



# Clean Lines:

## Strategies for Reducing Your Environmental Footprint

### Parts Washing Operations



#### A Green Suppliers Network review can help you:

- **Reduce water use and associated costs.** Parts-washing operations are among the largest consumers of water and can also offer the largest opportunities to achieve cost savings.
- **Reduce potential for environmental liability.** Parts-washing water stocks are contaminated with organic solvents, acids, alkalines, caustic substances, and heavy metals; all are harmful to the environment and must be strictly managed.
- **Increase competitiveness through efficiency and attract new customers.** By reducing your environmental footprint, you will help meet your customers' corporate environmental goals and potentially generate new business.

**A**s a partner with the Green Suppliers Network, you receive a customized, onsite technical review of your materials and processes that couples lean manufacturing techniques with sound environmental strategies—the *Lean and Clean Advantage*. You might choose to review your parts washing operations. While the science of parts cleaning can be very complex, the objective is simple—remove contamination, such as oil or rust, from the surface of the parts being cleaned to minimize defects and reduce rework.

Parts washing can be performed by detergency, solvency, chemical reaction, or mechanical action, and typically uses large quantities of water and one or more of the following:

- **Organic solvents**, the most widely used type of cleaners, are used primarily for removing organic or oil-based contaminants.
- **Acid cleaners** such as sulfuric, nitric, and hydrochloric acids are used to remove oxidation scale and rust from metal surfaces.
- **Alkaline cleaners** are aqueous solutions of inorganic salts often used in heated soak tanks to remove heavy, oily soils and some solid soils.
- **Caustic solutions** are often employed as a paint-stripping agent.
- **Abrasives** are designed to remove rust, oxides, and burrs to create a smooth surface. Common abrasives are sand, aluminum oxide, or silicon carbide mixed with an oil- or water-based binder.

Solvents and other chemicals used in parts cleaning often result in significant air emissions, wastewater discharges, and the generation of hazardous wastes. In the search for the cleanest parts-washing process possible, your Green Suppliers Network review team will help you select the least toxic and most environmentally friendly cleaner that is most appropriate for your operations.

#### STEPS TO A CLEAN PARTS-WASHING PROCESS

The following are just a few of the many strategies to consider while participating in a Green Suppliers Network technical review. The Green Suppliers Network provides experts in *Lean and Clean* manufacturing techniques who will help you visualize a future look for your operations, such as the enclosed process map, one that will save you money and reduce your environmental footprint.



#### About the Green Suppliers Network

Working in collaboration with the U.S. Department of Commerce's Manufacturing Extension Partnership (MEP), the U.S. Environmental Protection Agency (EPA) established the Green Suppliers Network to help small and medium-sized manufacturers stay competitive and profitable while reducing impacts on the environment.

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### Reduce Contamination and Surface Impurities Prior to Parts Washing

Many parts and products collect surface impurities from incoming soils applied by metal suppliers or contaminants, such as coolants, stamping fluids, and rust inhibitors, applied during prior processes. The Green Suppliers Network review team will help you identify sources of impurities and examine the following techniques for reducing contaminants:

- **Using recyclable protective coatings.** Peel coatings or shrink-wrap may substitute for protective coatings of oils grease or paint, which require solvent removal. These coverings will prevent dust and oils from depositing on the metal surfaces during shipment, storage, and handling. You might also be able to sell used wrapping materials to a recycler, thereby eliminating disposal fees and earning additional revenue.
- **Reducing rust.** Moisture, which causes rust to form, can be eliminated or reduced by properly drying the parts between operations or by storing parts indoors away from condensation or rain.
- **Pre-cleaning parts.** Wiping down parts with solvents, scraping using air blowers, or pre-dipping in cold mineral spirits can minimize impurities entering into parts-washing baths. Cleaning parts as a last stage in prior processes can reduce the need for refreshing parts washing baths.

### Reduce Water Use

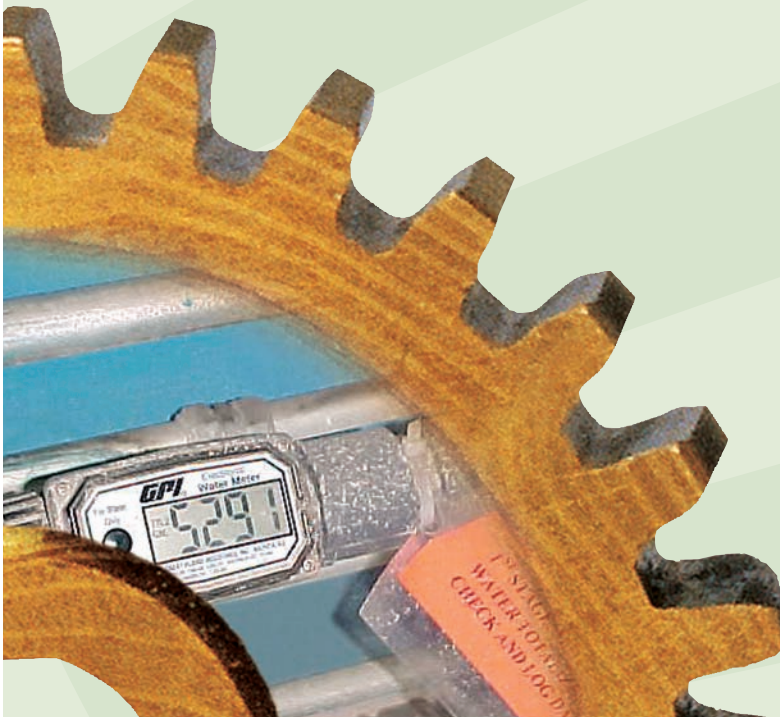
During your Green Suppliers Network review, *lean and clean* practitioners will likely identify your water use as an opportunity for increased efficiency. The Network review team might recommend the following strategies to reduce the amount of water used by your parts washing operations:

- **Use counter-current cascade cleaning methods.** Cascade rinsing is a method of reusing water from one rinsing operation to another, less critical rinsing operation before being discharged to treatment. Some rinse waters acquire chemical properties, such as low pH, which make them desirable for reuse in other rinse systems.
- **Use high pressure spray nozzles.** For certain workpiece configurations, spray rinsing uses considerably less water than does immersion rinsing. During spray rinsing, the parts are held over a catch tank and are sprayed with water. Water then drips from the part into the catch tank, and is then either recycled to the next stage or discharged to treatment. Spray rinsing can occur in a counter-current cascade configuration, further reducing water use. Spray rinsing can enhance draining over a process bath by diluting and lowering the viscosity of the process fluid film clinging to the workpiece. Using spray rinsing can also provide increased control of rinse water use.
- **Install fog nozzles.** Fog nozzles use much less water than conventional spray systems. Fog nozzles also benefit aqueous cleaned parts by covering the parts, thus preventing solution from drying on parts. Solution drag-out is also reduced.

### Reduce Solvent Use

Many parts washing operations also use solvents that contain high percentages of hazardous air pollutants (HAPs) and volatile organic compounds (VOCs). The Green Suppliers Network review team will identify ways to reduce or eliminate their use. For example, the review team might recommend the following techniques:

- **Install lids/silhouettes on tanks.** All tanks should be covered when not in use. Covers that can be used during cleaning (silhouette entries) permit even greater vapor loss reductions of up to 55 percent. All covers should be designed to slide horizontally over the tank top. This movement disturbs the vapor zone less than hinged covers.
- **Increase freeboard space on tanks.** An increase in the freeboard space from 50 percent (one-half tank width) to 75 percent can reduce solvent emissions by up to 46 percent. An increase of 100 percent in the freeboard space can provide an additional 39-percent reduction when air turbulence is a problem.



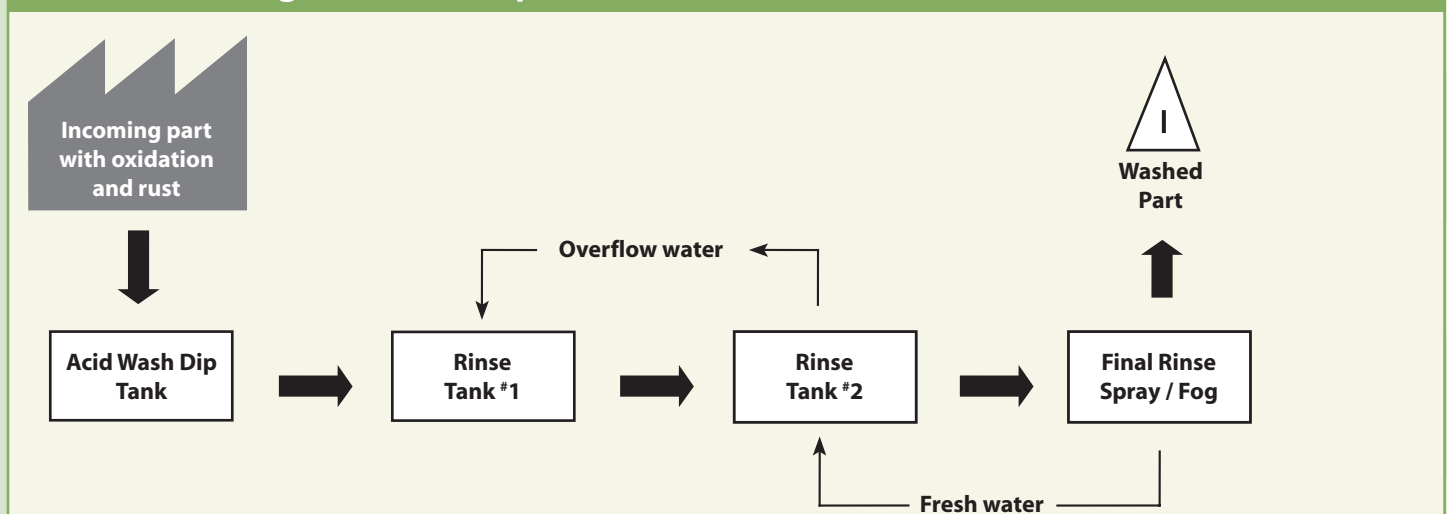
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- **Avoid drafts over solvent tanks.** Fans, air conditioners, heaters, windows, doors, general plant air movement, and equipment movement can blow the solvent vapor out of the tank. Locate solvent tanks to minimize natural drafts, or use baffles to prevent vapors from being disturbed. Solvent loss can be reduced by up to 30 percent.
- **Install freeboard chillers.** Freeboard chillers can reduce solvent use by as much as 60 percent. A second set of refrigerated coils above the condenser coils creates an additional barrier to vapor loss. Reductions in solvent use of 60 percent have been realized by this technique. However, because solvent contamination can occur if condensation accumulates on the coils, air inside the tank vapor zone should be dehumidified. Special water collection equipment might also be necessary.
- **Avoid solvent drag-out.** Solvent that is not properly drained from parts is immediately lost to evaporation outside of a tank. Adjust the positioning of baskets or racks for easy drainage. If necessary, rotate parts above tanks to promote drainage.
- **Bring parts up to temperature before removal.** The cleaning cycle is not complete until the parts have reached the temperature of solvent vapor and condensation has ceased. If condensation is forming on parts, solvent drag-out will increase.
- **De-water solvent.** A water separator should be able to reduce dissolved water in the solvent. The surface can also be skimmed to reduce the water content of the solution.
- **Do not overload solvent dip tanks.** Avoid inserting oversized items or large baskets into the tank. As a general rule, the cross-sectional area of the workload should not exceed 50 percent of the tank's open area.
- **Repair leaks.** Leaks are difficult to detect because of rapid evaporation of solvent losses. Careful inspection should routinely be performed, especially in hidden spots.
- **Consolidate cold cleaning operations into a centralized vapor degreasing operation.** Cold cleaning solvents typically must be discarded when contamination levels reach 10 percent; however, vapor degreasers can operate with up to 25- to 30-percent contamination. In addition, vapor degreasers provide much better cleaning, and the parts leave the unit dry.
- **Schedule jobs in batches to reduce need for frequent cleanings.** Optimize product lines so that solvent tanks do not sit uncovered without being used for extended periods of time by performing cleaning in batches rather than continuously.

If customer product **SPECIFICATIONS** and performance **REQUIREMENTS** are keeping your facility from implementing changes to your parts washing **OPERATIONS**, the Green Suppliers Network can help. By working with Corporate Champions—your customers—the Network can **EASE** barriers and **FACILITATE** process improvements specific to your situation.

### Parts Washing Process Map





“Participating in a Green Suppliers Network REVIEW was well worth it! Taking part in the PROGRAM led us to consider improvement OPPORTUNITIES that may have otherwise gone overlooked.”

-Scott Lakari, Vice President of Operations, Metalworks

## Mapping Out Water Use: Parts Washing Operations at Metalworks

**Metalworks**, a manufacturer of metal filing cabinets, was nominated to take part in a Green Suppliers Network review by its customer, Steelcase. Steelcase purchases two-drawer lateral file cabinets from Metalworks and distributes them in a line of office furniture. Metalworks fabricates, powdercoats, and assembles lateral file cabinets in its Ludington facility. Mary Ellen Mika, supply chain manager at Steelcase, approached Metalworks about taking part in a review. Scott Lakari, vice president of operations at Metalworks, had some initial hesitation but met with Steelcase to discuss how to overcome potential barriers. Once Mr. Lakari's concerns were eased, he and others at Metalworks were very excited about the opportunity. Mr. Lakari stated, "We felt the program was a good fit since we were already pursuing lean manufacturing and environmental improvements."

### The Situation

Metalworks' managers long wanted to draft a value stream map for their facility and their product lines but did not have the personnel or resources in place to do so. Mr. Lakari stated that

they simply did not have anyone within the company who had the right expertise to lead such an exercise. The Network review team examined the facility's product line for two-drawer lateral file cabinets, which includes multiple processes. The review team focused primarily on the facility's energy consumption, hazardous wastes and VOC emissions generated by the powder coating process, and water use for parts washing.

### The Solution

The Network review team drafted both a current-state and future-state value stream map for the identified product line. These maps helped Metalworks visualize and better understand how much water was actually needed in the parts washing process and how the water could be reused. Review team members suggested measuring the amount of water that spilled out of the rinse tanks and then estimating the amount of water needed to achieve the optimal rinsing. Following the technical review, Michigan's Department of Environmental Quality provided Metalworks with an intern to help inventory the amounts of water used and lost during the parts washing process.

Prior to the review, the parts washing process included a series of five rinsing tanks that were each filled with fresh water at the same time. This approach required 24 million gallons of wash-water annually. The review team recommended adapting the process to cascade rinsing. Cascade rinsing reuses water from one rinsing tank to another, less critical rinsing operation before being discharged to treatment. By changing to a cascade rinsing process, Metalworks reduced water use by more than 16 million gallons a year and saved \$30,000 annually.

This reduction in water use triggered additional savings within the parts washing process through the use of a reverse osmosis water treatment system. By pre-treating the water used in its acid-etching phosphate parts washers, Metalworks reduced the amount of chemicals added to the process by 20 percent, resulting in a savings of more than \$20,000. Metalworks expects a one-year payback period for the installation of the reverse osmosis system.

## PARTS WASHING QUICK LINKS

### Metal Cleaning Hub at the Waste Reduction Resource Center

<http://wrrc.p2pays.org/industry/metalclean.htm>

A list of links to the best *lean and clean* resources for metal cleaning.

### Precision Cleaning Web

[www.p2pays.org/ref/05/04280.htm](http://www.p2pays.org/ref/05/04280.htm)

Information on 15 technology categories representing the core of critical cleaning or general principles, strengths and limitations, plus compatibility issues and selection considerations.

### Solvent Alternatives Guide (SAGE)

<http://clean.rti.org>

SAGE is a comprehensive guide designed to provide pollution prevention information on solvent and process alternatives for parts cleaning and degreasing.

### Waste Minimization in Metal Parts Cleaning

[www.p2pays.org/ref/02/01064.pdf](http://www.p2pays.org/ref/02/01064.pdf)

This booklet provides information on ways to reduce wastes associated with metal parts cleaning operations. It was published by EPA's Office of Solid Waste and Emergency Response and is part of EPA's waste minimization program under the 1984 RCRA amendments.



United States  
Environmental Protection  
Agency

Office of Pollution Prevention and Toxics  
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### Metalworks: At a Glance

Location: Ludington, MI

Number of Employees: 300

### Green Suppliers Network Review Findings

- Annual Savings: \$30,000
- Water Use Reduction: 16 million gallons
- Energy Use Cost Reduction: \$150,000
- Water Use Cost Reduction: \$30,000