



MART® Chemical and Cleaning Technology

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1. Cleaning Technology

MART defines the term to clean as to overpower soils. The MART Power Washer is a high-impact pressure, high-temperature, water-based cleaning system that uses a combination of the following factors to achieve cleaning results:

Power x Temperature x Chemical x Time = Clean

A fifth factor, when appropriate, is wet grit blasting which means recycling the grit that is removed and blasting these particulates back at the parts being cleaned. The relationship of these cleaning elements can be varied in an infinite number of ways to achieve the same level of cleanliness. Your own requirements determine the relative value of each variable. Keep in mind that the MART Power Washer, a patented cleaning process, provides the highest blasting energy in the cleaning industry, thus allowing you to reduce wash-cycle times to a minimum and often achieve superior cleaning results. In addition, the high blasting energy of the MART allows you to clean in shorter wash cycles to save energy, and further reduces operating cost by using less chemical than conventional jet spray washers.

The exact combination of the factors must be determined for your application, based on the types of soils to be removed, the degree of cleanliness required, the cycle time required, the types of parts to be cleaned, and so on. The MART system provides the flexibility to optimize the cleaning process.

How the MART Power Washer Works

The Power Washer operates on a timed cycle. The operator places the parts to be cleaned in the Washer on the turntable, closes and latches the door, and then starts the timed cleaning cycle.

During the cleaning cycle, a high-temperature, high-pressure, water-and-detergent cleaning solution blasts soils from the parts. After the cycle has stopped and the steam has exhausted, the operator removes the cleaned parts. The Power Washer utilizes closed loop, waste minimization technology, continuously reusing its cleaning solution and effectively reducing the potential for pollution. (Note that the optional EQ-1 Wastewater Processor and Clean Machine further reduce pollution.) And, because the Power Washer is fully enclosed and the high pressure, high temperature blasted solution is confined within the Cabinet, the process is safe for the operator.

In order to better understand how the factors affect cleaning, let's look at each one more closely:

- Power
- Wet Grit Blasting
- Temperature
- Chemical
- Time

1.1 Power

The first key factor in the ability of the Power Washer to clean is power -- the blasting energy required to strip a specific type of soils from parts.

Pressure and Flow = Power

Power means the physical forces that remove the soils. The following formula expresses in horsepower (HP) the "cutting power" of the solution blasted from each nozzle tip:

$$\text{HP} = (\text{GPM} \times \text{PSI}) / 1714$$

where GPM (gallons per minute) = flow per nozzle
where PSI (pounds per square inch) = pressure

In general, MART systems, depending on pump size, blast with four to 100 times more "cutting power" than conventional jet spray machines.

What really counts, however, is impact pressure -- the force of the energy blasted at the target surface. It is impact pressure that most directly affects how quickly and effectively the soils are removed. The impact per square inch of a given nozzle depends on the following:

- Flow and pressure produced by pump
- Flow and pressure per nozzle
- Nozzle design
- Manifold-to-Nozzle transitions
- Spray pattern distribution
- Spray angle

MART Power Washers achieve an optimal balance of these factors to provide the highest impact pressure at the part surfaces.

1.2 Grit

Closed-Loop System And Wet Grit-Blasting

The MART Power Washer is a closed-loop system. This means that none of the washing or rinsing solution is discharged from the cabinet for treatment or disposal. Therefore, as soils are removed from parts, a patented feature reclaims the grit (when appropriate) and blasts it back at the wash load to provide a vigorous scouring action without any damage to parts. Thus, the grit becomes a valuable cleaning medium and actually acts to increase the impact pressure.

Note: In applications where the wet grit blasting is not desired, MART can provide fine filtration, including sub-micron filtration, to remove all particulate prior to its discharge from the nozzles.

In terms of results, wet grit blasting means that the dirtier the power washer gets, the faster it cleans. This feature is desirable for most rebuilding applications and some manufacturing ones as well.

1.3 Temperature

As temperature increases, grease and oil become more fluid; that is, their viscosities decrease so that they flow like water and are more easily removed. Since grease and oil are the primary binders that hold and contain the soils on the parts, washing temperatures above 160° F (71° C) generally produce faster cleaning results.

In addition, chemical is more aggressive at higher temperatures. As a general rule, for every 10° F (6° C) rise in temperature above 160° F, a chemical reaction doubles in speed.

1.4 Chemical

Chemical is the third key factor in overpowering soils and removing them from the surface of parts. While chemicals are necessary to enhance the cleaning process, a MART Power Washer does not rely primarily on chemical concentration. Impact pressure, cleaning time and temperature are also critical in obtaining the desired results.

The primary soil removal action in a POWER WASHER is hydraulic force. Thus most soils are blasted off the parts. Sufficient time is required for total soil removal, and cycling times will change depending on the nature of the soils to be removed. The temperature of the cleaning solution also effects the amount of solids removed by the primary impact forces. The higher the temperature the more grease, oils and waxes will be melted and floated away. The final key factor in overpowering the soils is the alkaline cleaner that plays additional roles in the cleaning process. Besides wetting the soils and releasing them from the substrate, the cleaner also plays a critical role in what happens to the soils after they are dumped into the cleaner bath and must be disposed of. Since the alkaline cleaners have a greater affinity to the surface of the parts than does the soil, it undercuts the soil and "pops" it from the surface. Light oils float to the bath surface where then can be skimmed, and heavy soils sink to the bottom where they can be collected as sludge and pumped or dragged out for removal.

Chemical is a key factor in optimizing the cleaning process by overpowering soils and removing them from the surface of parts. While chemicals are necessary to enhance the cleaning process, a MART Power Washer does not rely primarily on chemical concentration. In order to select an appropriate chemical you must first determine your cleaning needs, such as:

- Nature and composition of the substrates
- Required degree of cleanliness
- Nature of the soils to be removed
- Pump size and performance requirements
- Size, shape and surface of the parts to be cleaned
- Applications and usage of the Power Washer in your shop

Because a MART Power Washer can be customized and configured to specific requirements, the MART system can successfully meet cleaning standards when

charged with a light chemical concentration as compared to conventional jet spray washers. In general, this means that a 2-5% concentration by volume of a quality non-foaming chemical compound will give excellent cleaning results. However, like temperature and power, the exact type and amount of chemical are subjective and depend on your specific needs.

Chemical cleaners fall into three general categories:

- Organic solvents
- Emulsion cleaners
- Aqueous (water-based) alkaline cleaners

MART systems use aqueous (water-based) alkaline cleaner and not solvents, so you don't have to deal with solvent vapors or hazardous-waste contaminants. Generally, an aqueous cleaner is a solution composed of water, any combination of inorganics such as caustic and silicates, phosphates, acids, chlorates, or soda ash and a organic components including chelators, surfactants, emulsifiers, water softeners and corrosion inhibitors.

Soils are usually rejected by the cleaner, which means that the soil can easily be removed by any of several common methods, such as disc or belt oil skimming devices or sludge scrapers. The cleaner can therefore be recycled and reused.

A sequestrant is a binding agent that prevents undesirable chemical reactions, such as those that would form insoluble products like hard-water soap scum. The surfactant is a substance that lowers surface tension in order to penetrate and loosen soils. It coats oil droplets to prevent them from recombining. A corrosion inhibitor slows down the rate of chemical reaction that produces rust.

The water-based alkaline cleaner works by undercutting the soil, then "popping" it from the part surface. Light oils float to the surface where they can be skimmed or filtered off. Heavier soils sink to the bottom, and can be filtered or removed as sludge.

A key feature of this type of cleaner is that you only have to dispose of the contaminants as waste -- the Power Washer can recycle the liquid indefinitely, with replenishment of the chemical concentration by "sweetening" as needed.

Removal of Soils

The water-based alkaline cleaner readily removes the following soils:

- Cutting Oils
- Mill Markings
- Carbon Dust
- Paint & Ink
- Cosmolene
- Grease
- Low-melt waxes
- Rust preventatives
- Road soils
- Oil and chips

- Shop dirt
- Diesel carbon
- Finger prints
- Coolants
- Varnish

Note: that coatings such as epoxy, polyurethane and baked enamel cannot be removed by washing.

Applications

The water-based alkaline cleaner has many applications. It is successfully used, for example, in the following ways:

- Pre-cleaning cores before dismantling
- Final prep for plating
- Removal of chips and oils
- In-process finishing before packaging
- Final prep for painting
- Final prep for anodizing
- Soil removal prior to machining

Usage advantages of Alkaline cleaning processes

- Most parts "flash"-dry within a minute or two after removal from the washing cabinet
- A layer of corrosion inhibitor protects parts that sit for some time before the next in-process operation. The corrosion inhibitor can easily be removed by a water rinse. An optional Auto Rinse Cycle (ARC) will remove all chemicals and oils with heated fresh water to "flash"-dry parts without rusting.
- All washed parts and materials are clean and paintable without further preparation
- The cleaner is reused and will last a long time. (2 to 16 weeks or longer)
- Reduce toxic air emissions and thus improve the employee health environment
- Aqueous cleaners are forgiving and yielding consistent results within a range of concentrations
- Remove chips whereas solvents do not
- Will not dissolve heavy metals
- Don't contribute to VOC emissions

1.5 Time

Time lets power, temperature, and chemical do their work to overpower soils and remove them from parts. If soils are heavy and built-up, for example, setting a longer wash-cycle time will clean the parts.

MART Power Washer wash-cycle times are more efficient than those of conventional washers, due to the greater blasting power of the system. This power comes from the following:

- MART pump technology that produces the hydraulic energy
- MART oscillating Power Blast Manifold that directs the energy into all the deepest recesses of the wash load

2. Chemical-Concentration Management

This section discusses the following topics:

- Chemical: General
- Selecting the Right Chemical
- Selecting the Right Concentration
- The MART "Power Kleen" Advantage
- Maintaining the Proper Chemical Charge
- Chemical Measurement
- Correlating Titration and Conductivity Measurements
- Challenges
- Foaming Related to Chemical Concentration
- Super saturation of Solution

2.1 Chemical: General

MART systems use specifically formulated aqueous (water-based) alkaline cleaning chemicals, not solvents or chlorinated hydrocarbons. In an aqueous alkaline cleaner the main ingredient -- water -- is a powerful universally safe solvent whose cleaning abilities are enhanced by a designed mixture of additional components. There are many kinds of alkaline cleaners ranging from dishwashing detergent and laundry detergent to caustic soda. Because some of the earliest examples of alkaline cleaners were made by kitchen experimenters mixing lard and potash to make soap, many people refer to Power Washer chemical as soap. Today aqueous cleaners represent state-of-the-art metal cleaning technology that many refer to as the only long-term solution to the environmental and economic problems of industrial cleaning. A low concentration of 100% active chemical (3-5% by volume) is normally all that is required to achieve the desired cleaning result in a MART. A variety of factors affect the selection of the type and concentration of the alkaline chemical to use.

When charged with a light concentration of cleaner, the Power Washer will give excellent cleaning results. Generally, light means a 2-5% concentration by volume of any good quality non-foaming chemical compound.

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

Corrosion Protection

The fact that alkaline cleaners are non-corrosive to ferrous metals means that the cost to manufacture the equipment is far lower. 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 effects. As long as a minimum concentration of alkalinity is maintained, the steel components

are well protected and will provide years of service. Plain carbon steel POWER WASHERS are still in service that are 25+ years old.

Most 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 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.

2.2 Selecting the Right Chemical

When selecting 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 or zinc diecast, 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 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 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. Decide which soils you most want to remove, and then select a chemical that will do the work.

2.3 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:

Power x Temperature x Chemical x Time = Clean

Because the exact combination of these factors depends on a shop's cleaning standards and operating requirements, only chemical types and general concentration recommendations are possible.

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
- Makeup of Part
- 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 rule, for every 10° F (6° C) rise in temperature, a chemical reaction doubles in speed.

2.4 The MART Power Kleen Advantage

MART Power Kleen detergents and additives are specially formulated for use in recirculating cabinet washers. As a result you are assured that there is a product specifically designed for any particular cleaning application, and that all Power Kleen products provide the highest degree of efficient, effective cleaning.

Power Kleen products have been proven safe for a wide variety of surface materials, from ferrous and non-ferrous metals, to rubber, plastic and electrical insulation, and have been proven effective at removing a wide variety of contaminants including oils, greases, lubricants, carbon, paints, scale, road soils and other soils encountered in maintenance and production cleaning applications. No other compounds available today are more effective at cleaning than MART Power Kleen detergents.

Power Kleen products, having been specially formulated for use in cabinet washers, are highly effective at controlling foaming and are labeled "Controlled Foam" products. In addition, 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 that MART compounds remain active longer is that they contain NO fillers. Many chemical suppliers "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 washer and must be disposed of, thus adding to the disposal costs. With MART Power Kleen you get fully active chemistry and 100% of the chemical goes to work cleaning your parts. As a result, your cleaning dollar goes further and your disposal costs are less.

MART Chemical Sales and Technical Service staff is trained to help customers select the most appropriate product for their specific cleaning application. MART specializes in solving difficult cleaning problems and achieving the best possible solution to these problems. MART has been helping customers solve cleaning problems for over 30 years so chances are, when someone calls with a problem, MART has solved the problem for another customer and can quickly provide a solution that works.

Power Kleen I Rust Stripper

A premium quality, concentrated, foam-controlled, powdered alkaline cleaner and rust stripper for steel and cast iron that, in one cleaning step, is highly effective in the removal of grease and oil deposits and stubborn carbon deposits, along with rust buildup. This product is equally effective in hard or soft water, and does not attack base metal so part dimensions are preserved.

Power Kleen II – Aluminum Safe

Foam controlled, inhibited alkaline powdered detergents safe for ferrous and sensitive metal parts, rubber or plastic parts and electrical insulation. These products provide excellent cleaning of heavy greases, lubricants, carbonaceous soils and other commonly encountered soils without creating objectionable odors. In many applications, Power Kleen II and Power Kleen I perform well at lower temperatures (130° F) and short cycle times with extended change out intervals providing a very cost effective cleaning. These products can also be used in agitated soak-tank applications.

Power Kleen III-L Alkaline Spray Wash Detergent

A liquid, inhibited alkaline, foam-controlled detergent specially formulated for cleaning grease, oils, carbon and dirt from electric motors, generators, traction motors, alternators and other general equipment during the rebuild process. Power Kleen III-L is formulated to rinse quickly and completely, leaving no residue to attract moisture and cause conductivity problems in electrical equipment. While formulated for electrical equipment, this product has proven itself as a great performer in general equipment rebuilding operations by rapidly removing oils, greases and other dirt and carbonaceous soils commonly encountered in maintenance and rebuild operations.

Power Kleen III-P Alkaline Detergent

An inhibited alkaline, powdered, foam-controlled, inorganic detergent specially formulated for removing grease, oils, carbon and dirt from electrical equipment and parts during the rebuild process. Power Kleen III-P reduces conductivity problems by rinsing completely and drying thoroughly, leaving no residue to attract moisture. It will not attack electrical insulation and varnishes and contains no silicone to interfere with new coatings or paint.

Power Kleen IV Aircraft Parts Cleaner

An aqueous liquid, alkaline, foam-controlled detergent specially formulated for cleaning brake dust, grease, dirt, skydrol, rubber residue, brake residue and loose paint from a wide variety of aircraft components such as wheel and brake parts, engine parts, landing gear components, etc. Power Kleen IV does not contain any petroleum distillates or chlorinated solvents so it reduces chemical costs and waste disposal costs over most solvent cleaning systems. It contains buffers for the protection of aluminum and will not harm high-strength alloy parts. Power Kleen IV can be used at lower concentrations as a pre-cleaner prior to manual or solvent detail cleaning.

Power Kleen Defoamer A

A concentrated non-silicone defoamer that is specially formulated to control foam in industrial spray cabinets, continuous spray systems and agitated hot tanks. Defoamer A is effective in oil-laden or detergent-laden systems and does not inhibit or interfere with the cleaning in any way. It allows long wash cycles without interference from foam buildup. Power Kleen Defoamer A requires very low usage amounts and contains no residue-causing silicone so it will not cause paint adhesion or fish-eye problems.

Power Kleen RI Rust Inhibitor

A liquid, inorganic rust protection for the in-process and short-term storage of steel, iron and yellow metal parts. Power Kleen RI is concentrated for protection at low-use, low-cost levels.

Chart on Following Page...

PRODUCT	TYPE	MATERIALS CLEANED	MATERIALS REMOVED
Power Kleen I Rust Stripper	Inhibited alkaline: Powdered	Ferrous metals; sensitive metals; rubber or plastic parts; electrical insulation, ink tubs, equipment & parts except for aluminum or magnesium	Mill oils, heavy greases, lubricants, carbonaceous soils and other soils commonly encountered in maintenance and production cleaning operations.
Power Kleen II Aluminum Safe	Inhibited alkaline Powder	All metals, including aluminum; rubber or plastic parts; electrical insulation,	Oils, heavy greases, carbonaceous soils and other soils commonly encountered in maintenance cleaning applications.
Power Kleen III-L	Alkaline: Liquid	Electrical motors and equipment. Aviation and Aircraft parts.	Oils, greases, carbonaceous soils and other soils commonly encountered in maintenance cleaning applications.
Power Kleen III-P	Inhibited alkaline Powder	Electrical motors, generators and related equipment. General parts in equipment rebuild operations.	Oils, greases, carbon residue and other carbonaceous soils and dirt commonly encountered in maintenance and rebuild operations. Inks, oils and other soils encountered in ink manufacturing and maintenance operations.
Power Kleen IV	Alkaline: Liquid	Ferrous and sensitive metals. Specifically formulated for cleaning aircraft brake parts.	Oils, heavy greases, carbonaceous soils, rubber- based soils and other difficult soils commonly encountered in maintenance cleaning applications.
Power Kleen Defoamer A	Liquid	Compatible with all Power Kleen detergents	Reduces foam in spray cabinet operations that produce excessive foam.
Power Kleen RI Rust Inhibitor	Liquid	Steel, iron or yellow metals.	Provides rust protection for short-term storage after cleaning.

2.5 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.

2.5.1 Chemical Measurement

When a washer is first put into service, it is easy to compute the concentration of the cleaning compound, because you started with a fixed volume of water and added a known quantity of chemical. After you begin using the washer, however, you can only estimate the chemical concentration -- until you drain the washer, clean it out, and recharge it with fresh water and chemical. There are two commonly used estimating methods:

- Conductivity measuring systems
- Titration kits

Conductivity Measurement

A conductivity measuring system measures the strength of a fixed electrical currents flowing between two or more electrodes that are held at a fixed distance. Since the addition of cleaning compounds (chemical) to water changes the capacity of water to conduct electricity, conductivity measuring systems can provide an estimate of the strength of the chemical in the solution by measuring the relative conductivity of the solution.

Unfortunately, compounds other than cleaning chemicals also affect the conductivity of the solution in the washer. These compounds include iron oxide (rust) and carbon, both commonly found in most washing applications.

This means that while conductivity measuring systems can be used as a control point, this is done with the understanding that the oils, greases, metal particles and other contaminants that are byproducts of the cleaning process affect conductivity.

Thus, the only true measure of chemical concentration is to use titration tests in conjunction with conductivity measurements to determine a correlation. Once you know the correlation, you can get a fairly accurate estimate of chemical concentration in the solution by using a conductivity measuring system.

Titration

Titration is the estimation of the strength of a compound by measuring the amount of another compound of known strength that is required to produce an observable reaction.

Almost all titration kits supplied with cleaning compounds use phenolphthalein (indicator P) as a reactant, and an acid (hydrochloric or phosphoric) as a neutralizer. The indicator P turns red or pink or blue when added to a sample of the solution. By counting the drops of acid it takes to turn the solution back to its original color, you can arrive at a good estimate of the chemical concentration.

2.5.2 Correlating Titration Results and Conductivity Measurements

To measure the chemical concentration in your cleaning solution, titrate the solution once a week and perform a conductivity test at the same time. Your objective is to learn how chemical concentration and conductivity vary from wash to wash. Set up a graph that shows the correct concentration, and then graph the actual variance in concentration and conductivity.

After several weeks of testing and graphing, you should see a pattern -- this is the correlation between chemical concentration and conductivity. Given any conductivity reading on your graph, you will most likely see a difference between the ideal and the actual chemical concentration of the solution. Use this "compensation factor" to know how to adjust chemical concentration based on conductivity readings.

After you have developed a correlation between chemical concentration (the results of titration) and conductivity measurement testing, you can use a conductivity measuring system to provide a close estimate of the strength of the chemical in the solution.

At this point, conductivity measurement can be used for one of two purposes:

- As an indicator of the need to titrate
- As an indicator of the need to add chemicals

If the correlation between conductivity and titrated concentration is close enough for the purposes of the operator, then titration should only be used as a periodic check on the conductivity measuring system.

2.6 Challenges

There are two principal challenges related to managing chemical concentration:

- Foaming
- Supersaturation of solution

2.6.1 Foaming Related to Chemical Concentration

Foaming can occur for these reasons:

- Chemical Quality
- Chemical Concentration
- Type of Soils Being Removed
- Improper Solution Temperature
- Water Hardness

Chemical

The de-foaming component in a chemical compound represents only a small percentage of the total compound. De-foaming component percentages will vary from compound to compound. Since the Power Washer requires only a light chemical charge, you may need to add a "booster charge" of defoamant, if foaming is a problem.

Consider adding a de-foaming 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 operating temperature of the Power Washer 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 to be certain that the type and amount of chemical are appropriate for the following:

- Type of Metal
- Makeup of part(s)
- Operating Temperature of the Power Washer

Temperature

Test and adjust the operating temperature of the Power Washer to determine what is optimal for your chemical. Remember that altitude, water hardness, and types of soils can affect the temperature-and-chemical reaction.

2.6.2 Supersaturation of Solution

The MART Power Washer is a closed-loop cleaning system that 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 because the grease and oil to be removed has no where to go. This condition is called supersaturation of solution.

To eliminate this condition, you must remove greases and oils from the solution. The first step is to allow the solution to cool, causing the oils to rise to surface, then:

- Manually skim the greases and oils from the front reservoir; and change the solution
- or -
- Use an **Oil Skimmer** device to remove the floating oils. MART has excellent Oil Skimmers as options for just this purpose that are available on all its Power Washers

As part of the sludge clean-out procedure, you will clean out and recharge the Power Washer with chemical.

3. Summary

There are important differences between aqueous cleaning compounds. The proper use of any chemical additive is essential to obtain clean parts while maintaining a balance of chemistry that protects the Power Washer. Aqueous cleaners are made up of a number of ingredients including builders, surfactants, inhibitors and chelators. Most cleaners come with a long list of ingredients, many of which you may not need for your cleaning application. These extra ingredients may make it difficult to maintain the right balance of chemistry for your cleaning applications. Like any product, the ingredients you don't want are at the end of the list. In choosing an aqueous cleaner that will provide you with clean parts, protect your Power Washer and reduce waste water treatment problems, go with the advice of experts. Contact a MART Technical Services Representative to discuss your specific application.