NATIONAL GLASS ASSOCIATION with GANA

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Heat-Treated Glass Surfaces Are Different

Industry Cleaning Procedures to be followed to Avoid Glass Damage

Heat-treated glass (fully tempered and heat-strengthened) has been in use for many decades. The demand for fully tempered glass increased greatly with the passing of safety glazing legislation in 1977. Heat-treated glass usage has increased in recent years for a variety of reasons including, but not limited to, changes to the building codes requiring safety glazing in more applications, the need to meet higher thermal stress loads due to the use of more high-performance glasses and coatings with increased heat absorbing and/or reflecting properties, the use of larger glass sizes and increased design loads.

Currently, there are two types of heat-treated glass as defined in the ASTM International standard C1048 *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.* The two types are heat-strengthened (Kind HS) and fully tempered (Kind FT). Both types of glass are produced using the same equipment. A majority of the heat-treated glass produced over the last 40 plus years has been fabricated in horizontal roller hearth furnaces. The preparation stage for the heat-treatment process requires annealed glass to be cut to the required final size, the edges to be treated according to the specified finish (commonly seamed or polished) and the glass to be washed. The process then requires the glass to be transported on horizontal rollers through an oven and heated to approximately 1150ºF (621ºC). Upon exiting the furnace, the glass is rapidly cooled (quenched) by blowing air uniformly onto both surfaces simultaneously. The cooling process leaves the surfaces of the glass in a state of compression and the central core in compensating tension.

The color, clarity, chemical composition and light transmission characteristics of glass remain essentially un- changed after heat-treating. Likewise, hardness, specific gravity, expansion coefficient, softening point, thermal conductivity, solar optical properties and stiffness remain unchanged by the heat-treating process. The only physical properties that change are improved flexural and tensile strength, and improved resistance to thermal stresses and thermal shock. Under uniform loading, heat-treated glass is stronger than annealed glass of the same size and thickness. The heat-treating process does change the break pattern of the glass, i.e. fully tempered glass that is produced with sufficient center tension will break into relatively small pieces designed to meet the industry safety glazing standards, thereby greatly reducing the likelihood of serious cutting or piercing injuries.

As mentioned, the heat-treating process typically involves the transport of very hot glass on rollers. As a result of this soft glass-to-roller contact, some glass surface changes will occur. Minute glass particles (fines) from the glass cutting, edging and washing processes, typical manufacturing plant air-borne debris or dust, refractory particles from the tempering oven roof, as well as external airborne dirt and grit carried into the plant by the large volumes of quench air used in the process, may adhere to one or both glass surfaces. Also, the physical contact of the soft glass surface with

the rollers may result in a marking or dimpling of the glass surface. Cur- rent glass quality specifications contained in ASTM C1036 *Standard Specification for Flat Glass*, establish the size and number of glass imperfections allowed based on specific visual inspection criteria. The glass surface conditions listed above are not usually visible to the eye under normal visual circumstances. These surface conditions do not threaten the visual nor structural integrity of the product and are not reason for rejection of glass under the ASTM consensus standards.

However, despite being invisible, such surface conditions may be detectable to the touch. This difference in "feel", between annealed and heat-treated glass, can lead to issues during cleaning of the glass, as glass cleaning workers attempt to remove microscopic particles. With the best of intentions, they may attempt to scrape particles that can be felt, but not seen, and very often end up scratching and chipping the glass surface.

Additionally, once the glass is delivered to the construction site, construction materials and debris may be deposited onto the glass surface. Paint, stucco, concrete, adhesives, and other materials may be splattered on the glass and left for long periods of time. These materials and the methods for removing them may also damage the glass surface.

It is important to note that the recommended cleaning procedures for heat-treated glass are the same as for annealed glass. The use of scrapers, abrasives, and harsh chemical cleaning agents are not recommended for any glass product because they can cause irreparable damage. Despite the best intentions, window cleaners, and other tradesmen, may attempt to remove construction dirt and debris from the glass surface by scraping the surface. This can lead to glass damage, such as scratching and chipping, if any microscopic particles that are adhered to the surface become dislodged and are transported across the glass surface during the scraping process.

Acceptable cleaning procedures may be available from glass manufacturers and fabricators. In addition, the National Glass Association, with the Glass Association of North America, have published Glass Information Papers that may be referenced. Proper Procedures for Cleaning Architectural Glass Products includes industry recommended cleaning procedures as well as a list of Do's and Do Not's. Construction Site Protection and Maintenance of Architectural Glass addresses steps to avoid permanent damage to glass.

Heat-treated glass products are critical components of today's high-performance coated, insulating, laminated, spandrel, safety glazing, bullet-resistant, blast-resistant, and hurricane-resistant fenestration products. Mil- lions of square feet of heat-treated glass have been installed and provided trouble-free performance since the 1960s. Continued use of acceptable cleaning practices, combined with good judgment, will prevent glass damage and enable the glass to maintain its original attractive appearance for years to come.

Most Glass Technical Papers are available free of charge. Visit www.glass.org/store for the complete list, as well as other flat glass industry reference materials.

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