Glass Informational Bulletin **GANA TD 04-1207**

The Importance of Fabrication Prior to Heat-Treatment

Glass applications frequently require a variety of glass edge and/or surface fabrication. Some common fabrication processes include edge seaming, grinding, and polishing; hole drilling and notch cutting; and surface grooving, sand-blasting, and etching. The Glass Association of North America (GANA) recommends against glass fabrication after heat-treatment because it may weaken the glass and/or cause it to break.

ASTM International consensus document C 1048 - *Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass*[i] states:

Section 7. Fabrication

7.1 *Fabrication* – All fabrication, such as cutting to overall dimensions, edgework, drilled holes, notching, grinding, sandblasting, and etching, shall be performed before strengthening or tempering and shall be as specified. After the glass has been heat-strengthened or tempered, it shall not be modified except as recommended by the fabricator; for example, some Condition C coatings. No modification shall be made that will affect its structural characteristics or integrity as specified in this specification.

This supports the GANA recommendation stated above that glass should not be fabricated after heat-treatment.

The Heat-Treating Process

In order to provide greater resistance to thermal and mechanical stresses, and to achieve required break patterns for safety glazing applications, annealed float glass and patterned glass may be strengthened through a thermal process known as heat-treating. The most commonly used process for heat-treating architectural products calls for glass to be cut to the desired size and shape, edges prepared to the specified condition, and the surfaces to be washed. The glass is transported through a tempering oven where it is uniformly heated to approximately 1150 °F (621 °C). Upon exiting the oven, the glass is rapidly cooled (quenched) by blowing air onto all surfaces simultaneously. The cooling process places the surfaces of the glass into a state of high compression and the central core in compensating tension. As shown in Figure 1, each surface compression zone is approximately 20% of the glass thickness and the middle 60 % of the glass thickness is the tension zone.

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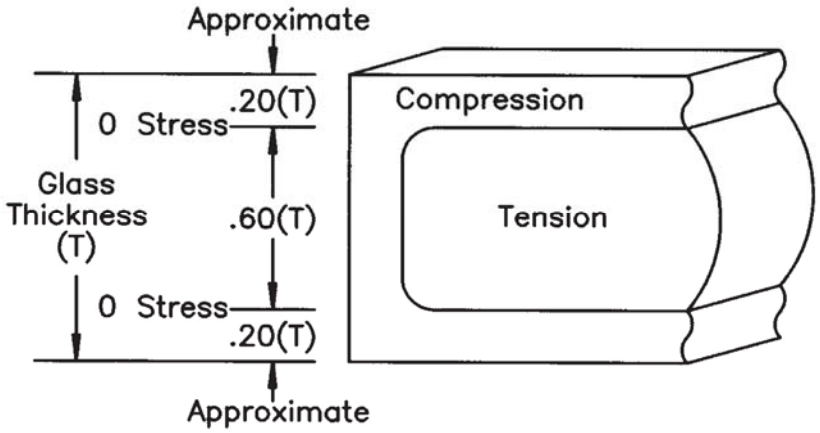

Figure 1 Heat-Treated Glass Compression and Tension Zones

Alteration of Surface Stress - Brought about by Fabrication after the Heat-Treatment Process

Fabricating glass after it has been heat-treated by cutting to size and shape, grinding edges, drilling holes cutting notches, grooving, sandblasting and etching may compromise the compression and tension zones of the glass resulting in a weaker or broken piece of glass. Compromising the surface compression zones of fully tempered glass may also negatively affect its ability to comply with the industry safety glazing standards:

- American National Standards Institute (ANSI) Z97.1 *American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications Method of Test*
- Consumer Product Safety Commission (CPSC) 16 CFR 1201 *Safety Standard for Architectural Glazing Materials*

Penetration of a surface compression layer is a major cause of heat-strengthened and fully tempered glass breakage. Since each compression layer in a lite of heat-treated glass is only approximately 20% of the glass thickness, penetration can occur in as little as 0.025” (0.64 mm) for 1/8” (3 mm) thick glass and 0.040” (1.02 mm) for 1/4” (6 mm) thick glass.

Heat-treated glass can be further fabricated by any process that does not alter the surface compression layer such as sputtered (vacuum deposition) coatings onto the surface; assembly of laminates and insulating glass units; and adding films and coatings for opacification.

GANA recommends that any fabrication that affects the surface compression layer of heat-treated glass (cutting, edgework, drilled holes, notches, grooving, sandblasting, etching, etc.) be completed before the glass is heat-treated.

The Glass Association of North America (GANA) has produced this Glass Informational Bulletin solely to provide general information as to practices of glass fabrication prior to heat-treatment. The Bulletin does not purport to state that any one particular type of fabrication and heat-treatment process or procedure should be used in all applications or even in any specific application. The user of this Bulletin has the responsibility to ensure the fabrication and heat-treatment guidelines from the glass and equipment suppliers are followed. GANA disclaims any responsibility for any specific results related to the use of this Bulletin, for any errors or omissions contained in the Bulletin, and for any liability for loss or damage of any kind arising out of the use of this Bulletin.

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