FLUID MANAGEMENT CONVERTS NUISANCE TO ASSET

Teamwork is the secret ingredient

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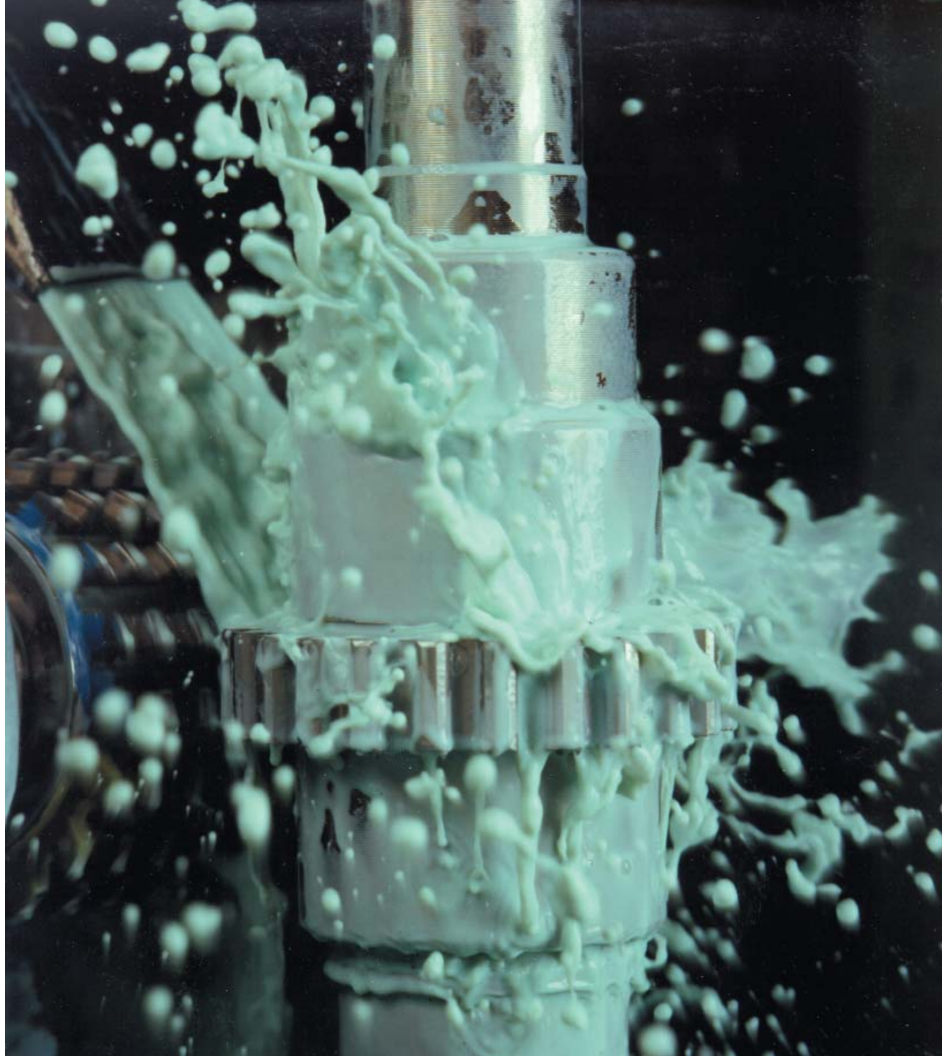


Gear hobbing

Starting with the wrong fluid makes management very difficult, if not impossible. That means it is critical to select a fluid that meets plant needs. Since fluid selection, use and maintenance are usually handled and performed by different groups within a metalworking facility, a fluid selection committee with appropriate cross-functional representation is recommended.

The functions or departments that should be represented on the fluid selection committee are: chemist or metallurgist; environmental engineer; facilities engineer; hygienist; maintenance engineer; production or manufacturing engineer; purchasing manager; and tooling engineer.

The fluid selection committee develops criteria that represent the interests of all areas/departments impacted by a fluid decision and shares that list with fluid suppliers. The result will be fluid candidates that meet the needs of the entire metalworking operation. Using just one fluid may not be acceptable or even possible, depending on the variety of operations performed. However, limiting the number of fluids used to two or three is desirable.

Establishing a fluid selection committee prevents fluid decisions based on the objectives of a single department or function. For example, a fluid selected solely on price by the entity with budget responsibility likely would increase scrap, disposal, machine downtime, tool damage and health concerns.

Case history

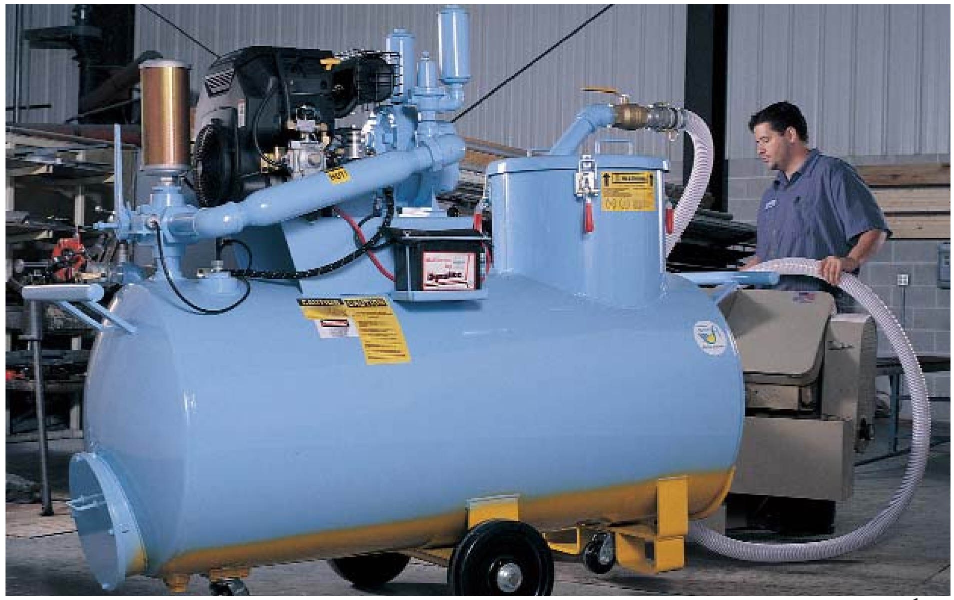
An aerospace company in the Northeast, equipped with individual sumps, machnines and grinds a variety of aerospace materials.Working with its coolant supplier, the firm achieved impressive results by implementing a coolant management process that included installation of coolant recycling equipment.

The following results are based on the same workload. The aerospace company tooling manager says they can push the tools harder and longer, knowing the coolant is of constant quality, and they expect to continue lowering tooling costs and waste disposal volume. Not a single sump of coolant has been discarded, since fully implementing the management process.

	Before	After
Coolant use per year	400 drums/$600 ea.	42 drums/$700 ea.
Tooling costs per year	$1.8 million	$700,000
Waste per year	1 million pounds	40,000 pounds

Testing for success

With a list of fluid criteria to present to a fluid supplier, it's easy to identify the coolants that might fit the bill. The fluid supplier will make recommendations based on knowledge of the facility and metalworking industry experience. The next step is testing. It's important to determine how a fluid performs under local conditions, on the required operations. But before starting the test, a thorough machine cleaning is mandatory. Machine sumps must be free of all contamination, including sludge, chip accumulations and residues. (See sump-cleaning procedures.)



Cleaning out a coolant sump with an LP Gas Yellow Bellied Sump Sucker from Master Chemical Corporation

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Before testing, needed preventive maintenance should be performed on test machines and records should be reviewed to ensure that any existing/emerging problems are not blamed on the test fluid. Also, make sure way and hydraulic oils are water-resistant. And, any grease used on the machine will need to be waterproof. (Sodium soap greases are water-soluble and should be replaced with calcium lithium soap greases or, ideally, aluminum complex greases.)

Closely monitoring and keeping detailed records during the test period will make product selection easier. Several coolant attributes can be determined rather quickly: tool life, surface finish, operator acceptance, filterability and foaming. The residue and biological characteristics, along with corrosion prevention, can take several months to evaluate.

Managing the fluid

Once the fluid has been selected, the ongoing process of fluid management begins. To manage the fluid, a number of variables that affect the quality and performance of the fluid must be controlled. The key to control will be fluid management training for everyone involved, to ensure understanding and buy-in.

The variables that must be monitored and controlled include: concentration, water quality, tramp oil contamination, bacteria and alkalinity.

1) **Maintaining proper concentration** – Fluids are formulated by the manufacturer for certain concentrations. Running the product above the recommended concentration wastes coolant, can cause excessive foam and residue, and may actually shorten tool life. Running it too lean can lead to corrosion, bacterial growth, poor tool life and poor part quality. Daily monitoring is done with a hand-held refractometer or a simple titration procedure. Often, the fluid supplier will run additional tests as a service. A positive-displacement proportioning mixer is recommended, because it delivers the selected ratio no matter the water pressure or how full the concentrate container. Some mixers will mix too lean as the level of concentrate goes down.

Keeping sumps topped-off is especially important. With today's newer, smaller sumps and increased speeds and feeds, a larger percentage of the sump evaporates each day. The fluid level drops, but the contaminant influx does not, which means a higher percentage of contaminants accumulating in a shorter period of time.

2) **Ensure water quality** – Since a working solution is mostly water, controlling water is essential to maintaining a quality process. Demineralized water is recommended because minerals in water react with and prevent a fluid from performing as designed, which often means using more fluid to compensate. Hard water fluid residues will be tacky and less resoluble, affecting, for example, limit switches and machine tool functioning.

Testing the forces on the metal during a drilling operation.

Using tap water as water evaporates from the sump, make-up fluid adds more minerals. In monitored coolant systems, the mineral content of a sump typically increased by a factor of four in just eight-weeks. As a result, using hard water increases conductivity, and the minerals serve as nutrients for bacteria.

Mineral content of local water supplies varies around the world, even regionally and by season. By using relatively low-cost demineralization techniques, such as ion exchange or reverse osmosis, water can be made uniformly pure and acceptable for metalworking fluid use. In moderately hard water areas, up to 15 grain (one grain equals 17.1 ppm hardness), deionization ion exchange is a satisfactory solution. In very hard water areas, more than 15 grains, reverse osmosis is more cost effective.

A conductivity meter is a simple way of checking the level of accumulated minerals in a fluid and should be done on a weekly basis. The fluid vendor will assist with setting the conductivity meter limits for the fluid being used.

Never use "softened" water. Softened water is even more likely than hard water to cause corrosion problems on machine tools, fixtures and work pieces.

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3) **Removing tramp oil** – Way and hydraulic lubricants, rust preventive oils on incoming parts, and tapping compounds are sources of fluid tramp oil contamination. Tramp oils lower the ability of the fluid to cool, promote bacteria and when delivered to the point-of-cut, create the smoky haze often seen in machine shops. In central systems, tramp oil should be maintained below 1.0 percent and below 2 percent in individual machines. Tramp oil can be removed from the coolant sump by skimming, coalescing or centrifugation.

4) **Controlling bacteria** – High-quality coolants, pure water, proper pH, concentration control and good housekeeping are simple but effective ways of controlling bacteria growth. A fluid at proper concentration has the ability to resist bacterial growth. However, if there are contaminants in the sump that encourage bacterial growth, such as tramp oil, floor sweepings, food scraps, chips or sludge, the fluid will be overpowered. Then it will be necessary to dump the sump or use additives.

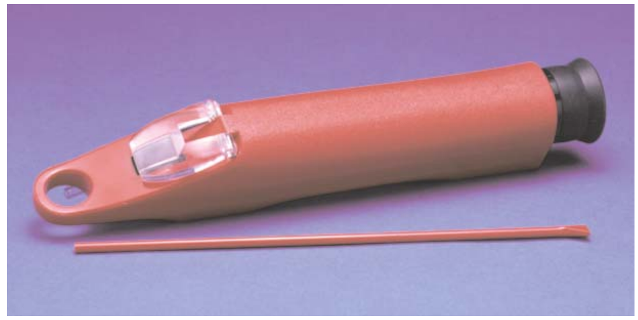
Filtration will remove chips. A dipstick analysis is a means of measuring bacterial and fungal levels. The fluid supplier will establish the limits for bacterial growth and can train plant lab personnel in the use of dipsticks.

5) **Monitoring alkalinity** – Keeping the pH at the fluid supplier's prescribed levels, deters biological growth, greatly reduces the amount of additives required and helps prevent corrosion. A normal pH level is between 8.5 and 9.5.

Good records and good practices

Fluid management requires testing, monitoring and good record keeping. All of which are preferable to downtime and machine cleaning. With variables identified and ranges established, monitoring will signal when the process requires adjustment and which variable needs to be corrected.

Training is also essential for all team members to understand the need and value of fluid management in a metalworking operation. While equipment that facilitates recycling will be required, with the high cost of disposal, the investment in equipment typically is paid back in less than one year.



Leica Refractometer used to test the concentration of the cutting fluid.

PREFERRED METHOD FOR CLEANING MACHINE TOOLS AND CENTRAL SYSTEMS

- Pump out used coolant and clean all chips, swarf and residue from the machine(s) and tanks, paying particular attention to difficult to reach and "blind" areas.
- Fill the machine sump or central system with enough water to run all pumps and lines. Add 3-5 percent TRIM WHAMEX to this system, depending on how much soil needs to be removed. Circulate the cleaner through all pumps and lines while allowing the cleaner solution to reach room tempera ture. While wearing protective gloves and eye protection, manually wash down machine surfaces using the solution in the sump. Continue this process until the machine is clean.
- Pump out and dispose of all the cleaner solution and make sure to remove any sludge, chips, or swarf.
- Rinse with tap water, circulating through all lines and rinsing down machine surfaces. Note that this rinse step will remove most or all of the rust inhibitors, so proceed to the next step as quickly as possible.
- Pump out and dispose of the rinse water in accordance with environmnetal regulations and recharge the machine or central system with the appropriate TRIM® coolant.

QUICK CLEANING METHOD (FOR NONCRITICAL INTERM CLEANING)

- Add 3 to 5 percent TRIM WHAMEX to the coolant already in the machine or sys tem.
- Circulate through the pumps and lines while manually cleaning exterior surfaces with the coolant/cleaner mixture, or use TRIM TASK. Wear protective gloves and eye protection while doing this.
- When the machine surfaces appear clean, pump out and dispose of the coolant/cleaner mixture. Be sure to scrape out and remove any remaining sludge, chips, swarf or residues.
- Rinse expoosed surfaces lightly with tap water, suck this out and immeditaly recharge the system with fresh TRIM coolant.

The Tramp Oil Terminator from the Systems Equipment Division of Master Chemical is a robust centrifuge unit, generating 6,500 Gs of centrifugal force, processing as much as two and one-half gallons of coolant a minute, depending on the type of coolant used and its condition.

Once the fluid process has been stabilized, machines will be cleaner, the environment healthier and fluids can run indefinitely. However, it is recommended that each machine tool still have a thorough machine cleaning once a year. A recycling operation every four-to-six weeks to remove the fluid does not qualify. Each metalworking operation needs to establish a regular schedule for individual machines or a once a year, summer or winter, plant wide shutdown. The annual cleaning process will be much faster and less nasty, since the machines will be in much better condition.

It's clear that fluids must be controlled and maintained properly to make their maximum metalworking contribution. And those charged with maintaining the fluids must be given the equipment, the responsibility, the authority and the time to do so.

The benefits of a fluid management program are well worth the effort: improved manufacturing process; optimum tool and wheel life; uniform finish and size control; better in-process corrosion protection; improved working conditions; increased machine uptime; reduced machine tool maintenance; greater productivity; less fluid concentrate consumption (typically 40 to 50 percent); and greatly reduced, if not eliminated, waste disposal.

Fluids have been labeled a "necessary nuisance." While they are certainly necessary for most metal removal operations, the term nuisance, which would indicate harm or annoyance—is not appropriate and doesn't apply to a quality fluid that is managed properly.

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TRIM

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