



Pacific Northwest Pollution Prevention Resource Center
Practical Solutions for Economic and Environmental Vitality.



Parts Washers: Aqueous-Based vs. Solvent-Based

Introduction

Parts washers are commonly used in auto repair shops to clean parts or components. Parts washers include cold cleaning units, vapor degreasers and conveyerized degreasers. Cleaning solutions used in parts washers include: 1) solvents, and 2) aqueous cleaners.

Solvent Cleaners. Solvents clean by dissolving away dirt. Solvents include petroleum-based solvents such as mineral spirits, stoddard solvent, and petroleum naphtha, and organic solvents such as trichloroethane, trichlorethylene, benzene, and xylenes.

Aqueous Cleaners: Aqueous cleaners are pH-neutral or alkaline water-based solutions that break down and remove dirt from part surfaces. Semi-aqueous solutions that contain small amounts of solvents are also available.

What's Wrong With Petroleum Solvents?

A solvent style parts washer is filled with several gallons of solvent that is stored in a settling pan at the bottom of the washer. A small flame-tight electric liquid pump is immersed in the solvent and skims clean solvent from near the top of the settling tank, and pumps it at low pressure through a stiff flexible nozzle onto a metal grating above the liquid where the metal components rest. Dirt and dissolved heavy greases fall into the bottom and settle to the bottom of the tank.

Mineral spirits and other chlorinated solvents are commonly used for parts cleaning because of their effectiveness in removing oil, grease, grime, and burnt-on carbon. However, their continued use raises significant environmental, health, and economic concerns:

- Chlorinated solvents can contaminate used oil, resulting in costly disposal;
- Petroleum and chlorinated solvents contain chemicals that may be toxic if inhaled, and some solvents may increase the risk of cancer;
- Petroleum solvents evaporate quickly, making worker exposure difficult to control;
- Solvent cleaning units are often the largest source of a facility's hazardous waste; and
- Some solvents leave an oily residue, requiring additional cleaning prior to painting or finishing.
- Petroleum solvents are highly flammable.

Mineral spirits are classified as VOCs that contribute to photochemical smog. The solvents also contain toxic components like benzene, toluene and xylene. Benzene is an established human carcinogen; toluene causes central nervous system damage; and xylene causes birth defects. The low vapor pressure blend contains a chemical called n-methyl pyrrolidone which is a reproductive and developmental toxin. These solvents pose a toxic risk to workers and the surrounding community. If the solvents are improperly handled, they can contaminate the site.

Why Use Aqueous-Based Cleaners?

Water-based cleaners and operation systems are a viable alternative to mineral spirits used in repair and maintenance parts cleaning operations. An aqueous-based parts washer is much like a large dish washer. It uses water and detergent combined with heat and mechanical energy to provide the cleaning action.

Aqueous cleaning products are water-based solutions that, unlike petroleum solvents, are non-flammable and non-hazardous. Instead of dissolving grease, aqueous parts washer units utilize heat, pressurized water, soap action, and agitation to break up dirt and grease.

Although they clean differently, aqueous cleaners perform as well as solvents in most cases. Some units are even fully automated, thereby reducing labor costs and increasing productivity.

Advantages of Using Aqueous-Based Solvents

- Lower hazardous waste generation and management costs;
- Little or no solvent vapors or aerosol mists that can be harmful to your workers' health;
- Equal or better cleaning performance;
- Reduction in cleaning labor with some aqueous cleaning units;
- Large cleaning capacities;
- Elimination of fire hazards;
- Longer solution life.

ports the growth of microbes which are introduced either directly into the cleaning formulation or in a filter. Because there are microbes, the formulation is of neutral pH. The microbes biodegrade the oil. An advantage of this system is that the bath cleans itself and may last indefinitely without requiring changeout. The majority of debris, oil, grease, and dirt should be removed prior to placement in cleaning unit. Heavily soiled parts may overload the system.

Advantages

- Ideal for light-duty cleaning activities
- Lower initial start-up costs
- No toxic vapors, less irritating to skin
- Minimal waste production

Disadvantages

- Microbial units require more maintenance to keep microbes alive
- Difficult to clean heavy or stubborn soils
- Not suitable for large parts

Cleaning Systems

There are five major cleaning system types commonly used today:

Sink-On-A-Drum

This type is the most common used in auto repair shops. It is a sink with a brush mounted on a drum which contains the water-based cleaner. The sink has a faucet and flow brush for cleaning the parts. The water-based cleaner is heated to about 105°F. Many units have filters for removing particulates and oil; some units have oil skimmers. The units are made of metal or plastic. Because the workers' hands contact the cleaner, the formulations used with a sink-on-a-drum must have a neutral pH to prevent skin damage.

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Disadvantages

- Difficult to clean heavy or stubborn soils
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Enzyme Cleaning System

These systems are generally modified sink-on-a-drum units. They are made of plastic and the cleaner is heated to about 105 degrees F. The system includes an enzyme cleaning formulation that sup-

Immersion Parts Washer

This type of unit consists of a sink with a false bottom. The bottom can be removed or opened so the parts can soak in the reservoir. Like the sink-on-a-drum, there is a faucet and flow brush for hand detailing the parts. The units are heated to about 105°F and can contain filters and oil skimmers. Both metal and plastic units are available.

Advantages

- Reduces scrubbing time and reduces labor costs
- Allows for extended soaking

Disadvantages

- More expensive than Sink-On-A-Drum units.
- May be difficult to clean

Spray Cabinet

In this type of system, the parts are placed inside a cabinet and the door is closed. High pressure spray from nozzles flushes the parts and cleans them just like a dishwasher. This is a more aggressive cleaning method than the other

systems. The formulation can be neutral or alkaline since the workers' hands do not contact it. The formulation is generally heated to between 120° and 180°F. These units are made of metal and often have filters or oil skimmers. Spray cabinets, because they are automated, reduce labor costs for cleaning. *(NOTE: never use mineral spirits in a spray cabinet as this could create a fire/explosive hazard.)*

Advantages

- High level of cleaning performance
- Ideal for heavily soiled parts
- Large cleaning capacities available
- Automatic units reduce labor costs
- Lower waste management costs

Disadvantages

- Moderate to high initial start-up cost
- Uses more electricity than solvent unit
- May require rust prevention for steel parts (rust inhibitors, additional drying)

Ultrasonic System

This type of system relies on sound energy to accomplish cleaning. Through a process called cavitation, the energy causes bubbles to form; these bubbles explode in crevices and holes to clean the parts. These systems are most appropriate for cleaning complex parts like transmissions and carburetors. Higher pH cleaners can be used in these units since workers' hands do not contact the cleaner. Like the spray cabinet, these systems are automated so they reduce labor costs for cleaning. Similarly, you should avoid using mineral spirits in this kind of system.

Advantages

- Ideal for hard to clean parts with blind holes or hidden surfaces (transmissions, carburetors)
- Very high performance cleaning
- Significant reduction in cleaning labor

Disadvantages

- High initial start-up cost



Managing Your Aqueous Cleaning Wastes

Aqueous wastes are typically less toxic than petroleum solvents and, therefore, managing those wastes is often easier and less expensive. Proper management of aqueous wastes depends on the type of cleaning solution used, type of equipment, and the type of wastewater treatment system in the facility. (*Note: It is illegal to dispose of any parts washer solutions into drywells, onsite septic systems, storm drains, or onto the ground*).

- **Onsite Septic Tanks:** No type of industrial waste may ever be disposed into on-site septic systems. This may contaminate your septic tank or drain field, which may result in a costly system failure.
- **Oil/Water Separators:** Since parts washers emulsify oils and greases, disposal of aqueous solution into an oil/water separator is not effective. When emulsified, oils are not separated and will simply pass through the system.
- **Municipal Sewer System:** In some cases, aqueous solutions may be disposed into the municipal sewer system. However, special permission is required from the sewer utility, who may also require laboratory testing of the waste. *Always contact your municipal wastewater utility before utilizing this disposal method.*
- **Evaporation of Aqueous Solutions:** Since most aqueous solutions do not contain volatile organic compounds (VOCs), they may be evaporated, leaving only a smaller amount of sludge for disposal. Some parts washers may contain special evaporator units for this specific purpose. (*Note: It is unlawful to evaporate petroleum solvents for disposal purposes*).
- **Disposal by Hazardous Waste Vendor:** Utilizing a waste disposal vendor is the preferred method for managing aqueous solutions. Since aqueous solutions are less toxic than petroleum solvents, disposal costs are generally less. Studies have shown that large waste vendors typically charge approximately 1/3 less for aqueous solutions. Furthermore, utilizing a licensed vendor reduces your liability and ensures that the waste is properly disposed.
- **Disposal of Aqueous Sludge:** Tests have shown that aqueous sludge typically contains toxic heavy metals and solvents and therefore, should not be disposed into the normal trash. It is recommended that all sludge be managed as hazardous waste.
- **Other Types of Waste:** Waste such as skimmed oil sludge and solution filters should be managed as dangerous waste. (*Note: The Washington Department of Ecology does not allow skimmed oil or sludge to be mixed with used oil*).

Good Management Tips For a Parts Washing System

- **Use the least hazardous cleaning solution in your parts washer;**
 - ⇒ Check the Safety Data Sheet (SDS) before you purchase a product to ensure the least toxic material. Use aqueous cleaners instead of solvents.
 - ⇒ Use a non-ignitable parts washer cleaner (flashpoint greater than 140°F).
 - ⇒ Avoid using listed hazardous solvents and prevent contamination of your cleaning solution with listed hazardous solvents by avoiding the use of aerosol spray cans near your parts washer.
- **Reduce wastes by maximizing your solution life**
 - ⇒ Only wash parts when necessary.
 - ⇒ Only change your cleaning solution when it no longer adequately cleans parts. Do not change your solution on a scheduled basis and only allow contract pickups when necessary.
 - ⇒ Drain your parts thoroughly over the parts washer to reduce loss of cleaning solution. When using aqueous cleaning units, select cleaning units with filtration and oil skimming to remove solids and oil from aqueous cleaning solutions and extend solution life.

Frequently Asked Questions

Q1: Are aqueous-based cleaners more expensive than mineral spirits cleaners?

A: Companies can reduce labor costs by utilizing automatic aqueous parts washers. Start-up costs may be greater initially, but many units can pay for themselves with increased productivity. Water-based cleaners are often less expensive than mineral spirits systems because they do not require change-out as often. Filters and oil skimmers can extend the bath life of the cleaners.

Q2: What is the best system for my shop?

A: If your shop is small with only one mineral spirits parts cleaner, and your workers devote a small amount of time to cleaning and you have light contamination, a sink-on-a-drum or enzyme system will be your best option. Enzyme systems minimize waste generation but they are suitable for only light or medium contamination. If you have multiple parts cleaners and devote a lot of

time to parts cleaning, a spray cabinet would help reduce the labor cost. If you clean many transmissions or carburetors, an ultrasonic cleaning unit may be your best bet. Spray cabinets and ultrasonic systems are aggressive cleaning systems, and are best for medium- to large-sized shops where workers have to devote a significant amount of time to cleaning parts with medium to heavy contamination.

Q3: Where can I find out about the cleaning systems that are available?

A: Check the Yellow Pages under the automobile parts and supplies. Some vendors supply equipment, other vendors supply cleaning formulations and still others provide waste hauling services.

Q4: I just cleaned a part using only hot water, without cleaning solution. Can I dispose of the wastewater into my septic system?

A: No. the wastewater may now be contaminated with oils, solvents, or heavy metals. No type of industrial wastewater may ever be disposed into on-site septic systems.

Q5: What kind of aqueous cleaner should I use?

Neutral pH cleaners should be used in equipment (like a sink-on-a-drum, enzyme or immersion unit) where workers' hands contact the cleaner. Higher pH alkaline cleaners should be used only in equipment (like spray cabinets and ultrasonic cleaning units) where there is no hand contact. The safest cleaners are those with no solvent alternatives.

Q6: If my aqueous solution and sludge is contaminated by toxic metals, oils, or other solvents, how do I determine if my aqueous waste is a regulated dangerous waste?

A: A laboratory can analyze a sample of your waste to determine if it is non-hazardous or a regulated waste. This may be worthwhile for larger volumes of waste, since it could reduce disposal costs. However, for smaller volumes of waste such as sludge and filters, it may be less expensive to just assume that it's hazardous and dispose of it accordingly. It all depends on the volume of waste, your vendor's disposal rates, type of cleaners, and the individual cleaning processes. Your hazardous waste vendor can help you make this decision.