Smart Cleaning for Stamped Parts

Cleaning systems need to clean *and* comply with environmental rules. A custom-made system may be the answer for the kind of parts your shop produces.

Michael Tolinski
Contributing Editor

Choosing the best approach for cleaning a particular metal part depends on a multitude of factors. The decision becomes even trickier as cleaning standards become more rigorous and as choices expand in parts-cleaning equipment and chemicals. Fortunately, given the relatively simple part shapes that are typical with stamping processes, stamped parts don't always require state-of-the-art cleaning chemicals and equipment to prepare them for painting, plating, welding, or other secondary operations.

However, in a volume-driven business like metalforming, a choice of cleaning system does require extra attention to processing speed, ease of use, flexibility, and efficiency in resource use. These issues are addressed by various cleaning system technologies, surveyed below, including multi-stage conveyor washers for continuous cleaning, low-footprint systems for small-scale manufacturing, and more recyclable cleaning chemistries that cut waste.

Flow-Through Results

The most rigorous metal-cleaning applications are for odd-shaped parts with heavy contaminant loads and stringent, solvent-free cleaning standards. These kinds of parts, such as aluminum cylinder heads, often require complex cleaning technologies, according to Ed Kiebler of LS Industries (Wichita, KS). "But in the stamping, forming, fabricating end of things, we're still using aqueous-based, pass-through, or flow-through washers to clean most applications."

Flow-through washers, in general, convey parts through a tunnel of various pre-soaking, cleaning, and rinsing stages. An extreme simplification of the process might be a car-wash analogy—parts come in one end covered with stamping and drawing lubricants and other contaminants, and come out dry at the other end. Given the continuous nature of the system, "There's a tremendous need for that style of washer for stamping and forming," says Kiebler.

"Part shape isn't as critical in a flow-through washer as other factors," he says. "A lot of it has to do with the solids you're trying to clean off. As a rule, you're cleaning stamping oils, release agents from molds, flux, and so on, which don't take a lot of pressure to clean off."

Pass-through systems can be major-size plant installations, with some of them approaching 50′ (16 m) in length. But the concept is adaptable for cleaning the largest parts and fabrications. For example, Kiebler

Solvents Face Uphill Fight

Job shops that continue to rely on solvent-based cleaning methods may soon find the trend towards aqueous cleaning too difficult to buck. These shops know that organic solvents are highly effective for cleaning metal parts and have continued to stick by them, even as regulatory pressures have pushed other shops into installing water-based systems.

"It was really just in the mid-1990s that there was this tremendous shift from solvents to aqueous and semi-aqueous cleaning systems," says researcher Marilyn Bradshaw. Bradshaw is with market research firm Colin A. Houston & Assocs. Inc. (Brewster, NY), which completed a study of cleaning surfactant use in the metalworking industry over the period 1995-2005.

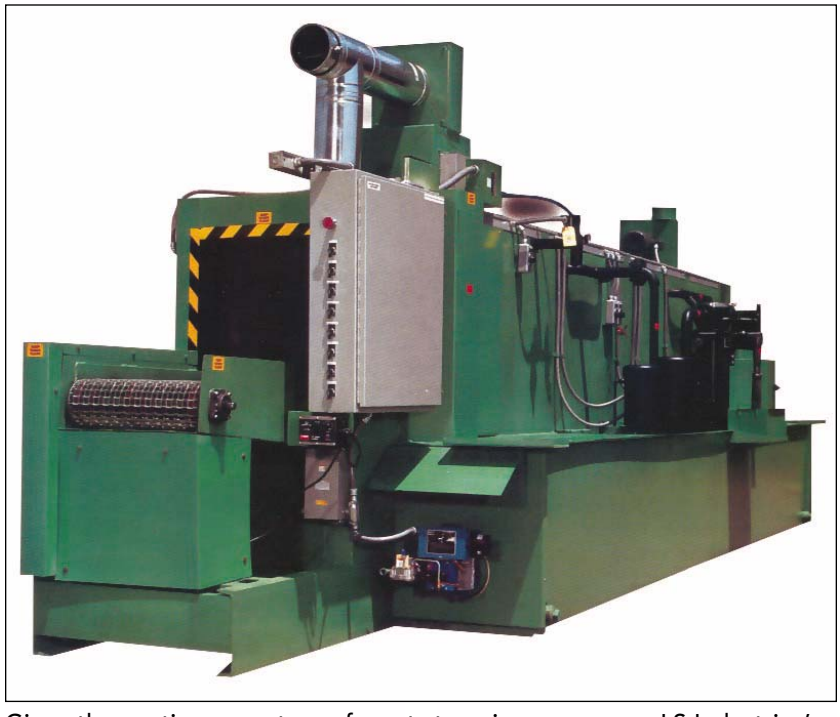
But, she says this move to aqueous cleaning isn't technically or economically feasible for every application. Organic solvents used in vapor degreasing and other processes, besides being effective, are often required for certain part sizes and shapes, types of contamination, and strict cleaning standards. "Certainly, a smaller company that's traditionally used solvents would make every effort to find a way to continue using them."

Solvent users can face major hurdles when installing new aqueous cleaning equipment. "Typically aqueous and semi-aqueous systems involve more cleaning steps, and this takes up more space for equipment in the plant. Sometimes that means a complete redesign and reconfiguration of the whole production process."

Those who have stuck with solvents are finding more environmentally safe solvents and solvent blends, she adds. Moreover, to meet regulatory standards, they've improved their equipment to reduce VOCs (Volatile Oxide Compounds). A system upgrade might mean enclosing cleaning equipment better or finding a better way of reclaiming solvent. "It's not as big an investment as switching to an aqueous system, so you can meet the initial standards for workplace safety while still using solvents."

Even though safe solvent cleaning may be possible, political forces are strengthening against it, says LS Industries' Ed Kiebler. For example, he notes that California has virtually banned solvent cleaning in manufacturing operations, with tight controls that may eventually spread to other states.

Thus, solvent cleaning is in an ambiguous position. California tends to have very stringent pollution laws, so similar nationwide crackdowns on solvents may still be a way off. And before a total ban occurs, the death knell for solvents may be sounded by increasing costs of solvent handling and disposal. But these factors must first win out against the sheer effectiveness of solvents. "Given there were no restrictions or limitations," says Kiebler, "everybody would prefer to use solvents because they do a wonderful job."



Given the continuous nature of most stamping processes, LS Industries' flow-through parts washer is a typical approach for parts cleaning in metalforming operations.

mentions two systems LS recently quoted that are large enough to clean entire car frames.

Another kind of flow-through system has just been put into production to clean some of the largest stamped components: automotive fuel tank halves. The "Centri-Spray" washer system for Ford Motor Co. fuel tank production is supplied by ICA Cinetic Automation Corp. (Farmington Hills, MI).

In production, upper and lower tank halves formed in a large press are manually loaded onto chain conveyors for pass-through cleaning. Parts are conveyed through the washer by an indexing chain, a mechanism similar to the chains on a roller coaster, says ICA vice president Mark Pehrson. The washer's soapy solution contains a rust inhibitor and degreaser and is sprayed with the force necessary to remove stamping oil and other contaminants that might have fallen onto the tank's large surface area. The washer has six

This large chain-conveyor washer is being installed by ICA Cinetic to clean the stamped halves of vehicle fuel tanks (shown foreground and right). Critical in the operation is not only cleaning stamping oil and residue from the parts but also the final drying stage, since water can corrupt the welding process.

stages of washing, rinsing, and dry-off cycles—all of which are done in an 18-second cleaning cycle, says Pehrson. After the drying stage, part halves are inverted and passed on to a welding operation.

The most difficult challenge for this application isn't the washing, but the drying, says ICA's Ford account manager Walt Cunial. "Drying is the most critical part, because if there's any water contamination or droplets, they could cause problems during the welding process." The necessary "bone-dry" condition and part cleanliness is verified with random checks using a sprayed, contaminant-sensitive chemical.

Small-Part Options

Conveyor washing works for many larger parts, but cleaning smaller parts is another issue, says LS Industries' Ed Kiebler. "The only dilemma you have with a flow-through style washer is that your parts have to be heavy enough to keep from being blown around."

In general, small parts can often be poor fits for any system that uses high-force sprays of cleaning solution and belt conveyors. "When you talk about thin-wall stampings, or light stampings, you eliminate typical applications for stampings, which are spray systems," explains Edward Tulinski, vice president of Jensen Fabricating Engineers Inc. (Jenfab, Berlin, CT).

"Typically, when you get into thin, light parts and try to convey them on a belt washer, you have great difficulty keeping them in the machine or keeping them lined up like little soldiers." Thus, the movement caused by the spray pressure makes consistent cleaning more difficult.

Actually, the limitations of conveyor spray washers have more to do with part shape than weight, he explains. "If the part has a lot of flat surfaces and is lightweight, it tends to move around in the spray section. It makes it difficult to clean because you'll start getting nesting and stacking.

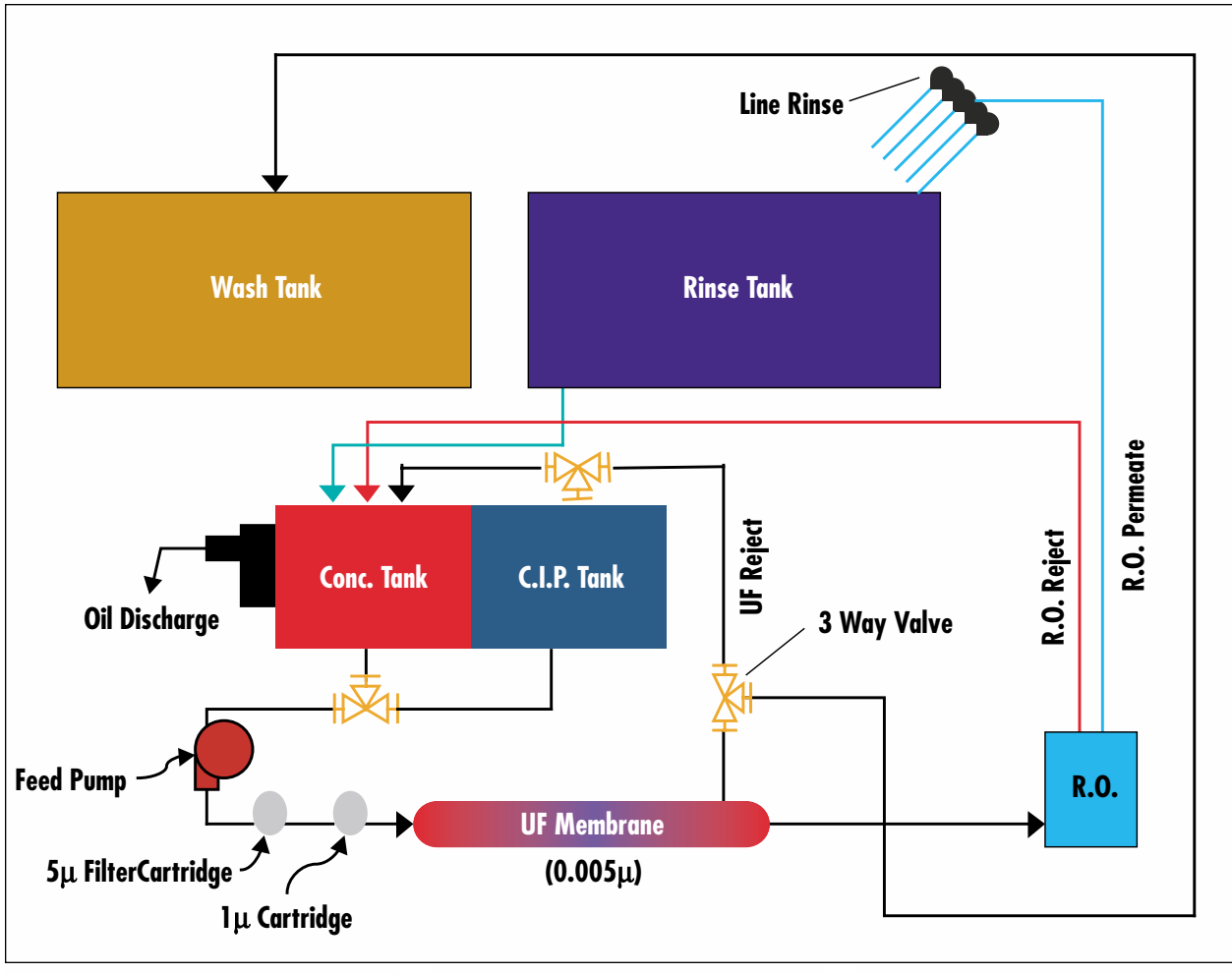
"So a lot of small stampings are done on rotary drum systems, and a lot are done in baskets with agitation processes." Tiny progressive-die stampings, for example, might be sent continuously from the press to a rotary-drum washer. Or depending on volumes and part size, shape, and weight, they might be suited for a batch immersion process with tumbling, compressed air, or other forms of agitation.

Cellular and Lean Cleaning

Cleaning systems designed for flexible manufacturing show how much specific operation characteristics complicate the choice of a cleaning system. For instance, Jenfab's custom systems for "lean" cleaning provide necessary production flexibility, but only for the shop they're designed for and its range of parts. "Our newest technology is complete cellular manufacturing systems," says Tulinski. "We've made four or five for customers, but each one is application-driven; I can't say that one is better geared for small stampings than another."

Generally, stamping operations are continuous processes that don't lend themselves to cellular concepts. "Many stamping operations generate very high part volumes, in which case, a 'lean cell, one-piece, or small-lot flow' concept would not be appropriate," says Roger Hesse of Stoelting Inc. (Kiel, WI).

For specialized stamping or low-production jobs, cleaning systems are available that are small enough to fit between manufacturing cells or portable enough to shift from cell to cell. These support a one-piece flow environment, says Hesse, and can be "placed as close together as possible



A schematic of a typical cleaning wastewater recycling system. Wastewater travels through filtration, ultra-filtration ("UF"), and reverse-osmosis ("R.O.") units, which remove contaminants not drawn off in the concentration tank. In Ransohoff's "neutral-based chemistry" system, streams fed back to wash, and rinse units contain reusable cleaning agents that retain their effective cleaning power through the loop.

to reduce the operator's walking distance between operations."

For more continuous parts washing, he points to alternatives that use "hopper style" loading. For example, Stoelting's "Mini Parts Washer" and VersaForce models are typically positioned right after the stamping press. The parts come off and drop into a hopper or immersion bath and continue through spray-wash, rinse, rust-inhibitor, and drying stages. Hesse says the washers can support a production rate of one part per second or greater and have compact footprints ranging from 3 × 5′ (1 × 1.5 m) to 3 × 12′ (1 × 4 m) or 7 × 7′ (2 × 2 m).

Chemistry Neutralizes Waste

Integral to the selection of a parts-cleaning system is the choice of cleaning chemicals. For aqueous-based cleaning, the soaps and surfactants in use are typically classified as alkaline (the most often used) or acidic. And these choices have expanded, as metal cleaning continues to move away from what used to be the main chemicals for removing non-water-soluble contaminants: organic solvents (see the sidebar in this article).

But aqueous cleaning requires a lot of water and creates a lot of waste. Thus, the question of how best to treat the wastewater and reclaim its useful chemicals has become a central issue. Often, cleaning agents can be partially reclaimed from the washer's wastewater as it's recycled, although some of the cleaning power usually is diluted, or "stripped," by the filtration units that remove dirt and oils.

So cleaning system suppliers are developing systems in which little or none of the cleaning agent is stripped during filtration, leading to near-zero chemical waste. By completely recycling cleaning chemicals, manufacturers have reduced cleaning costs by extreme amounts, claims Ken Schapker of Ransohoff Inc. (Cincinnati). "We had a customer that had $300,000 in chemical costs, which has been basically reduced to something like $5000 per month." He says such reductions are possible with the "neutral-based" surfactant/polymer cleaning chemistry the company calls Evercycle UCI.

"The reason it's a recyclable chemistry is because it splits oil—it doesn't pull it into an emulsion—whereas alkaline materials tend to emulsify the oil," explains Schapker.

This allows the chemistry to stay in the recycling loop. Also, the chemicals work at lower temperatures than alkaline cleaners, and they're safe on all parts, including aluminum. However, he does admit that alkalines are good for cleaning strong, tenacious oils, and that neutral-based chemistry isn't for every situation.

For one neutral chemistry "success story," Schapker points to an installation at an oil-filter manufacturer. The Honeywell Fram plant in Greenville, OH, has been using the neutral chemistry system for over a year. The plant cleans millions of deep-drawn filter housings before powder-coating them in the final assembly.

In making its conversion to neutral chemistry, the plant didn't need to replace the operation's belt-conveyor washer, says Schapker. "It's just a conveyor-belt washer—anybody could have built it. It was one they already had in the process when we got called in." Rather, Ransohoff installed wastewater-handling and reverse-osmosis filtration systems for recycling the new cleaning chemicals.

Field engineer Lyle Carman says that only the filter housing's outer metal surface is cleaned; it's internal components are shielded from the washer. "Filters are placed on the conveyor in such a way that water can't get inside." The system not only removes drawing oil and particulate from the drawing process but also excess latex sealant from the filter sealing process.

"The reason Fram wanted to make the change was that the alkaline cleaner they were using was not recyclable," says Carman. Part of the alkaline chemicals would be stripped away by the ultra-filtration membranes, but the neutral chemicals pass completely through them. This recyclability is said to have allowed 80% savings in chemical costs, along with energy savings, labor savings, and major reductions in rejected parts because of process consistency.

The neutral-based cleaner is used at 3% concentration (by volume) in the washer's wash and rinse cycles. No pure-water rinse is needed because none of the cleaning residue interferes with the powder coating process, says Carman. The closed-loop recycling has allowed the plant to operate since May of last year with no discharge of cleaner or rinse water.

Carman says the change to neutral chemistry was "totally transparent" and that it mainly just takes a willingness to change to apply it to other cleaning situations. However, people who already have a cleaning process that "works" may not have the confidence or motivation to switch to a fully recyclable system. There are also practical concerns that hinder change, adds Carman. "To make a change, they may have to go to their customer and get approval to change. In a painting operation, they would have to do extensive pre-testing to make sure the quality's the same." Still, cutting waste can be a strong motivator. ❐

WANT More Info?

For more information about parts cleaning, circle the following numbers on the reader service card. For faster results, visit the following manufacturers' web sites via www.sme.org. Scroll down to and click on the *Forming & Fabricating* logo. Under "Issues On-Line," select June 2002, then "Smart Cleaning for Stamped Parts."

Company	Circle
ICA Cinetic	360
Jenfab	361
LS Industries	362
Ransohoff	363
Stoelting	364