

## Tempered Glass Breakage

This information is intended to provide a better understanding of the unusual breakage characteristics of tempered glass.

There is frequently a misconception that tempered glass is "unbreakable" or "nearly unbreakable". This is not true. Tempered glass is definitely breakable and some of the things that can break annealed glass can also break tempered glass.

Fully tempered glass as supplied for shower doors, patio doors, etc., is four times stronger than annealed glass of the same type and thickness and can meet CPSC break-safe requirements for Category I or II safety glazing.

Fully tempered glass, when broken, fractures into many small particles. This is by design and is proof of a well tempered product, not of a defective product. It is this fail-safe characteristic of tempered glass that makes it an excellent product for safety glazing applications.

Breakage of annealed glass is usually a simple one or two line fracture attracting little attention or comment (unless the glass has been destroyed by a severe impact). Cracked lites of annealed glass have been seen by most everyone a number of times and cause no great surprise. Conversely, breakage of fully tempered glass is spectacular; infrequently seen or experienced by the public, and attracts considerable surprise, comment, and question.

Annealed glass is easily broken by mechanical stress, impact, and moderate thermal stress. Fully tempered glass will withstand much greater stresses than annealed glass before failure. However, it is the nature of fully tempered glass that it cannot break in the simple fashion of annealed glass, but the individual lite must "release" entirely into small fragments, even for a very small initial fracture.

Another characteristic of tempered glass is that occasionally a lite will not release (break) immediately at the time of damage, but at some time in the future, perhaps weeks later. This adds to the surprise and amazement of people since no apparent cause is immediately evident. This type of behavior is one of the factors leading to the so-called "spontaneous breakage" of tempered glass.

Spontaneous breakage or delayed release can occur if the lite has been damaged during its manufacture, shipping, subsequent installation, consumer handling or use, or damage from

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improper cleaning, or if there is an inherent weak spot or stress concentration within the glass body. Most all damaged lites or lites with inclusions that cause excessive stress concentrations will not survive the thermal rigors of the tempering process. Of those that do survive, most will release within a short time, leaving a small percentage that may not release until weeks or months later.

Although some spontaneous breakage will occur as noted above, much breakage is erroneously called "spontaneous" only because there was no easily visible cause. Frequently, inspection of the glass surroundings will reveal damage done to the glass through installation or abuse, so that the glass is stressed near its breaking point and a subsequent movement, or temperature change forces the glass to yield. This is more correctly identified as stress or thermal breakage.

There will always be the possibility of some spontaneous breakage where tempered glass is used and a few lites may break for no explainable reason. This is the nature of tempered glass.

Since glass (including tempered glass) can be broken and because most unexplained breakage is beyond the manufacturer's control, it is unreasonable and impractical for anyone to effectively warrant against glass breakage.

For additional information contact AGC Technical Services at 1-800-251-0441.

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