# Hard Water Deposits/Water Spots & Glass Corrosion

What You Need To Know



- *Window cleaners are constantly faced with various issues pertaining to exterior glass stains, hard water deposits, basic water spots the do's & don'ts as well as glass corrosion issues in both commercial and residential settings. Learn first hand how to distinguish what type of stain and how to remedy it. We will also cover the ever popular glass corrosion issues that continually plague window cleaners. In this seminar we'll cover and discuss all aspects of glass corrosion, stains, deposits, chemicals & polishers.*
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## What Are Water Stains?

- Hard water stains are caused primarily by various elements: Calcites (Calcium), Silicates, Magnesium Carbonate, Iron (Rust)
- Water spots are always on relief ON the glass surface
- True glass corrosion penetrates the glass causing pitting & flaking of the surface.

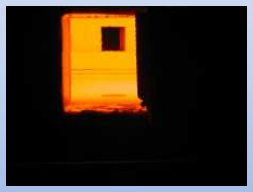
## Common Causes of Deposits

- Building Rundown from pre-cast and stucco panels
- Sprinkler system water from poor aiming or on windy sides of the building

## Let's take a look at Glass

- To understand why some deposits are harder to remove than others, and how not to "burn" glass, you need to understand how glass is made. We'll stick with the basics.

## The Float Glass Manufacturing Process

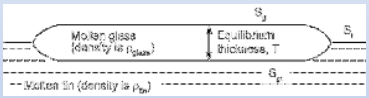


- Almost all glass manufactured in America today is float glass. Float glass is the process of leveling molten glass by floating it on a bed of molten tin.

## The Float Bath

- At this point, about 25 – 30 milligrams of tin is bonded to the float side of the glass.
- This tin side will react to UV light, and certain acids will adversely affect it.

## Cross Section Diagram

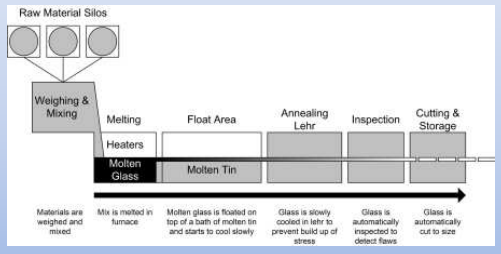



- This diagram represents a cross section of the glass floating on the molten tin. The molten glass does not spread out indefinitely over the surface of the molten tin. Despite the influence of gravity, it is restrained by surface tension effects between the glass and the tin. The resulting equilibrium between the gravity and the surface tensions defines the equilibrium thickness of the molten glass (T).
- The resulting pool of molten glass has the shape shown above.
- Notice how much the glass is settled into the molten tin.

## The Cooling Lehr

- The nearly half mile long ribbon of glass exits the cooling lehr. It is now a continuous flow from the melting furnace through the float bath and the cooling lehr.

## Diagram of Glass Production



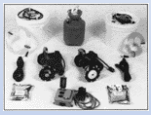

## Why the Tin Side is Important

- Approximately 25 – 30 milligrams of tin is absorbed into the glass during the float.
- With a proper ultraviolet light a "grayish" reflection can be seen which differentiates the tin from the air side.
- On the air side, no reflection of the UV light is seen.
- Improper use of certain acids will react with the tin and burn the glass, also known as "tin etch haze"
- This is sometimes irreparable, and may require replacement of the glass

## The Arsenal

## The Machines





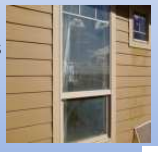

## Iron/Rust Removal

- Usually on the surface, not embedded in glass.
- Easiest removal method is Phosphoric acid.
- Can also be removed with a white pad and hard water removal product.

| Stain Color | Stain Source |
|---|---|
| Light Yellow | Tannin |
| Red/Orange | Iron Oxide |
| White (Powder Residue) | Hard Water |

## Hard Water Deposits – Calcium or Magnesium Carbonate

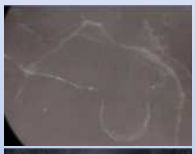
- Usually white in color
- Can usually be removed with minimal effort
- A decent hard water stain removal chemical and a white pad.
- Sometimes it's as easy as vinegar
- Any remaining stain is likely a silicate

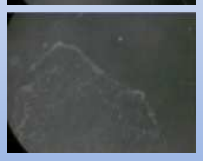



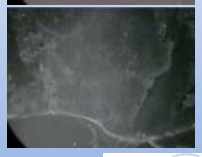
## Hard Water Deposits - Silicates

- Silicate bonds with the glass.
- Hydrofluoric acid will remove them.
- Hydrofluoric acid will react with the tin side.
- Mechanical methods are usually required for complete removal.

## More Silicate Deposits







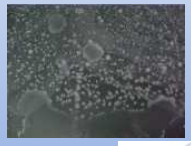
## Edging & Seaming Create Silicate Deposits

- Edging and belt seaming operations present unique problems for maintaining glass surface quality in that the glass fines by-products are extremely reactive with water and yield substantial levels of soluble silicates, even at room temperature. When dilute solutions (4 PPM Si) of silicates evaporate on glass, deposits remain behind which react with the glass creating "glass-on-glass" defects that are impossible to remove except by means of abrasive polishing or dissolution in hydrofluoric acid. Arising from the very large surface area to mass ratios characteristic of large numbers of minute particles, the intense reactivity of glass fines is most effectively controlled by washing all glass articles immediately after edging or seaming.

**Paul Duffer – Glass Reactivity and Its Potential Impact On Coating Processes**

## TRUE Glass Corrosion

- The result of time, temperature & a stagnant environment
- Often found inside failed IG units.
- It is the high pH in this stagnant environment that changes the chemistry of the glass surface & causes corrosion
- **Cannot occur in a dynamic environment, i.e. the exterior of a building**

## Two Types of Corrosion

- Whenever water is allowed to remain on glass for more than a moment, a unique chemical exchange happens that can cause corrosion. If dwell time is minimized, there is usually no visible damage. However if the conditions are right, either of two types of corrosion occur; Stage 1 or Stage 2.
- Stage 1 - stated simply, is when water leaches sodium ions from sodium/lime/silica glass. Stage 1 corrosion only occurs when the pH level is well below 9.
- Stage 2 - This results in microscopic pitting of the glass surface as the silicon/oxygen bonds of the glass are broken. The result is a white, chalky look. Only occurs when pH of 9 + is present.

## Corrosion Up Close


- Stage 2 corrosion can be seen easily, it is a white, chalky film from the glass flaking & cracking. Stage 1 can be removed with proper grinding & polishing. Stage 2 corroded glass should be replaced.

## Glass Corrosion Review

- **Stage 1** – Ion exchange, pH < 9 - can be corrected with mechanical, abrasive or acidic methods
- **Stage 2** – Glass Network Dissolution – pH > 9 – microscopic pitting, flaking, white chalky translucent appearance – glass cannot be saved
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## Low-E Coating Glass

- Pyrolytic coating is a metal oxide coating applied on line during the float process. The coating is fused into the glass surface at high temperature making it extremely hard and durable. It can be glazed to the outside (surface 1) or inside (surface 2) of the building. It can be handled and cut like standard float glass and processed into heat strengthened, toughened, laminated, curved glass and IG Units. These products are also known as an 'on line' or 'hard coat' reflective glass
- Vacuum coating involves the deposition of metal particles on the glass surface by a chain reaction in a vacuum vessel. It is often called a 'soft coat', because the coating is more susceptible to damage than a hard coat glass. Where tempering of the glass is required, the product must be tempered first and then vacuum coated. Vacuum coated glass is available in laminated form with the coating on the inside, protected from damage. Also called sputter coating

## After the Battle

**Before** **After**

## More Sparkling Results

**Before** **After**

## Making Them Sparkle!

**Before** **After**

## Buildings Will Thank You

**Before & After**

**Before & After**

## Your Clients Will Thank You!

**Before**

**After**

With the proper knowledge & training, hard water removal can be a very lucrative add-on service and set your company apart from your competitors.

## 

- A big thank you goes out to the people who contributed to this seminar:

- Craig Aldrich - Photos & Presentation
- Jeff Klass – Concept Design, Layout & Production
- Paul Duffer – Technical Information & Advice
- Dan Fields – Photos & Technical Advice
- Jason Klovansky - Photos
- Winsol Laboratories – Photos
- Dr. Robin Kent – Tangram Technology, UK - Photos, Diagrams & Technical Input
- ABC Window Cleaning Supply – Photos
- Colker Company – Photos
- J. Racenstein Inc. – Photos
- All the window cleaners who contributed photos