GLASS STAINING

VIRACON TECH TALK

Glass staining occurs when a chemical change or degradation of a glass surface occurs. This document outlines potential causes of glass staining as well as related prevention and cleaning recommendations.

GLASS STAINING

CAUSES OF GLASS STAINING

During Construction

Overall, flat glass for commercial buildings is uniquely resistant to chemical attacks and other types of deterioration. However, glass staining can occur from a reaction to acids used during new concrete cleaning, masonry runoff and prolonged water contact during storage and shipment.

Glass staining implies a chemical change or degradation to the glass surface. Glass is inert to most acids, as well as other chemicals. Only phosphoric and hydrofluoric acids are harmful to glass. In concentrated form, these two chemicals will rapidly etch a glass surface. During building construction, hydrofluoric acid is often used to clean new concrete. This solution can accidentally splash onto the glass, seriously staining it in just one hour, resulting in costly glass replacement.

Unlike acids, alkaline cleaning materials, such as ammonia and trisodium phosphate, will attack glass surfaces. In concentrated form, these solutions can cause serious etching. Diluted, these alkaline solutions still attack the glass but more slowly. As a result, glass surfaces should always be thoroughly rinsed after cleaning to avoid staining.

Concentrated liquid cleaners used as a lubricant for gasket-glazed installations can also cause glass staining. Even though the glass is rinsed, some of the cleaner can get trapped between the gasket and the glass. This cleaner eventually seeps out, attacking the glass. As a result, it is important to use lubricants recommended by the gasket manufacturer.

Glass staining after installation can occur from the rain run-off of unsealed concrete panels or mortar joints. This concentrated alkaline solution can cause serious glass etching in a matter of days.

During Storage and Shipment

Glass staining during storage or shipment is normally caused by an alkaline attack triggered by the presence of water. Water from a leaky pipe or roof may collect between the glass panes when stored inside a building if the glass is packed too close together in crates or on racks. If the glass is stored outside, water may collect between the panes from rain, snow or groundwater.

Condensation of water vapor on the glass can also cause glass staining and etching when glass is stored outside or in an unheated warehouse. The condensation is a result of the glass temperature being below the dew point of the surrounding air. The glass temperature changes more slowly than the air temperature because of its bulk and the temperature lag of the glass.

A crate of glass stored overnight during cool temperatures may be close to the air temperature early in the morning. However, after sunrise the air temperature and moisture vapor content often increases rapidly, while the glass remains at a much lower temperature for hours. The results are condensation and trapped water, making it difficult for the water to evaporate—sometimes taking up to 24 hours to evaporate. If the same temperature cycle reoccurs, the glass surface can remain wet for weeks or months. As the water evaporates, the alkaline solution becomes more and more concentrated, eventually etching the glass surface.

DETECTION

Stages of Glass Staining

During the first stage of staining, you will see a transparent white film appear on the glass. Under certain lighting conditions, for installed glass that has not been washed, the white film covers the entire glass surface. Visually, it cannot be readily separated from surface contaminations, such as atmospheric dust and other materials.

The second stage appears as an iridescent, discoloration or oil film on the glass surface. It is multi-colored with an irregular pattern. It can be seen when daylight or other light sources are viewed in reflection from the glass surface.

The final stage produces an irregular translucent white discoloration, which can be seen under most lighting conditions. It can also reach the stage where an object cannot be clearly distinguished through the glass.

PREVENTION

Building Design

Designing a building that eliminates or minimizes contact between glass and run-off from other materials can decrease the possibility of alkaline staining. For instance, treat concrete and mortar surfaces with silicone or other surface sealers. Or, design drip caps to divert water away from the glass.

Construction

During construction, it is virtually impossible to prevent some alkaline materials from washing over the glass. A solution may be to protect the glass with clear polyethylene sheets. The sheets should be vented and should not touch the glass. The vented holes should be 1 inch (25.4mm) in diameter and be placed every 12 inches (304.8mm) along the top and bottom. This can also be used to protect glass when hydrofluoric acid is used for cleaning concrete.

If alkaline material contacts the glass, it should be washed within a few days. This can increase building costs, but is less costly than replacing stained glass.

Storage Guidelines

For glass stored in crates, stoce packs or other conditions where the glass surfaces touch or are separated by interleaving materials, ensure that the glass is kept dry at all times.

Once water is allowed to penetrate between the glass panes, the potential for staining and etching increases. If the interfaces become wet, separate the glass plies to allow them to dry.

Since water vapor is a gas, it readily penetrates between glass plies that are in contact with each other. To prevent moisture condensation, keep the glass temperature above the dew point of the surrounding air. For glass stored indoors, maintain a uniform indoor temperature. For glass stored near loading docks, do not expose the glass to cold outdoor air temperatures longer than 15 to 20 minutes.

For glass stored outdoors, try to keep the glass at, or warmer than, the outdoor air temperature. Store the glass crates under cover to protect against rain, snow and direct sunlight; do not obstruct air

movement around the crates. Direct sunlight on crated glass can cause breakage from thermal stresses. For insulating glass, high temperatures from solar heating can cause expansion of the air space, which can result in glass breakage or damage to the insulating seal. The best choice is to store the glass in shaded areas near surfaces heated by the sun.

Do not wrap stored glass in polyethylene sheets or other impermeable material. Instead, use roofing paper, which does not allow the liquid to penetrate, but allows the passage of water vapor.

If construction delays occur, make arrangements to have unprotected glass stored off site and follow these storage guidelines to prevent staining damage.

GLASS CLEANING AND MAINTENANCE RECOMMENDATIONS

During the construction period, the glass may become more heavily soiled than at any other time. Special care should be taken at the initial cleaning to make certain the glass surface will not be damaged because of heavy surface contamination. In addition, all of Viracon's architectural glass products require routine cleaning to prevent the build-up of potentially harmful mineral deposits and airborne contaminants. For standard cleaning procedures, review Viracon's *Glass Cleaning and Maintenance Recommendations*.

Cleaning Stained Glass

The following cleaning recommendations are intended for uncoated glass surfaces only. They are for specific projects with severe residue and dirt buildup and should not be used as standard cleaning procedures.

Do not clean the glass under direct sunlit conditions. Start cleaning the glass at the top of the building, systematically working downward. This reduces the risk of residue and cleaning solution from contacting clean glass at lower levels.

The following list of glass cleaners begins with the mildest and progresses to the strongest. Once a cleaning solution removes surface contaminants, stop at that level and do not use a stronger solution.

A. Commercial glass cleaner
B. Isopropyl alcohol (IPA) and water (50-50 mix)
C. Soft Scrub™ cleanser
D. Cerium oxide and water, only optical-grade cerium oxide should be used.

Procedures (Cleaner A or B)

1. Spray—or use a clean, grit-free cloth or sponge—to apply commercial glass cleaner or IPA and water to the glass. Clean no more than 10 to 15 square inches (6452 to 9678 square mm) at a time.
2. Wipe the cleaning solution on the glass surface in a circular motion, applying light to moderate pressure. Depending on the adhesion and severity of the residue, three to five passes in the affected area may be required to remove the residue.
3. Rinse immediately with generous amounts of clean water.
4. Remove water from the glass surface with a squeegee or a clean, lint-free cloth.
5. If residue is still present, repeat steps 1 through 4.

Procedures (Cleaner C or D)

1. Make a paste with either Soft Scrub cleanser or cerium oxide and water.
2. Using a clean, lint-free cloth, wipe the paste onto the glass in a circular motion with light pressure (two to four pounds). Since Soft Scrub and cerium oxide are abrasive, they can scratch the glass if greater pressure is used. Depending on the adhesion and severity of the residue, three to five passes in the affected area may be required to remove the residue.
3. Rinse immediately with generous amounts of clean water.
4. Remove any excess water from the glass surface with a squeegee or a clean, lint-free cloth.
5. If residue is still present, repeat steps 1 through 4.

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