

## **Coolants and Coolant Management**

*Managing the use and care of your metalworking fluid can significantly reduce cost as well as provide a safe, clean working environment.*

Metalworking fluid management can produce a competitive advantage in today's marketplace. Industry estimates that metalworking fluids make as much as 10 percent of the cost of a finished part. It includes the initial cost, housekeeping, cleaning and disposal. At the same time, tooling only makes up about 6 percent of the cost of a finished part. The goals of metalworking fluids management are to reduce costs by increasing the life of the metalworking fluids and to decrease the amount of disposal. Other benefits include providing a safer and cleaner work environment for the operators.

### **Coolant Selection**

Proper metalworking fluid selection is essential in coolant management. For example, some lubricants and corrosion inhibitors are targeted specifically to work with certain metals, so choosing a metalworking fluid designed for aluminum might give poor performance if it is used strictly for ferrous metals. Also, metals that corrode easily will require an oil-based product. Finally, some hard-water situations call for specific metalworking fluids. Choosing the wrong metalworking fluid can be a costly mistake on many fronts, so start off right by choosing the appropriate metalworking fluid for the job. Most manufacturers have a team dedicated to helping companies in their product selection process.

There are three major classes of metalworking fluids, and they each carry their own inherent advantages and disadvantages. All metalworking fluids will lubricate, cool the metal, carry off chips and provide rust protection for the work piece and the machine. However, the huge number of available ingredients makes it possible to create an infinite number of variations.

### **Water-Soluble Oils**

Water-soluble oils are the workhorses of the metalworking industry. They are most commonly used for CNC machining of ferrous metals, but can be used in a wide variety of applications. They leave behind an oily layer on the parts and machines, which acts as a rust preventative. When the coolant is used properly, it is very uncommon to have rust problems. The disadvantage of the water-soluble oils is that they will emulsify tramp oil, so that the tramp oil (hydraulic oil, spindle oil, etc.) now becomes part of the coolant. In effect, this weakens the emulsion stability of the metalworking fluids and can eventually split the emulsion.

### **Synthetic Metalworking Fluids**

Synthetic metalworking fluids lend themselves well to grinding and light-duty machining. Synthetics work great for grinding because they allow for swift settling of the small fines created during grinding. Grinding fluids should be cleaner than machining fluids because they cover a larger work area and can splash more than a machining operation. Whereas water-soluble oils will absorb tramp oils, synthetics typically will reject the oils — allowing them to be skimmed from the surface of the metalworking fluid.

In some applications, this feature allows synthetics greater longevity in the sump. Many synthetics work well for machining all metals and some of the newer and more expensive synthetics can approach the tool life of water-soluble oils. The disadvantage of synthetics is that some components such as lubricants and rust preventives can be used up before the rest of the metalworking fluid.

### **Semi-synthetic Metalworking Fluids**

Semi-synthetic fluids are a good compromise between the water-soluble oils and synthetics — they are hybrid products of both water-soluble oils and synthetics. Therefore, they carry both the advantages and disadvantages of both groups. Semisynthetics are less likely to cause rust than synthetics, will still provide rust protection because of their oil content and will emulsify tramp oils. Semi-synthetics are suited ideally for machining and grinding of cast iron.

Manufacturers will formulate different grades of products, so that there are products available for all types of machining operations. Each category of coolant can have low- to high-grade products. Typically, the higher the price of the product, the better performance it will give. Just because a metalworking fluid is lower in price does not mean that the customer will save money in the long run, because tool life can be affected greatly by metalworking fluids. To get the most out of your metalworking fluid, select the right metalworking fluid to begin with, then adhere to a good sump maintenance program.

### **Drain, Clean and Recharge**

Proper metalworking fluid management starts with the draining, cleaning and recharging of the machine. This is the most important step in breaking the cycle of rancidity and metalworking fluid failure. An effective biocide/fungicide intended for the use in metalworking fluids should be added 24 hours before the machine is drained, cleaned and recharged. The coolant should be circulated and the machine can continue to make parts during this process. This will eliminate the bacteria and fungi in the sump, pumps, filters and coolant lines. Do not use bleach as a biocide. Bleach will only shorten the life of the metalworking fluid. Drain and properly dispose of the old metalworking fluids. Clean the chip and swarf from the machine.

Fill the system with just enough fresh water and alkaline cleaner that the pumps can circulate the solution. Circulate the cleaning solution for 15 to 20 minutes — this will clean the grease and sludge from the sump and coolant circulation system. Pump out the cleaning solution and circulate clean water through the system.

The machine tool is vulnerable to rusting after the cleaning process. Use a spray bottle with a mixture of 50 percent new concentrate and 50 percent water to spray all of the surfaces on the machine to prevent rusting. Make sure that you spray under all of the machine fixtures, and clean or change all of the filters on the machine tool.

Refill the system with fresh metalworking fluid and circulate. Remember always to use the OIL (oil in Last) method when mixing soluble oil or semi synthetic. This will produce stronger emulsions increasing the life of the fluid. In the worst cases a biocide/fungicide treatment should be considered two or three days after the drain, clean and recharge.

### **Maintenance Ongoing**

maintenance of a metalworking fluid sump is divided between concentration and contamination management. Today's metalworking fluids are designed to function properly in concentration ratios of 3 percent to 10 percent. Just as diluted paint will not be very effective, the same holds true with coolants. The easiest (and most important aspect) of metalworking fluid management is to keep the concentration within the recommended range for the application. This will help prevent a host of future problems. Concentration can most effectively be checked with a refractometer. The use of pH to check concentration will not work, because metalworking fluids can have the same pH over a wide range of concentrations.

Over time, even the best coolants can lose components. The most common reason for the selective depletion of metalworking fluids components is adding water to the sump to reduce the concentration due to evaporation. Always add some concentrate to the sump even in low concentration to make up for the components that are being consumed in the process.

Foreign material in the sump can reduce the effectiveness of the metalworking fluids. The two main contaminants are: 1) tramp oils (way lube, hydraulic oil, spindle oil, etc.) and 2) fines created during the machining process. As previously discussed, tramp oils can emulsify with semi-synthetics or water-soluble oils, causing the emulsion to split. These tramp oils also can create a favorable environment in which bacteria can grow. Any fines that are not removed from the sump can rob the metalworking fluids of rust protection prematurely.

The simplest and most cost-effective method of removing tramp oil is a wheel skimmer. The skimmer is engineered with an injection molded frame that will accept both twelve- and eighteen-inch wheels. A new skimmer has a smaller footprint than conventional wheel skimmers, making it easier to fit on most sumps. Exclusive bidirectional tramp oil drains make it possible to remove oil from either side of the unit. Tramp oil skimmers are most effective when the sump is not in use. Coupling the skimmer with an automatic timer from a hardware store will allow it to operate during the off hours. Typically, a wheel skimmer only needs to operate one or two hours to completely remove tramp oils from the surface of a sump.

Proper maintenance of metalworking fluids is not complicated or time-consuming when compared to the advantage of longer coolant life.