

# Optical Distortion in Laminated Glass with Heat Strengthened Glass Substrates

Laminated glass is produced by bonding a plastic interlayer between two or more panes of glass under heat and pressure in an autoclave. The result is a durable, high performance glazing composite material, which if broken, tends to retain glass fragments and reduces the risk of injury or property damage. Laminated glass is typically used in windows and doors requiring safety glazing, security glazing, burglary resistance, sound control, ultraviolet filtering, and hurricane impact-resistance.

Using heat strengthened glass in lieu of annealed glass offers several benefits over standard laminated glass since heat strengthened glass is twice as strong as annealed glass of the same thickness. Heat strengthened laminated glass provides an opportunity to offer larger window sizes to meet wind load requirements without the necessity of using thicker annealed glass. Heat strengthened glass also reduces breakage potential from thermal and bending stresses.

Although heat strengthened glass does offer potential advantages over annealed glass, heat strengthening can also result in properties such as roll ripple, bow, warp and kink, which often result in visible distortion (see Fig. LG03-1).

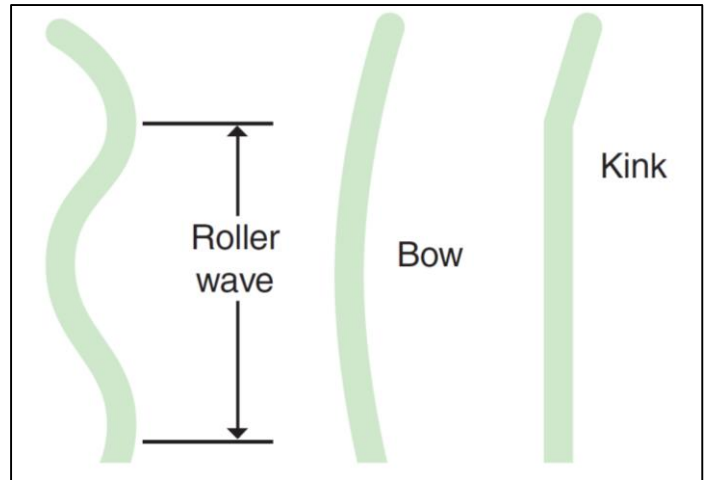


Fig LG03-1 Heat strengthened glass distortion nomenclature

Visible distortion in heat strengthened glass when used monolithically or incorporated into insulating glass units is detectable, but is seldom aesthetically objectionable.

Using heat strengthened glass as the substrate when laminating typically results in a greater degree of visible distortion due to the lens effect of having the glass surfaces out of phase or non-parallel when bonded together in the laminated glass make-up (see Fig. LG03-2). This lens effect can result in a magnification of objects when they are viewed through the glass in transmission as well as when viewing reflected images.

Some level of visible distortion is unavoidable and expected when using heat strengthened glass in high performance impact resistant glazing products. Distortion of images whether viewed in transmission or reflectance may be accentuated when viewed at angles other than normal (90°) to the surface; often the more acute or obtuse the angle, the greater the distortion.

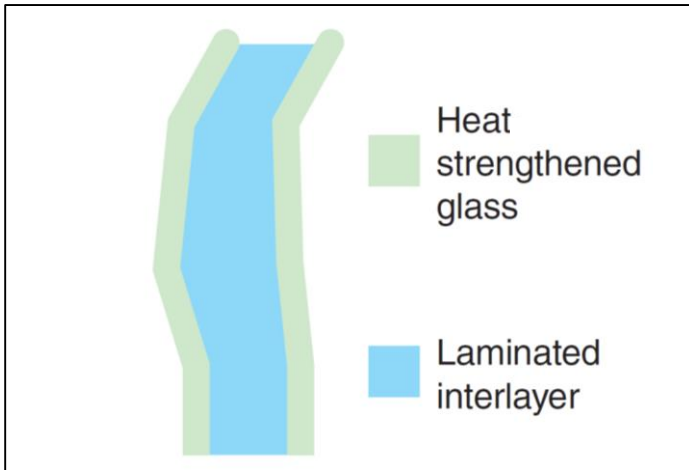


Fig LG03-2 Heat t strengthened laminated glass composite showing lens effect

Because of the above mentioned distortion concerns, Cardinal recommends that annealed glass laminates be used in lieu of heat strengthened glass laminates whenever possible, unless heat strengthened glass is required to meet extreme conditions (i.e. high wind loads or thermal stress conditions).

When heat strengthened glass laminates are specified, the customer should be notified by the window manufacturer about the potential for visible glass distortion. In addition, the window manufacturer should show mock-ups of the heat strengthened laminated glass product to the customer so that they can view and sign off on the distortion concerns.

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