How-to

Characteristics of Metalworking Fluids – Foam

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It has been said that in metalworking fluids (MWF), foam is a real headache. While in certain operations controlled foam is necessary for fluid to function properly, in many other cases it is a real problem. These problems stem from several "foam facts":

1. Foam does not lubricate very well.

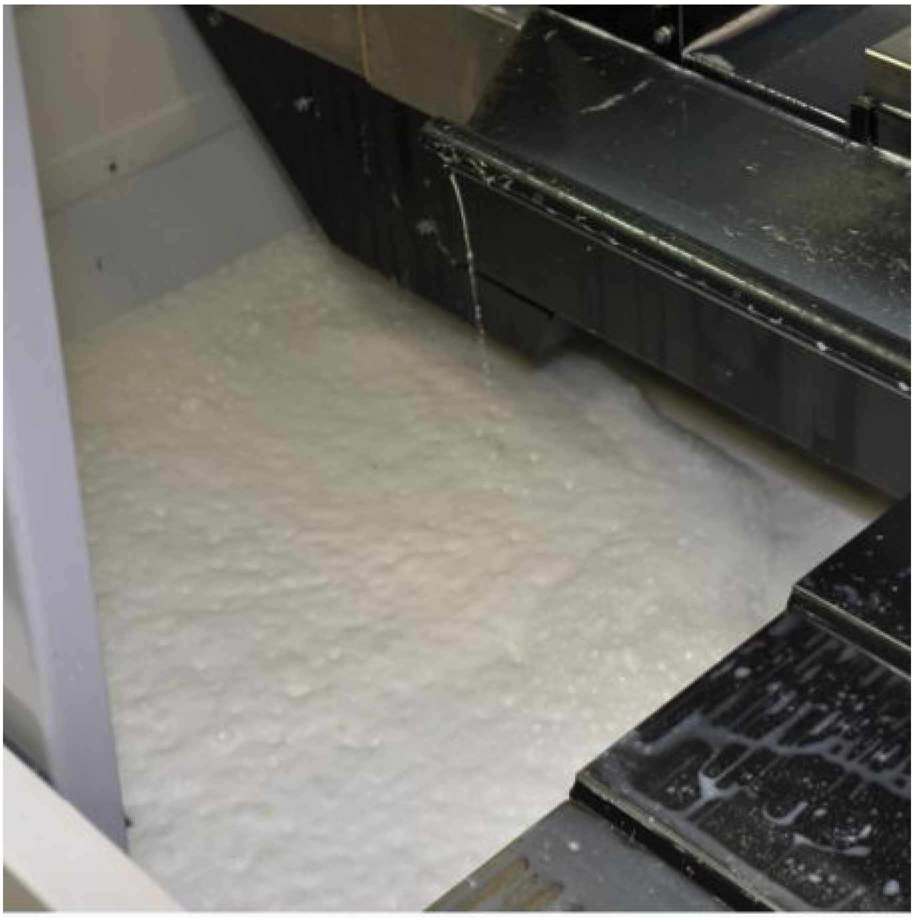
2. Foam does not cool very well and in many situations will actually serve as an insulating blanket.

3. When a given volume of fluid is filled with gas – made foamy – volume increases substantially.

4. Because foam may "float" chips and fines, it will affect filtration and the ability of the fluid to "settle the fines".

5. Foam contributes to chemical odor and mist problems.

6. Foam, if sucked into pumps and machine plumbing, can cause substantial damage.



Foam in metalworking fluids can be a necessity or a major headache. Foam doesn't lubricate well, it cools poorly, it increases fluid volume, it adds to odor problems and, most importantly, it can damage machine plumbing.

For foam to occur, several different conditions need to be present. If it is possible to "design out" any one of these items, you will alleviate your foam problems. These conditions are:

1. The application must include agitation and/or fluid movement.

2. The fluid must have "surface active characteristics" – contain surfactants or emulsifiers.

3. The moving fluid must be exposed to a gas (typically air).

4. The fluid must trap or entrain some of that gas.

If it is possible to engineer out one or more of these conditions, foam control becomes much easier. As with all manufacturing engineering problems, fixing the root cause of the problem is always preferable to treating the symptoms of the problem, so try the engineering solution before resorting to adding antifoam.

High coolant velocities, pressures, and flows have always been required for gun and ejector drills and the tendency for these coolant systems to generate foam with water-miscible coolants has kept many of them running with straight oils. As the use of high- pressure, high-volume, and high-velocity coolant to break up and flush chips out of the cutting zone has been widely recognized, straight oil is no longer a viable option. So in situations where high-velocity coolant is installed on turning and/or machining centers, fluids especially designed to be low foaming have been developed. These fluids have been optimized to resist foam and air entrainment and thus allow you to fully exploit the capabilities of the machine and its high-pressure coolant delivery system.

It is the very nature of most MWFs that they must be in motion to do their job and very often the more and faster the fluid moves, the better. (Higher velocities and volume often improve fluid performance.) However, this movement often exposes the fluid to more air (gas) entrainment opportunities than necessary. (These are situations where moving fluid is exposed to or has air injected into it.)

These are typical examples of "mechanical" issues that contribute to the foam issue and an “engineering solution” is the proper answer:

1. Leakage in valve stems from loose packings.

2. Leakage by pump shaft packings.

3. Leakage in piping, rotary unions, or other connections.

4. Pin holes in hose.

5. Bypass valves being closed too much, producing excessive back pressure in the system.

6. A pump oversized for the job or "throttled back" so that it churns the system.

7. Sump too shallow or pump set too high so that it "sucks air" into the intake.

8. The coolant pump running in the wrong direction.

9. Excessive cascading or "drop" of the coolant to the tank surface.

On the fluids side of the foam equation, these are some of the issues to look at in solving a foam problem:

1. Fluid and concentration selected.

2. Tramp oil contamination.

3. Washing or "floor soap" contamination.

4. The water and how the fluid was mixed with it.

5. Misuse or overuse of topical antifoams.

6. Carryover from preceding operations, e.g. drawing or mold-release agent on the part, etc.

Just a word about topical antifoams—Keep in mind that antifoams, once added, will eventually be carried out of the system and subsequent, periodic additions may be required to control foam. As coolants age and become contaminated with tramp oils and "dirt," their tendency to foam decreases; it is fresh, clean coolants that exhibit the greatest tendency to foam. The over-addition of antifoams can contribute to foam problems because, as formulated, they contain large quantities of emulsifiers.

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