

## Tempered Glass Is Always Perfect...Except When It Isn't

Every fabricator strives to deliver perfect tempered glass. That is why you buy from them. Most of the time, they succeed in this perfection. Sometimes their in-house quality program will reject glass, but you never know this. What happens when they ship the glass and your foreman says, "Boss, we have a problem!" Could be you and the fabricator are working to different standards of perfect. ASTM C 1048-04 is the standard for Heat-Treated Flat Glass, either Heat-Strengthened or Fully Tempered. This is the puppy we should all be petting.

Last week we learned that flat glass isn't perfect, so if a fabricator tempers a piece of flagrantly flawed float (say that three times), and it still meets the standards, you own it. Tempering adds even more variables to the mix.

Let's read excerpts of the standard on distortion in glass:

7.4.1 "Thermally tempered and heat-strengthened glass is made by heating glass in a furnace to a temperature at which the glass becomes slightly plastic. Immediately after heating, the glass surfaces are rapidly cooled by quenching with air from a series of nozzles. The original flatness of the glass is slightly modified by the heat treatment, causing reflected images to be distorted."

7.4.2 "...Fully tempered and heat-strengthened glass that has been made in a horizontal furnace may contain surface distortion. Distortion will be detected when viewing images reflected from the glass surfaces."

7.4.4 "Sealed insulating glass units also exhibit distortion regardless of glass type. Air or gas, trapped in the sealed airspace between the panes, expands or contracts, with temperature and barometric changes, creating a pressure differential between the the airspace and the atmosphere. The glass reacts to the pressure differential by being deflected inward or outward."

The standard addresses concerns that we all have. It acknowledges that glass isn't perfect. Mostly, when it comes to scratches and rubs in glass, the flat glass standard C1036, applies. So if a scratch is not visible from 11 feet away, it doesn't exist. These standards are critically important to your business. Ask your fabricator for a copy, or go to [ASTM.org](http://ASTM.org), where you will pay a fee for a download.

The biggest issues with tempered glass is size tolerance and 'bow and warp'. There are special sections that address both of these.

Here is a basic chart for size tolerance that should be adhered to:

Thickness.....	Finished Size Tolerance, Length or Width, plus or minus
1/8 .....	1/16
3/16 .....	1/16
1/4 .....	1/16
3/8 .....	3/32
1/2 .....	1/8
3/4 .....	3/16

As this is a plus or minus tolerance, one side of a 1/2 lite can be full by an eighth, the other side shy an eighth, making the lite 1/4 out, and it still is acceptable.

The standard for bow and warp is based on the overall size and thickness of the finished lite. Let's look at the allowable bow in just two thicknesses,

Size(in) 20-35...35-47...47-59...59-71...71-83...83-94...94-106

1/4 .....	(.12).....(.16) .....	(.20).....(.28).....(.35).....(.47).....(.55)
3/8 .....	(.08).....(.08).....(.16).....(.20).....(.24).....(.28).....(.35)	

A lite of 1/4 tempered, 48 x 96, can be warped over a half-inch! Do you find this acceptable? The standard does, and if your glass comes in with this warp, what do you do?

Talk with your fabricator early-on in your relationship and understand what tolerances they ascribe to. Do they have a tighter standard for a high-quality piece like a shower door or table top, than they do for general glazing? This is the key. Know what your fabricator expects of themselves and you will know the standard you can promise your customers.

One last thought, these standards are not law. If you make a contract with a customer to provide perfect glass, that is fine. Buy you probably will need to order two or three lites to get one that is dead-on perfect. If you try to always sell perfect, you better adjust your pricing now.