



GLASS WASHING:

UNDERSTANDING AND MAINTAINING A GLASS WASHING MACHINE

TIPS FOR OPERATING AND MAINTAINING YOUR GLASS WASHER

There are many variables that effect glass cleaning such as water quality, maintenance, glass types, plant environment, and upstream processes for example. Therefore, it is important to remember that achieving clean glass can be a moving target from day to day, and plant to plant. The goal is to use as many good practices as possible to achieve consistently clean glass.

1.0 WHAT IS NEEDED FOR OPTIMUM GLASS WASHER PERFORMANCE?

Assuming you have a well designed and constructed glass washing machine, there are four main items that you must provide to achieve consistently clean glass from the machine.

1. Heated wash water and detergent
2. Good quality rinse water
3. A good maintenance program
4. Roll covering and brush bristles in good condition

2.0 HEATED WASH WATER AND THE USE OF DETERGENT

The wash section of the machine is understandably a very critical step in the glass cleaning process. When the glass passes from this section, it must be free of all debris and dirt. The only thing that should be on the glass as it passes from this section is trace amounts of detergent and wash water solution that can easily be removed in the rinse sections.

The critical components of the wash section are one or two pairs of brushes, as well as water, detergent and heat.

THERE ARE SEVERAL REQUIREMENTS FOR A GLASS WASHER DETERGENT

1. It must be non-foaming and easily rinsed.
2. It must be effective in removing cutting oil and Lucite-type packing materials.
3. It must not attack or deteriorate the glass, or the metal, rubber, and nylon components of the glass washer. It must also be compatible with any coatings on the glass.



We recommend a liquid or powder type detergent, which is very mildly acidic and non-foaming. You should always consult with your coated glass supplier for their recommendations as well. Depending upon the type of glass and coatings you are cleaning, temperatures of the wash water should be in the 110° F to 140° F range.

Some companies do not use detergent in their washers. If you are achieving clean glass without detergent, that is fine. However, it is our opinion that the use of a heated detergent is the only method to guarantee complete removal of oils from the glass.

3.0 GOOD QUALITY RINSE WATER

After the glass passes through the heated wash section, it will progress into the rinse sections of the washer. As mentioned previously, when the glass enters the rinse sections, it will still have trace amounts of wash solution on it. The first pair of rinse brushes should remove this wash solution. The glass is then rinsed with a final pair of brushes and conveyed to the drying section.

The water that is used in the final rinse must be as clean as possible. Anything that is in the rinse water could contaminate the final product. Contaminates such as minerals could be dried on the glass resulting in visually dirty glass and more importantly cause adhesion problems for any downstream processes.

4.0 THE EFFECT OF MINERALS IN WATER

As you know, normal water contains a large variety of minerals. If water contains a large amount of minerals such as calcium or magnesium, the water may leave a white, chalky residue on the glass when it evaporates. If you were to let a droplet of water dry on a clean piece of glass, you might see a white or grayish colored ring. What is in this ring is a residue of minerals that were in the water.

When a plant is located in an area where the mineral content is high, you may find that the glass will have this residue on it, in the form of streaks, as it exits the washer. Besides looking bad when held up to an inspection light (or in your customer's window), these minerals can cause adhesion problems for the sealants, inter-layers, or other film or coatings that you may be applying to the glass after washing.

However, for as long as glass washing machines have been in existence, companies have been (and still are), using un-treated water for rinsing with acceptable results...because the mineral content is low in their water.

5.0 TREATED WATER ALTERNATIVES

If the mineral content in your water is high, and you are experiencing mineral streaks and spots on the glass as it exits the washer, you will most likely have to use some sort of treated (mineral free) water in the final rinse of your glass washer.



Softened water is not recommended for providing streak free glass. Softening is an exchange process that simply exchanges the hardness ions for sodium ions. Because this is only an exchange process, the total dissolved solids (TDS) in the water remains nearly the same as the source water...and the sodium can also cause spotting and streaking. It should be noted however, that softened water could be used in the wash tank, because it enhances the cleaning ability of the detergent.

This leaves two treatment alternatives:

- DEIONIZATION (DI)
- REVERSE OSMOSIS (RO)

Deionization (DI), and Reverse Osmosis (RO), differ in their method of removal of the total dissolved solids (TDS). DI is the complete removal of the TDS, and RO is 95% removal of the TDS. These processes eliminate the minerals that would remain on the surface of the glass during the drying stage, and consequently eliminate streaking and spotting caused by the minerals in the water.

DI or RO water is recommended for use in washers that are cleaning glass prior to coating, silk screening or lamination. Producers of soft coat Low-E glass are also strongly recommending the use of treated rinse water.

DI water can be obtained from local water treatment companies who have the ability to provide DI exchange tanks to your facility, although it is possible to install in-plant regenerating systems as well.

RO water systems are generally installed within your facility.

The choice as to which water treatment system to use is generally made based on cost and convenience.

Generally, treated water is used in the final rinse only of the glass washer. However, some companies use treated water in both rinses, which is fine...it just uses more of the expensive treated water.

6.0 MAINTENANCE PROGRAMS

Glass washers are commonly overlooked in terms of maintenance programs. Many assume as long as the washer was producing visually clean glass, then it was doing its job. However, with the advent of high performance coatings, the cleanliness of the glass is much more critical and consequently more attention must be given to the maintenance of the washer.

Vitally important to the longevity of a glass washer, and more important to the main goal of achieving consistently clean glass, is good maintenance. The cleanliness of the glass coming out of a washer is directly related to how well the machine is maintained.



7.1 MAINTENANCE INTERVALS: INITIAL/STARTER CHECK

There are four (4) important maintenance events in a good maintenance program.

The first occurring after the first week of operation on a new machine, or one that has not had any maintenance for a long time, or one that has been moved from one location to another.

1. Tighten all fasteners, including electrical connections in the control panel.
2. Grease the entire machine.

Important!! Grease the machine with a handgun. Pump only one or two pumps of grease into each fitting. You should never observe grease on the outside of the bearing housing. Too much grease will push out the bearing seals, allow moisture to enter, and cause the bearings to seize. Care must be taken to keep oil and grease off rolls, brushes, and belts. If you see grease on the outside of the bearing housing it should be wiped off immediately, because it will drip down into the wash and rinse tanks, and then be pumped on to the brushes and rolls.

3. Check for proper rotation of motors on a newly installed machine, or one that has been moved recently. A blower running backward will produce some air at the air knives, but not enough for optimum glass drying.

7.2 MAINTENANCE INTERVALS: ONCE A WEEK or EVERY 40 HOURS

1. Remove standpipes and drain both detergent and rinse tanks. Completely clean tanks and removable screens. Fill tanks with new water and add detergent. Actually, with the use of treated water and the processing of coated glass, we now recommend draining and cleaning the tanks after every shift.
2. Check air filters, if you cannot see light through them, replace them.
3. Lube pinch roll drive gears. (this applies to older washers with steel gears only)
4. Sparingly grease all pinch roll bearings in the wash and rinse sections.

IMPORTANT! While cleaning the tanks, it is important to pay attention to the electric immersion heaters in the tanks. Immersion heaters used in tanks are mounted horizontally near the tank bottom to allow convective circulation. They are located high enough to be above some sludge build-up in the bottom of the tank. When the heaters are turned on, the entire heated length of the heater should be immersed in water at all times.

Scale build-up on the blades of the heater, and sludge on the bottom of the tank must be eliminated. If not controlled, it will inhibit heat transfer to the liquid and possibly cause overheating and failure of the heater.



Extreme caution should also be taken not to get silicone lubricant on the heater blades. The silicone will prevent the “wetting” of the blades by the liquid, act as an insulator, and possibly cause the heater to fail.

7.3 MAINTENANCE INTERVALS: EVERY 250 HOURS

1. Grease brush and roll bearings.
2. Perform standard 40 hours maintenance.

7.4 MAINTENANCE INTERVALS: EVERY 500 HOURS

This is an important event in any good maintenance program. At this point, the machine should be opened-up as completely as possible to perform this scheduled maintenance.

1. Standard 40 and 250 hours maintenance.
2. Inspect brushes and rolls for any damage or glass chips.
3. Check brush adjustment.
4. Check belt and chain condition and adjustment.
5. Thoroughly clean all rolls.
6. Lightly oil the chain with a quality 30 Weight petroleum oil without additives.
7. Lightly oil the brush bearing guides, pinch roll adjustment screws, and brush idler pulley slides with a light machine oil.
8. Check grease level in gear reducer.
9. Remove plugs in ends of spray pipes and clean out with wire brush bore cleaner and drill bit.
10. Clean line strainers in the in-line pump filters if equipped with them.
11. Clean air filters and inside the air tubing, by sliding a thin piece of metal back and forth in each air knife slot to dislodge any debris, then blow out.
12. Finally, using a low pressure sprayer with hot water, carefully clean the inside of the washer to remove dirt, grease, and slime. Of course, be careful not to spray bearings, motors, and other water sensitive components....and NEVER aim the sprayer nozzle directly at the brush bristles.

Some companies that wash glass with “soft” coatings actually perform this 500 hour maintenance at the end of every week of operation.



8.0 SLIME IN A GLASS WASHING MACHINE

Why is there a build-up of slime on the inside of my glass washer?

It happens primarily when treated water is used in the washer. Since there is an absence of chlorine in DI or RO water, algae will grow in the water, just like a swimming pool that has no chlorine in the water. This bacteria growth appears as slime on any surfaces that the treated water contacts.

There are several ways to minimize this bacteria slime:

1. Place an ultraviolet light in the treated water plumbing system. This light will kill bacteria in the water only when the water is being re-circulated. It will not kill bacteria when the water is not flowing through the system.
2. Make sure there are no dead legs in the water plumbing system that will permit the water to become stagnant. Do not allow water to remain in tanks overnight or weekends.
3. Drain and wipe down the internal surfaces of the re-circulating tanks each day when the machine is finished operating. Use a mild detergent for wiping and then flush well with clean water.
4. Once a week, clean all the internal metal surfaces of the machine that are contacted by treated water, including the tank, and sheet metal surrounding the rollers, and brushes, using a low pressure steam cleaning machine.
5. A chlorination procedure can be used to reduce algae growth. This procedure involves the use of a 5% solution of ordinary, non-scented household bleach, re-circulated through the washer on a periodic basis. Warning! There is a very specific set of rinsing steps that must be followed with this procedure.

Your treated water system supplier may also have suggestions for removing bacteria slime.

9.0 MAINTAINING QUALITY IN THE DRYING SECTION

Have you ever watched an IG operation where the operators turned the glass over when it exited the glass washer, so that the top surface coming out of the washer was then on the inside of the IG unit?

The reason for this is that the operators do not have the confidence that the bottom surface coming out to the washer will always be spot free. Unfortunately, the cause in many cases is due to a lack of good maintenance practices in the drying area of the washer and not the fault of the washer.

In addition to keeping the rolls in the drying section perfectly clean and free of cuts or gouges, internal cleanliness of the drying system is very critical. The blower contributes a large amount of contamination to the washer. Using a good grade of air filtration and keeping the entire drying section, including the internal blower housing, tubing, and air knives as clean as possible, will prevent the drying section rolls from becoming dirty and then transferring dirt to the glass.



Many times glass washers are placed in dirty environments, and / or where an oil mist is in the air. The ambient air supply to the blower should be as clean as possible. There should not be any processing equipment near the washer with exhaust valves that emit an oil mist into the air. Aerosol or paint sprays should not be used near the washer. Any of these can contaminate the internal surfaces of the drying system and place a film on the glass. Also, do not place the washer near open outside doors.

Keeping the drying section clean is as important as keeping the water clean and free of minerals.

10.0 BRUSH AND ROLL MAINTENANCE

Well, we are down to the last important items that are needed to achieve clean glass. Your rolls and brushes need to be in good condition.

10.1 BRUSH AND ROLL MAINTENANCE - BRUSHES

1. Brushes should be adjusted so that no more than 1/32" (0.7mm) of bristle is touching the glass. Excessive bristle contact with the glass causes a "mopping" action instead of a "brushing" action. This mopping action results in reduced scrubbing of the glass and excessive bristle wear.
2. On a horizontal washer, it is important to instruct operators to use the entire width of the conveyor as they load glass during the day...assuming the process line permits it, load glass alternatively on the right, center, and left.

If they load glass on one section of the conveyor all the time, it will cause the brush bristles to wear unevenly across the face of the brush. If the brush is worn unevenly it can no longer be adjusted properly. Of course, this is not possible on a vertical washer.

10.2 BRUSH AND ROLL MAINTENANCE - ROLLS

1. The top pinch rolls should be adjusted so that they just touch the lower conveyor rolls very lightly. The full weight of the top rolls must never rest on the bottom rolls. If this happens, flat spots will develop in the rubber covering of the roll, which can cause marks on coated glass.
2. The rolls in the drying and unloading sections must always be clean and free of cuts or gouges. The glass is clean when it leaves the last rinse brush. If there is any debris on the drying section rolls, it will be deposited on the clean glass. Cuts or gouges in these rolls can cause water streaks on the glass in the drying section.

11.0 A PLAN FOR SUCCESS

Protect your investment and make maintenance a priority. We recommend using a maintenance schedule with a checklist. You can find a copy in your Maintenance manual. This will keep everyone from operators to management on track with who did what, and when, ensuring proper care is performed.



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11.1 A PLAN FOR SUCCESS - DAILY START-UP PROCEDURES

Another item we recommend is a daily start-up schedule posted on the control panel or as near to the machine as possible where operators cannot miss it.

11.2 A PLAN FOR SUCCESS - TROUBLE SHOOTING GUIDE

A good source for diagnosing problems is a trouble-shooting guide included in your maintenance manual. If you have a problem, it's best to look here first for a solution rather than making changes to the machine that might cause other more serious problems. If a solution cannot be found, please contact the Billco Service Team at 724.452.7390.

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Well, that covers the items required for optimum glass washer performance. Following are a few other items that I would like to mention, that are also very important issues related to optimum glass washing technology.

12.0 PRE-SPRAY ZONES

A Pre-Spray is an optional item that is available for glass washing machines. Glass loaded into your washer can have all sorts of debris on it from manufacturing and shipping. This can include various chemicals, cutting oil, Lucite, clay, dust, sticker glue, and perhaps some more debris you might have put on the glass like edge grinding materials.

All this debris places quite a load on a glass washer to remove everything in the short space and time the glass will spend in the machine.

The primary purpose of a Pre-Spray is to remove the loose debris from the glass before it reaches the wash section of the machine. This reduces the amount of work required by the wash section, and also minimizes contamination of the wash and rinse sections of the machine.

This Pre-Spray section is mounted on the load conveyor of the washer, and consists of a sheet metal housing which supports one or two pair of spray lines with spray nozzles. Pre-Spray zones can also be integrated into the body of the washer during the build process.

This unit generally uses plant water at a minimum of 40 PSI pressure. However, for best results, the pressure should be 80 PSI or more.

If your washer is not already equipped with a Pre-Spray, I would urge you to consider adding one.



13.0 STATIC ELIMINATION

Have your operators ever complained about getting shocked when they unload glass from the washer conveyor, or have you found a light coating of dust particles on the glass when it exits the washer? I'm sure some of you have heard these complaints. In some plants it never happens. In other plants it only happens in the winter or in climates where the atmospheric conditions are very dry.

Basically it is a build-up of static electricity on the glass as it passes through the machine. It is caused by the combination of rubber-covered rollers, nylon bristles in the brushes, and the high velocity of air rushing through the air knives.

Now that we know it exists, how do you stop it? There are two things you can do:

1. Be sure the machine frame is well grounded to a suitable source like a water pipe or building column.
2. If this doesn't work, then purchase a Static Elimination System. This kit consists of a pair of specially designed bars and 110 Volt power supply. The bars are mounted above and below the pass line, immediately after the drying section. As the glass passes between the bars, the static charge in the glass is drawn off.

14.1 LOW E GLASS

As you know, there are two types of Low-E coatings:

1. Pyrolytic coating (or hard coat) - is sprayed on the semi-molten clear glass during the float glass manufacturing process. For washing purposes, a pyrolytic glass coating has the same physical properties as clear float glass.
2. Vacuum coating (or soft coat) - is applied to clear float glass in a multiple vacuum chamber process, sometime after the float glass was produced. In general, vacuum coatings require more care during washing, than pyrolytic coatings or clear float glass.

Cleaning Low-E coated glass does not require a special glass washing machine. However, it does require some special features, and a different approach or commitment to maintaining a glass washer.

14.2 LOW E GLASS – PROCEDURES FOR CLEANING BOTH BOTH TYPES OF COATINGS

You must keep the washer very clean.

The washer must be adjusted perfectly, with a minimum of roll and brush pressure.

The roll covering in the last rinse and drying sections must be perfectly smooth and clean, with no cuts, gouges, or other imperfections.



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The spray lines and holes or nozzles must be clean and clear, and water flow must be to the manufacturers original flow rates and pressures.

Use a detergent that you have tested with samples of the coated glass you are processing. You should also consult the glass supplier for any recommendations they may have.

Most suppliers of coated glass now recommend 140°F (60° c) wash water temperature.

You should never stop the glass part way through the washer.

Treated rinse water is recommended.

Cold glass should be raised to room temperature before processing.

14.3 LOW E GLASS - ADDITIONAL PROCEDURES FOR VACUUM (SOFT) COATINGS

For processing vacuum coated glass, there are a few additional recommendations:

It is recommended that brushes with softer than standard bristles should be used in the washer. Your Glass Washer manufacturer or coated glass supplier can make a recommendation.

Glass washer cleanliness, adjustments, and condition are absolutely critical. A good rule of thumb to use: The washer should be in as close to brand new condition as possible.

The washer should be thoroughly cleaned once a week. Low pressure steam cleaning of the internal sheet metal surrounding the brushes, inside the tanks, and water collection pans is recommended.

Note: It is extremely important that high pressure cleaning never be used. Direct contact of high pressure water on the bristles will cause matting of the bristles and lead to replacement of the brushes.

For best cleaning results, the glass should be washed within 2 hours after cutting.

14.4 LOW E GLASS – LOW E SURFACE DETECTION SYSTEM

You can install a detection device on the load conveyor to assure that the Low-E coated surface is always facing upward (as it should be), as it is processed through the washer. This is a simple yet effective way to minimize errors.

15.0 HOW DO YOU CHECK TO SEE IF THE GLASS IS CLEAN?

Now that you have done all these things to assure that your Glass Washer is performing properly, how do you check to see if the glass is clean?

To assure that the glass surfaces are suitable for the next fabricating process, there are several methods that are used in our industry to check the glass surfaces as the glass exits the washer.



Note: an asterisk indicates a test that is normally performed in a laboratory

Intense Light for Visual Inspection

- The most commonly used method in the Glass Industry
- Normally fluorescent lighting under off-load conveyor of Washer
- Can be used to detect 10 micron or greater particles, heavy stains or marks.
- Cannot detect light stains.
- Normally detects defects that will be seen when installed in a home or office.
- Low-e glass will generally show marks on glass that may not show on clear glass.

Water Break Test

- Wet a section of glass with mineral-free water
- A beading action indicates dirty glass
- Cannot detect contamination such as minerals or salt deposits

Steam Test

- Apply steam to cool glass
- Contamination will usually show when water vapor condenses on the glass.

Water Droplet Contact Angle *

- Can detect the presence of films or contaminants with a different surface energy than the glass.
- Requires a piece of hardware to read the droplet angle accurately
- Can only test a small area at a time.

Dusting using Titanium Dioxide Pigment Powder *

- Requires a piece of dark colored, privacy glass
- Hand clean the glass vigorously with a solvent, then run glass through Glass Washer.
- Apply powder using a blush brush, as if you were looking for fingerprints
- It shows contaminants, and the water relief patterns from the air knives.
- Very difficult to interpret results

16.0 INTERPRETING MARKS FOUND ON GLASS AFTER WASHING

If there are marks on the glass, one must carefully examine the marks for clues as to what actually caused them. Determining the exact location of the mark helps to speed-up the process of eliminating the marks.



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What is the mark...is it a scratch, smudge, squiggly streak, glass defect, stain, random mark, or a repeating mark?

Here are some things to look for:

Scratches can be caused by glass chips in rollers or brushes, or by sagging spray pipes. Scratches can also be caused by processes prior to the washer, like seaming tables.

Smudges can be from finger prints, glue from stickers left on the glass, or dirty marks on rollers, especially on rollers in the drying area.

Squiggly streaks are generally caused by minerals in the rinse water being dried on the glass in the drying area. I covered this earlier in my presentation.

Defects in glass are generally permanent, and cannot be removed by the brushes in a washer.

Stains are usually caused by condensation forming on the glass during shipping or storage. In most cases, these stains have permanently changed the surface of the glass and cannot be removed by brushes and / or chemicals.

Random marks can be glass defects, debris falling on the glass in the drying section or offload conveyor, or droplets of algae dropping on the glass in the rinse section.

Repeating marks are usually caused by dirt or an oily mark on a roller in the drying or off-load section. The distance between the marks usually corresponds to one revolution of a roller. The marks are generally in a parallel line.

When investigating a mark on the glass, it is important to determine what surface the mark is on, and the direction of the mark, as it relates to the conveying direction. Knowing this information will help you identify where in the washer you need to look to find the source of the mark.

One final thing to remember....if it is necessary to remove a mark by scraping it with your fingernail, or vigorous rubbing with a rag, then it is unlikely that the Glass Washer brushes will remove it. This applies to sticker glue as well.

17.0 CLOSING

This concludes my presentation. I will leave you with one final comment about the importance of your Glass Washing Machine.

YOUR GLASS WASHER REPRESENTS A LARGE MONETARY INVESTMENT, BUT MOST IMPORTANT, ITS OPERATION, OR LACK OF, CAN SERIOUSLY EFFECT YOUR PRODUCTION CAPABILITY, YOUR PRODUCT QUALITY, AND EVEN YOUR PRODUCT WARRANTY.



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Thank you for reading this article, and may your glass cleaning always result in consistently pristine surfaces!

Written by: Bob Lang, Solution Specialist at Billco Manufacturing Inc.