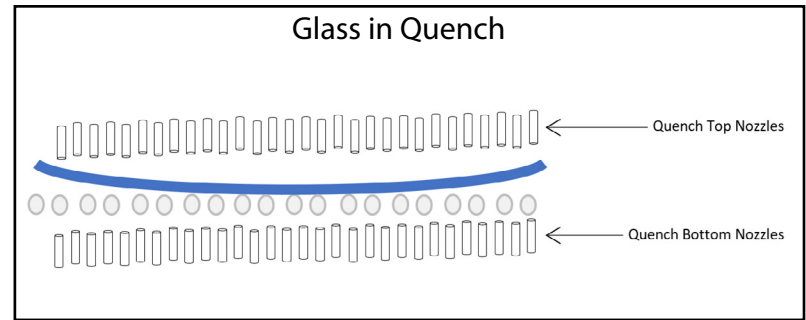
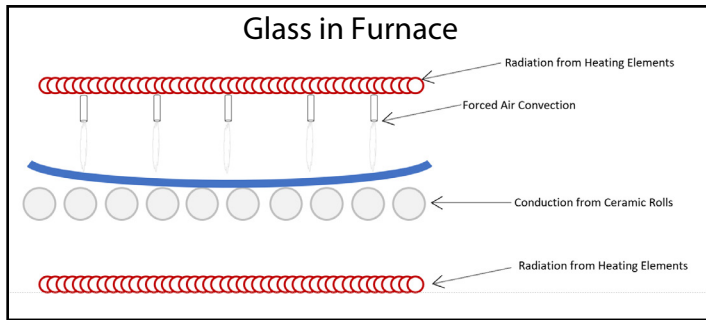


Introduction

Bowing of tempered glass is a common occurrence due to the violent nature of rapid heating of the glass in the furnace. As the glass rides in the furnace, conduction from the ceramic rollers absorbs into the bottom surface causing the glass to unequally (top surface vs bottom surface) heat up to temperature. Upon exiting the furnace, quench cooling pressures, from top to bottom, must be adjusted to counter this effect.

Bowing

When fully tempered glass is showing an upward bow (smile) air should be added (diverted) to the top of the quench. When finished glass shows a downward bow, air should be added (diverted) to the bottom of the quench. This is the BIC (Blow Into Cavity) method of air differential.



Thinner glass (3-4mm) tends to bow easier and more excessively than medium and heavy glass. This is due to the rapid cooling of thin glass (within 2-3 seconds) upon exiting the furnace due to the high air pressures required to achieve proper tempering. Low-e Coatings are designed to reflect radiant heat thus making coated glass bow significantly easier in the furnace.

Bowing and Warping Standards

ASTM C1048 Table 2 allows for bowing and warpage based on the longest dimension. The table below depicts the maximum amount of bowing allowed (in mm), per glass thickness. In the table below, a 34" x76" lite of 3mm tempered may be bowed 12mm (1/2") at its maximum point.

Size (inches)	0-20	20-35	35-47	47-59	59-71	71-83	83-94
3.1mm	3mm	4mm	5mm	7mm	9mm	12mm	14mm
4.0mm	3mm	4mm	5mm	7mm	9mm	12mm	14mm
5.0mm	3mm	4mm	5mm	7mm	9mm	12mm	14mm
6.0mm	2mm	3mm	4mm	5mm	7mm	9mm	12mm
10.0mm	2mm	2mm	2mm	4mm	5mm	6mm	7mm
12-24mm	1mm	2mm	2mm	2mm	4mm	5mm	5mm

Measuring for Bowing and Warping

Using a straight edge and calipers, questionable glass should be checked by standing the panel upright in portrait orientation and placing a straight edge along the edge and measuring the largest gap.





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