Machining

Don't Cut Costs Here: Spending More on Metalworking Fluids Boosts Machine Shop Profits

Kip Hanson | Jan 10, 2023

Machine shops struggling to lower costs amid surging inflation may be able to get a break by upgrading to high-performance cutting fluids that prolong tool life and reduce high recycling expenses.

The newest, most advanced ***fluids*** can also help metalworkers take fuller advantage of state-of-the-art machine tools as well as deal with the challenges of specialty metal alloys that are not only far more durable than their predecessors but more difficult to cut and shape.

“Metals are getting tougher and machine tools are getting faster, so whether it’s tooling, programming software or cutting fluids, it behooves shops to stay current with the latest technology,” says John Treese, director of global training for Master Fluid Solutions.

Both ***Master Fluid Solutions*** and ***Castrol*** displayed some of their most recent innovations last fall at IMTS 2022, the largest manufacturing trade show in the Americas.

For Castrol, that category includes its XBB line, a biocide- and boron-free water-soluble oil that’s been engineered to stringent industry standards.

Watch Video: IMTS 2022—Breakthroughs from Master Fluid Solutions

While boron has long been praised as a “magical” additive, thanks to its ability to inhibit corrosion, reduce foam and keep cutting fluids stable, it has some significant drawbacks, says Jennifer Johns, an applications engineer for Castrol.

“Its use creates some health concerns for the operator, as do biocides,” she says. “In addition, most machinists are familiar with that yellow, sticky film that forms on machine surfaces and is almost impossible to remove. That’s boron.”

Removing that film doesn’t quite require a jackhammer, but it’s close, she says—one customer even experienced machine damage when a boron-encrusted spindle jammed during a tool change.

“I’ve since found one of our alkaline cleaners—S 5001—does a nice job on boron, but it doesn’t change the need to eliminate it from metalworking fluids,” she says.

Fluid Price vs. Performance

While ***water-soluble cutting fluids*** have been around for decades, work well, are relatively inexpensive and last for months if well-maintained, there are reasons besides eliminating potentially harmful ingredients to continue refining them.

Productivity is a major one, and recent additions to the TRIM lineup of cutting and grinding fluids at Master Fluid Solutions—among them TRIM E715, TRIM MicroSol 642RX and TRIM E860, are all designed to achieve maximum metal removal across a range of alloys and operations. They also feature high lubricity and low foaming.

Price, however, often outweighs such capabilities in purchasing decisions.

“A typical shop might use hundreds of different cutting tools but only one cutting fluid, so it’s pretty easy to zero in on that line item when you’re looking for cost reductions,” says Treese, the director of global training for Master Fluid Solutions.

That kind of thinking may hurt more than it helps.

Cutting tools represent 3 to 5 percent of total machining costs and cutting fluids make up only about 10 percent of that amount, or less than half a percent overall, Treese says, citing studies by major tooling providers.

> **Metals are getting tougher and machine tools are getting faster. Whether it’s tooling, programming software or cutting fluids, it behooves shops to stay current with the latest technology.**
> John Treese
> Master Fluid Solutions

Explore Metalworking Fluid Options for Your Specific Application
SHOP FLUIDS & COOLANTS

Reducing ‘Carry-Off’

That makes it easy to argue that a small performance increase more than offsets the cost of any metalworking fluid.

One major consideration for shops choosing cutting fluids should be their tendency to “carry off,” which has a significant impact on cost, he says.

“Carry-off is the amount of fluid that sticks to the chips and workpiece and is directly related to the size of the oil droplet and its wetting factor,” he says. The more fluid that’s carried off, the more workers must add to replenish it.

Treese offers two analogies. The first is that of a sump filled with pingpong balls vs. one filled with softballs. Smaller droplets, i.e., those that are like pingpong balls, carry away less fluid and are therefore less expensive.

Read More: How Synthetic-Based Cutting Fluids Can Boost CNC Cutting Speeds

Second is the wetting factor. Large droplets that cling to the chip surface are more prone to carry-off, increasing fluid loss, while ones with good wetting form "a nice, flat puddle" that resists carry-off, and again, are more cost-effective.

Perhaps most importantly—to the machinist, at least—is the performance of cutting fluids, sometimes referred to as cutting oils or machining oils.

"The space between the cutting tool and chip is minuscule, so smaller oil droplets and higher wetting allow more lubricant and water to squeeze into the cutting zone, increasing effectiveness," Treese says. "Think of it from an engineering standpoint—if you have two plates of metal rubbing on one another, would you want several big ball bearings carrying that load, or several hundred smaller ones?"

Cutting Fluid Maintenance

Another reason to periodically reevaluate cutting fluid choices is, as Treese implies, higher machine performance. Spindle speeds on CNC machining centers are much higher than those of yesteryear, with 12,000 rpm or greater (often much greater) quite common.

And many CNC machine tools—lathes and machining centers alike—are now equipped with high-pressure coolant (HPC) systems. The "tiny droplets" just mentioned must therefore withstand pressures of 1200 psi and higher without creating excess amounts of foam.

Whatever the brand or type of cutting fluid, proper maintenance is key to long-term performance, the two experts agree. Suggestions include:

- Avoiding the use of hard water. Reverse osmosis or deionized waters are best.
- Acknowledging that sump skimmers are a must on any machine tool.
- Investing in a coolant recycling system for fast cleanouts.
- Routinely checking coolant concentrations with a refractometer and mixing makeup fluids accordingly.

The last item brings up a common oversight: Always add the concentrate to the water, not the other way around.

Better yet, buy a coolant proportioner for the most accurate mixing. "And don't be afraid to ask for help from your fluid provider," says Castrol's Jennifer Johns. "There's a reason why we and others carry so many different formulations, and deciding which one is right for your application isn't always easy."

Lastly, modern cutting fluids share another similarity with cutting tools—they often need a higher rpm to be effective.

During one recent customer visit, Master Fluid Solutions' Treese delivered the welcome news that the business could and should increase spindle speeds, often by 30 percent or more. Doing so was necessary to generate the heat needed for good chip flow.

"Modern cutting fluids do such a good job of cooling that chips will stick to the carbide if the rpm is too low, resulting in built-up edge and flaking," he says. "It's not unlike touching your tongue to a frozen flagpole. That's also why it's crucial that shops maintain the correct concentration, which is key to coolant longevity and a reproducible cut. I can't stress this enough."

Copyright ©2025 MSC Industrial Supply Co.