



VIRACON®  
GLASS IS EVERYTHING™



T E C H T A L K

---

G L A S S S T A I N I N G

# GLASS STAINING

This Tech Talk provides you with important information on the causes of glass staining, and how to prevent it from occurring during construction and storage.

## 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 gasketglazed 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 cigarette smoke, 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 DESIGNS

By designing a building wall that eliminates or minimizes contact between the glass and run-off from its opaque portions, you can decrease the possibility of alkaline staining. For instance, treat all concrete and mortar surfaces with silicone or other surface sealers. Or, design drip caps into the wall system to divert water away from the glass.

### CONSTRUCTION

During construction, it is virtually impossible to prevent some alkaline materials from washing over the glass. If it occurs, the glass should be washed within a few days. This can increase building costs, but it is less costly than replacing the stained glass.

One cost-effective method is to protect the glass with clear polyethylene sheets. The sheet should be vented and not touch the glass. The vented holes should be 1 inch (25.4 mm) in diameter and be placed every 12 inches (304.8 mm) along the top and bottom. This can also be used to protect glass when hydrofluoric acid is used for cleaning concrete.

### STORAGE GUIDELINES

If glass is stored in crates, stocce packs or under conditions where it touches or is separated by interleaving materials, ensure that it 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 time 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 the outdoor air temperature or warmer. Store the glass crates or stocce packs under cover to protect against rain, snow and direct sunlight and 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 spaces, which results in glass breakage or damage to the edge seals. Shaded areas with surfaces heated by the sun are ideal.

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 the unprotected glass stored off site to prevent staining damage.

## Cleaning Guidelines

### TYPES OF CLEANERS

The following list of glass cleaners may be used to clean the glass surface. The list of cleaners begins with the mildest and progresses to the strongest. Once you find a cleaning solution that 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

### TYPE A AND B CLEANING PROCEDURES

1. Apply commercial glass cleaner or IPA and water to glass. You can either spray it or use a clean, grit-free cloth or sponge saturated with the cleaning solution. It is recommended to clean an area no more than 10 to 15 square inches (6452 to 9678 square mm) at a time.
2. Apply light to moderate pressure using a circular motion when wiping the cleaning solution on the glass surface. Three to five passes in the affected area may be required to remove the residue, depending on the adhesion and severity of the residue.
3. Rinse immediately with clean water and remove any excess water from the glass surface with a squeegee or a clean, lint-free cloth.
4. If residue is still present, repeat steps 1 through 3.

## TYPE C AND D CLEANING PROCEDURES

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

Only optical-grade cerium oxide should be used. It can be obtained from the following companies:

**Sommer and Maca Industries, Inc.**

5501 West Ogden Avenue  
Chicago, IL 60650  
800.323.9200

**C.R. Laurence Company, Inc.**

2503 East Vernon Avenue  
Los Angeles, CA 90058  
800.421.6144

## IMPORTANT NOTES:

1. These cleaning recommendations are intended for uncoated glass surfaces only. They are for specific projects with severe residue and dirt buildup. These should not be used as standard cleaning procedures.
2. Do not clean the glass under direct sunlit conditions.
3. 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.

## Glass Solutions

### THE LEADER IN GLASS FABRICATION

As an international company, Viracon offers the most complete range of high-performance architectural glass products available worldwide. However, we're not just another company that fabricates glass. Rather, we're a company that delivers design, aesthetic, budget and performance solutions for each of your projects. Glass solutions that meet your needs—giving you peace of mind.

Since 1970, Viracon has expanded its facilities to perform more glass fabricating processes at a single site than any other fabricator in the world. Our state-of-the-art tempered, laminated, insulating, security, silkscreened and high-performance coated products give you the choices you need from one single source. This single-source responsibility is evident in our complete line of product offerings, technical expertise, design assistance and responsive customer support.



DUKE ENERGY CENTER

LOCATION: CHARLOTTE, NORTH CAROLINA // GLASS TYPE: VRE1-38, VRE1-54, VE1-2M, VRE1-59

PHOTOGRAPHER: CHILDRRESS KLEIN PROPERTIES



VIRACON®

GLASS IS EVERYTHING™

The information contained in this publication is presented in good faith. It is believed to be accurate at the time of publication. Viracon reserves the right to change product specifications without notice and without incurring obligation.

[viracon.com](http://viracon.com)

800 Park Drive, Owatonna, MN 55060  
800.533.2080

Copyright © 2001-2014 Viracon.  
All Rights Reserved.  
VTT-002B VRJC0804