



Innovation in Metalworking Fluids



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5 Considerations When Selecting Metalworking Coolants & Fluids

Metalworking fluids are engineered for a variety of lubrication and cooling operations. Since there are many combinations it is imperative to first select the correct fluid for the application. When cutting metal from the workpiece, one of the considerations in selecting a fluid is the cutting speed. Lower speeds demand a fluid that serves as a lubricant to prevent friction-induced wear, galling and chatter. Each of these can cause reduced tool life and scrap parts.

At high speed, the fluid needs to provide more cooling to prevent the tool and workpiece from becoming too hot and likely deforming the part and also reducing tool life. In addition, the right selection of machine coolants and lubricants help remove chips, improves the surface finish of the material being machined and reduces the possibility of corrosion.

The Statistics of Why to Use Cutting Fluids

Cutting at high speeds creates heat. That's why we use coolants. Chips are formed in every metal cutting process. As temperature increases at the shear of the cut, plastic deformation of the metal occurs. Because of the increased plasticity of the metal when cutting at high speeds, the cutting force should be decreased to avoid deformation of the finished part.

Studies show that heat distribution follows three primary paths:

- 2% of heat is created at the tip of the cutting tool
- 18% occurs where the tool creates the chip, which is the secondary shear zone
- As much as 80% of the heat is generated at the cut in the material where the chip is formed

Yet the heat needs to go somewhere. With high speed machining heat is generated in the cut and dissipates as follows:

- 5% goes through the part
- 20% goes through the tool
- The remaining 75% is taken out with the chip

Studies show that the input and dissipation of heat can be controlled in favor of the machining process by using the correct fluids for the application. When cutting at the proper speed for the tool and material, proper fluid selection and how it is applied will allow more of the heat to be redirected into the chip, and away from the tool and part.



Innovation in Metalworking Fluids



Choose According to the Application

Machining performance issues can occur because of the wrong choice of fluid or oil. Sometimes the issue is a change in manufacturing process that alters the choice of the fluid being used. There are a number of factors to consider, including:

- Newer machines
- Changes in specifications
- Varying batches of raw material
- New environmental concerns and corporate sustainability goals

To begin the process of selecting the correct fluids, some basic considerations must be taken into account:

1. Types and grades of metals
2. Machining operations
3. Tooling
4. Types of Machines
5. Coolants that provide longer sump life

1. Different Metals Require Different Coolants & Lubricants

Hard to machine metals, such as stainless steel, titanium, Inconel and others are more difficult to machine than standard carbon steels and require high performance fluids that contain higher amounts of oil for lubrication. Standard carbon steel, aluminum and brass, although softer metals and are much easier to machine, require fluids with an increased water content for extra cooling.

Hard, metals that have low-machinability characteristics require additive cutting oils with exceptional anti-weld and extreme-pressure capability. These metals along with aluminum, brass and most carbon steels are ideal for using long life synthetic coolant cutting fluids formulated to provide the best in extreme pressure additives for the most severe applications.

2. Machining Operations

Machining such as drilling, turning and milling can be performed at higher speeds with elevated levels of cooling and modest extreme pressure additives. Drilling, tapping and sawing fluids are





Innovation in Metalworking Fluids



ideal for semi-synthetic fluid formulations which provide both lubrication and cooling properties.

3. Tooling

The types of lubricants used in metal cutting and forming are not just dependent on the metal being machined, but also on the type of tool being used. Some specialty tools have coatings and certain grinding abrasives contain chemicals that are not compatible with many cutting oils and coolants. Therefore, it is imperative to select machine cutting fluids that are compatible with the tools being used.

4. Types of Machines

Different types of machinery often require different cutting fluid characteristics.

Grinding and deep-hole drilling machines use lighter viscosity oils that provide higher rates of cooling and excellent chip removal without foaming. Products that are oil-free allow for extended sump life without sticky or oily residues left on machines or parts. There are high quality oils that use state of the art technology to achieve maximum corrosion protection on a



variety of metals which are ideal for multi-metal shops that use a variety of machine types.

In addition, minimum quantity lubricants are designed to minimize the amount of fluid used in both cutting and forming applications. These vegetable oil based products offer outstanding lubrication on a variety of different metals in many machining operations.

CNC machines may have specific restrictions due to the types of seals they have and can experience incompatibility between the cutting fluid and machine components. And surface grinders may not need the tougher machine cutting coolant that a centerless grinder may require.

5. Longer Sump Life

Today's market continues to be driven by the want to become more environmentally conscious while improving the company's profit. This trend has pushed metalworking fluid formulators to create products that have a longer in-use life. Traditional water-based products, with little maintenance and without built-in buffering chemistry, would last a couple of weeks to a month



Innovation in Metalworking Fluids



at most before the shop had to dispose of and recharge with fresh fluid. This cost the shop in downtime and money in fluid consumption and lower production. Additional costs were realized once regulations were put into place deeming metalworking fluid waste was to be handled as hazardous. Newer technology has been developed and used by metalworking fluid formulators, improving the sump life significantly. New age, high oil, semi-synthetic coolants specifically have been engineered to provide buffering that allows them to operate in a pH range that is uninhabitable to bacteria. In addition to the chemistry, machine operators are also instituting better fluid maintenance programs that can help identify problems before they become overwhelming. Shops that were changing out their sumps every two weeks because of bacteria growth can now run for months before having to change out. This decreases downtime, decreases waste, and increases profits; a win for everyone.

Conclusion

Selecting and using coolants and cutting fluids is not as simple as it sometimes seems. And it is usually not as simple as using the same machine cutting coolant or just any type of lubricant that has been used in the past. In today's world of high precision machining one must consider many variables before selecting the best fluids for the specific application. From metal type, to tooling, to the specific machining processes, selecting and properly using the correct cutting oils, lubricants and coolants is key to ensuring quality finished parts and achieving a process ROI that will satisfy your company and your customer. Call us today for more information at 800-229-6744 or click the button below.