

# 1. **Chemical-Concentration Management**

This section discusses the following topics:

- Chemical: General
  - Selecting the right chemical
  - Selecting the right concentration
  - Maintaining the proper chemical charge
  - Problems
    - Foaming related to chemical concentration
    - Supersaturation of solution
  - Charging the power washer with chemical
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## 1.1. **Chemical: General**

Your MART Power Washer uses an aqueous (water-based) alkaline cleaner, not a solvent. When charged with a *light* concentration of cleaner, the washer will give you excellent cleaning results. Generally, *light* means a 2-5% concentration by volume of any high quality non-foaming chemical compound.

Good chemical management should be done on a daily basis. Check the concentration of the cleaning solution and adjust it as necessary -- this is important not only for cleaning results, but it will also reduce cleaning time and other chemical-related problems such as foaming.

You must also use some chemical during the cleaning cycle in order to prevent corrosion (rusting) damage to the washer itself.

Most chemicals provide adequate corrosion prevention at low concentrations, but some do not. Generally, to prevent corrosion the pH of the solution must be above 10.5. Your MART Service Tech. can discuss with you in more detail the pH requirements, and which chemicals may cause corrosion. If you do not know what your solution pH is, you must monitor it to verify that it is kept above 10.5.

MART Power Washers are aqueous based cleaning systems. They are designed and manufactured to work with wash solutions that are of the same specific gravity and viscosity as water. Chemicals or additives, which alter the specific gravity or viscosity of the wash solution, will change the overall performance of the system. Use only chemicals that are designed for use in aqueous systems.

## 1.2. Selecting the Right Chemical

When you select a chemical, *first* determine the compound best suited for the type of metal or part. *Second*, take into account the type of soils to be removed.

Use the following guidelines in selecting the right chemical:

**Type of Metal** for **ferrous metals**, such as cast iron or steel, select a caustic compound containing sodium hydroxide or potassium hydroxide.

For **non-ferrous metals**, such as aluminum, select compounds specifically designed to wash parts without destroying them. Such compounds contain, for example, sodium metasilicate, trisodium phosphate, and sodium bicarbonate. The compound may also contain a small percentage of inhibited caustic, to make it more aggressive, without damaging the metals.

**WARNING!** *Exposing aluminum to a high concentration of caustic chemical, such as sodium hydroxide or potassium hydroxide, will blacken the surface of the parts being cleaned, and, if exposed for five minutes or more, can etch the surface.*

**Type of Soils** A wide of range of compounds is available to remove soils. Each compound reacts differently with the soils -- some are more aggressive than others at "popping" certain soils from part surfaces. However, no compound removes all types of soils equally well.

To select a chemical, decide which soils you most want removed.

For further details on various chemical compounds and their suitability for your application, call your MART Service Tech to discuss your requirements, or contact your chemical supplier.

**WARNING!** *The selected chemical must prevent corrosion to the steel parts in your washer. Generally, a solution pH above 10.5 is required. Do not use chemicals that cause corrosion, or that cause a solution pH below 10.5.*

**WARNING!** *The selected chemical must be non-foaming.*

## 1.3. Selecting the Right Concentration

The MART Power Washer is a high-pressure, high-temperature cleaning system that uses a balance of the following factors to achieve cleaning results:

$$\text{Power} \times \text{Temperature} \times \text{Chemical} \times \text{Time} = \text{Clean}$$

Because the *exact* combination of these factors depends on your shop's cleaning standards and operating requirements, specific chemical concentration recommendations are not possible. Below are formulas for calculating the amount of chemical needed to charge a reservoir of water for cleaning. To use these you will need to know the volume of your washer's reservoir and the recommended initial chemical concentration. Select the formula to use based on whether your chemical is powder or liquid.

For Powder:

Reservoir Size (gal) x Recommended Concentration (oz/gal) = lbs. of Chemical to add.

Divided by 16 oz. / lb.

For Liquid:

Reservoir Size (gal) x Recommended Concentration (oz/gal) = gals. of Chemical to add.

Divided by 128 fluid ozs. / Gal

You must test and adjust the variables in your application to determine an effective chemical type and concentration.

Chemical concentration depends on:

- Your cleaning standards
- Type of metal or material being cleaned
- Shape of parts
- Type of soils to be removed
- Rate of speed required in cleaning
- Operating temperature of the washer
- Water hardness

Every chemical compound has an optimal operating temperature range. Generally, chemical is more aggressive at higher temperatures. As a general rule, for every 10° F

(6° C) rise in temperature, a chemical reaction doubles in speed.

The MART Chemical Group offers a complete range of chemicals for use in MART Power Washers. They can help you select the proper chemical from our Power Kleen line and recommend an appropriate initial chemical concentration.

If you are using your own chemicals contact your chemical supplier for details -- and adjust your MART Power Washer's chemical concentration accordingly.

## **1.4. Maintaining the Proper Chemical Charge**

After you have developed an effective chemical concentration, as described in the previous section, you must monitor and maintain it for optimal cleaning results and washer performance.

Initially, you could start by monitoring chemical concentration weekly (or, every 40 hours of washer operation). However, you should develop a monitoring schedule based on the frequency of washer operation, degree of cleanliness required, the types of soils to be removed from parts, and so on. Your monitoring schedule should account for all the variables in your application in order to give you the best cleaning results, while using the least amount of chemical possible.

For help in developing a chemical-concentration-monitoring schedule, call your MART representative to discuss your application(s) and requirements, or contact your chemical supplier.

There are two fast and accurate monitoring methods:

### **1. Titration Test**

Perform this test to determine the concentration of chemical by titrating the alkalinity of the solution with an indicator and a drop count.

The results determine the number of ounces of chemical to add per gallon of water-capacity.

Refer to manual chapter "*Maintenance*" for procedural information.

### **2. Conductivity Test**

Conductivity testing equipment is optionally available from MART. Refer to manual "*Options*" if you have purchased a conductivity controller and probe equipment for your washer.

## 1.5. Problems

There are two principal problems related to managing chemical concentration:

- Foaming
- Super saturation of solution

For related information, refer to manual chapters "*Maintenance*" and "*Troubleshooting*."

### 1.5.1. Foaming Related to Chemical Concentration

Foaming can occur for these reasons:

- Chemical compound
- Type of soils being removed
- Improper solution temperature

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#### Chemical

the de-foaming component in a chemical compound represents only a small percentage of the total compound. And, de-foaming component percentages vary from compound to compound. Since the washer requires only a light chemical charge, you may need to add a "*booster charge*" of *de-foamer*, if foaming is a problem.

Consider adding a defoaming agent rather than more chemical, given the following conditions:

- Your cleaning needs are being met.
- You have determined that the type and amount of chemical are appropriate for the soils being removed.

- You have determined that the washer's operating temperature is appropriate for the type of soils, and the type and amount of chemical.

## **Soils**

The type(s) of soils can react adversely with the chemical during cleaning to cause a foaming problem. Select a chemical that is appropriate for the soils to be removed. It is also a good idea to check with your MART representative or your chemical supplier to be sure that the type and amount of chemical are appropriate for the following:

- Type of metal
- Makeup of part(s)
- Operating temperature of the washer

## **Temperature**

Test and adjust the washer's operating temperature to determine what is optimal for your chemical. Remember that altitude, water hardness, and types of soils can also affect the temperature-and-chemical reaction. Refer to section "*Temperature Adjustment*" in this chapter.

If you need to discuss your application(s) and requirements, call your MART representative or contact your chemical supplier.

## **1.5.2. Super saturation of Solution**

The MART Power Washer is a closed-loop cleaning system. It re-uses the cleaning solution without discharging it for treatment or disposal.

When the cleaning solution is fully saturated with greases and oils, merely adding more chemical will not improve cleaning results -- the volume of emulsified greases and oils is greater than the grease to be removed and has no where to go. This condition is called *super saturation of solution*.

To correct this problem, you must remove *greases and oils* from the solution. Allow solution to cool and oils to rise to surface, then:

- Manually skim greases and oils from the front reservoir; change the solution.
- Or -
- Run the optional **Oil Skimmer** device. If you have purchased one from MART, refer to chapter "*Options*" in this manual.

As part of the sludge clean-out procedure, you will clean out/re-charge the power washer with chemical. Refer to chapter "Maintenance" for the sludge clean-out procedure.

## 1.6. Charging the Power Washer with Chemical

If you have successfully completed the startup procedure to this point, you are ready to charge the washer with chemical.

When you charge the washer with chemical, always follow the chemical manufacturer's recommendations.

In general, most manufacturers recommend 4-6 oz. (120ml - 180ml) of chemical per gallon of water.

***WARNING! When handling chemicals, always wear gauntlet-type thermally protected and water-repellent protective gloves, protective eyewear, a filter-type air mask, and a full body apron that is thermally protected and water-repellent. Use a long-handled shovel only, when working with or dispensing granular chemical. (Some chemical is liquid.)***

For **granular chemical**, follow this procedure:

1. Open and secure Power Washer door.
2. Using a Long-handled shovel and wearing protective gear and clothing, slowly place chemical on the false floor in the rear of the MART Power Washer. Do not dump chemical directly into washer reservoir. Violent exothermic (heat released) reactions, splashing of chemically and physically heated solutions and the premature release of fumes may occur. Avoid contact with chemical and solution. Avoid inhaling dust and fumes.
3. Close the washer door and start the pump to dissolve the detergent. Operate the wash cycle @ 160 to 190 degrees F.

For **liquid chemical**, follow this procedure:

1. Turn the *main power supply OFF*.
2. Pump out the amount of water that is to be replaced by liquid chemical.
3. Pump the liquid chemical **SLOWLY** from drums onto the false floor, or over the doorframe.

***CAUTION! Use extreme caution when pumping liquid chemical! The operator should stand back from the washer and wear gauntlet-type thermally protected and water-repellent protective gloves, protective eyewear, a filter-type air mask, and a full body apron that is thermally protected and water-repellent.***

***WARNING! Do NOT pour liquid chemical into the front reservoir.***

## 1.7 Corrosion Protection

Since alkaline cleaners are non-corrosive to ferrous metals the cost to manufacture cleaning equipment can be reduced. Stainless steel is not required for construction and protection of the reservoirs, pumps, tanks, cabinets and turntables. In fact carbon steel can be used for the reservoirs and cabinets with no detrimental effects as long as the concentration of alkalinity is maintained. With proper maintenance of your chemical concentration the carbon steel components are well protected and will provide years of service. Carbon steel MART power Washers are still in service that are 20+ years old.

***Many chemicals provide adequate corrosion prevention at low concentrations, but some do not. Generally, to prevent corrosion in carbon steel the pH of the solution must be above 10.5.***

MART Power Washers are aqueous based cleaning systems. They are designed and manufactured to work with wash solutions that have the same the specific gravity and viscosity as water. Chemicals or additives, which alter the specific gravity or viscosity of the wash solution, will change the overall performance of the system. Use only MART Power Kleen chemicals or other chemicals that are designed for use in aqueous systems.

Below is a short introduction to the complete chemical line offered by the MART Corporation Chemical Group.

## 1.8 MART Chemical Group

MART Power Kleen detergents and additives are specially formulated for use in all MART Power Washers. Power Kleen products cover a wide range of applications and most likely there is a Power Kleen product specifically designed for your particular cleaning applications. In all cases Power Kleen products provide the highest degree of efficient, effective cleaning.

Power Kleen products are highly effective at controlling foaming and are labeled "Controlled Foam" products. Additional defoamer products are available to help in difficult foaming situations.

Power Kleen products remain effective longer than many other detergents used in cabinet washer applications and, in many instances, less Power Kleen detergent is required for a given application. Power Kleen chemicals have 100% concentrated active ingredients. The reason MART compounds remain active longer is that they contain NO fillers. Other chemical suppliers may "fill" or bulk up their chemistries with non-active ingredients that do nothing except fill up the chemical drum. These fillers end up as sludge in the bottom of the Power Washer and must be disposed of, thus adding to the disposal costs. Since MART Power Kleen is fully active chemistry 100% of the chemical goes to work cleaning your parts. As a result, your cleaning dollar goes further and your disposal costs are less.

## 1.9 Recommended Chemicals

### **Power Kleen I – Iron and Steel**

Fast acting, long lasting Power Washer detergent for removing heavy oils and grease, many types of carbon, and other deposits from all ferrous metals.

### **Power Kleen II – Aluminum Safe**

Multi-Metal, biodegradable Power Washer detergent for removing oil, grease and dirt from both ferrous and non-ferrous materials.

### **Power Kleen IIIP – Electric Safe**

Powdered Power Washer detergent for removing oil, grease and dirt from electric motors, generators, etc. Rinses completely with no conductive residue.

**Power Kleen III** – Electric High-rinse

Liquid Power Washer detergent for removing oil, grease, and dirt from electric motors, generators, etc. Highest rinsability factor with no conductive residue.

**Power Kleen IV** – Aerospace

Specially formulated Power Washer detergent for removing carbon, grease, and dirt from Aerospace Metals, Aircraft Parts, and chemically sensitive space age metals.

The MART Corporation web site [www.marttechservice.com](http://www.marttechservice.com) is a vast information base for cleaning chemistry and has complete information for the entire Power Kleen line of chemicals. At the site you may download MSDS sheets for each product and find more in depth application data for each product. Optionally, you may call MART Chemical Sales and Technical Services staff who are trained to help customers select the most appropriate product for their specific cleaning applications and answer questions regarding chemical use and application.