Machine Tool Lubrication – Grease and Oil Compatibility

The proper selection and use of grease and lubricating oils is critical to machine tool health and productivity. It is estimated that 50% or more of all machine tool maintenance down time is related to "lubrication issues". It is not our intention in this Technical Bulletin to belabor the importance of proper preventative maintenance, but rather to comment on the issues associated with the selection of these oils and greases as they relate to metalworking fluids.

When working with conventional straight cutting and grinding oils, compatibility between the lube oils and greases and the cutting oil is typically not an issue. The basic chemistry of both the cutting and lubricating oils is very similar. This is not necessarily true if either of the oils in question is based on "synthetic" or "vegetable" oil chemistry rather than conventional "petroleum" oil chemistry.

When dealing with water soluble metalworking fluids, the issues are much more critical and much more involved. Typically what is desired are so called "water resistant" oils and greases. That is lubricants that will resist being emulsified into the metalworking fluid.

This is desirable for two basic reasons.

1. Lubricating oils that are easily water soluble do not remain in place long enough for them to properly lubricate the systems so the lubricant needs to be applied more frequently and in larger amounts.
2. From a fluids point of view, oil that gets into a system unintentionally (TRAMP OIL) is one of the major killers of metalworking fluids.

To address these "tramp oil" issues, multiple tracks are typically perused. The most effective programs do all of them to the greatest extent possible. They include:

1. Formulate (select) the fluid to resist or mitigate the affects of tramp oil as much as possible. Sea water rejects tramp oil and cools very well but is not a good metalworking fluid in most situations.
2. We want to put as little tramp oil as possible into the system. This is typically done by properly maintaining the lubrication systems to insure that as little oil as possible leaks out.
3. We want as much water resistant oil and grease as possible. This water resistance reduces the probability that the oil will become mixed with the fluid.
4. We are looking for lubricants that contain minimum levels of "detergency", a cause of foam, and ZDP (zinc dithio phosphate). ZDP is an anti-wear agent which has been implicated in dermatitis, corrosion and residue issues.

In the metalworking industry greases are not only used to lubricate some parts of the machine but are also used as a type of "gasket or seal" to protect the interface between tools and tool holders, fixtures and ways, and bolts and their threads. These and other parts of the "machine tool" system often benefit by a light coat of water resistant grease between the mating surfaces. This film of grease prevents the metalworking fluid from "wicking" its way between the two surfaces and causing corrosion or location problems.

In situations where a fixture is going to be mounted on a machine for several days or more, or where the fixture and the mounting surface are made from dissimilar metals, a light coating of grease applied to the mounting area will prevent a galvanic cell from forming. In situations such as when the mounting bolts hold a centerless grinding wheel in place, putting a light coat of water resistant grease on them will reduce the tendency of the fluid to penetrate between the threads on the bolt and the threads in the flange, making it much easier to disassemble the parts when it is time to change the wheel.

The best source of information about your lubricating oils is your lubricant supplier. Metalworking fluid formulators like Master Chemical can and do, testing on lubricating oils and greases for compatibility; but it is important to understand that most lubricating oils and greases are manufactured to a "mechanical specification" rather than to a chemical formula. The formula of most products is subject to change between batches. In other words, most lube oils are manufactured to have certain levels of lubricity, but most of the charteristics that affect their compatibility with metalworking fluids are not part of the typical specification.

It is easy to check miscibility of an oil or a grease in your own shop. Add 10% of the oil to be tested to a sample of the working solution (either new or used) at the desired concentration. "Spin" the mixture in a blender for a minute and then pour it into a graduated cylinder. Allow this to sit for a few hours and measure how much of the oil has "split out" to the top of the cylinder. More is better than less, and faster is better than slower. To check a grease, place a small amount of grease on a steel plate and a small amount of working solution on the grease and then try to work the fluid into the grease with a spatula or similar utensil. The less fluid that goes into the grease, and the less the grease changes, the better and more water resistant the grease is.

NOTES:

1. Test protocols to help you run your own "water resistant" grease and lube oil tests are available from Master Chemical Corporation.
2. Techniques and tools for removing tramp oil from metalworking fluids are discussed in other TRIM® Technical Bulletins.
3. For additional information on this subject contact your Master Chemical District Manager, Authorized Distributor, the Tech Line (800-537-3365 North America only) or our website at www.masterchemical.com/8/8c-frames.html.

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