflective coating. The ASTM C1048 standard mentions this pattern as something specific to tempered glass that should not be considered a defect or be confused with discoloured or non-conforming glass.

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