Technical Bulletin

Control of Bacteria and Fungal Growth in Metalworking Fluids — Cleaning Individual Machine Tool Sumps

The battle to control microbiological growth in machine tools sumps is won or lost in the sump. The key issue in this battle is "machine cleaning practices and procedures". While machine cleaning is only one of many fluid maintenance practices that affect sump life, others include concentration control, tramp oil contamination, and water quality to name a few.

It has been estimated that at any given time less than 1% of the total microbiological load in a machine tool is actually circulating in the fluid. Rather the vast majority of the "bugs" are at home in the biomasses and "crud" that are to be found on the walls and bottoms of most machine tools' sumps and fluid delivery plumbing. Even the strongest biocides will only penetrate a short distance into these very dense residues, meaning that to reduce the biological load in a machine tool sump these havens made up of chips, residue, hard water soaps, and tramp oil must be "broken up" so that the bacteria can either be exposed to the appropriate biocide or mechanically removed by machine cleaning.

This "annual" machine cleaning needs to be differentiated from the periodic pumpout that occurs when the fluid is pumped out for recycling or disposal. During these fluid change outs, every effort is made to get the fluid in and out of the machine as quickly as possible while removing whatever chips and residue that are easily available. The "annual" machine cleaning should be thought of as periodic fluid system maintenance, and should address not only getting the coolant delivery system clean but removing built-up residue, etc., on the machine and insuring that the coolant delivery system works properly.

Before we look at a typical machine cleaning plan, let's look quickly at the preventative maintenance that you may (should) want to do to the fluid delivery system. Remember, that as big a problem as a "stinky" contaminated sump is, if you can’t pump coolant, etc., you probably can't make parts. Some of the things that should be on your coolant system checklist are:

1. Is the pump(s) in good shape: impeller, seals, motor, and electrical connections, etc.?
2. Chip conveyer: motor, drive belt or gear box, flights, etc. functional and in good condition
3. Is the filter/filter system functioning properly: is the right media being used in the proper amounts, etc.?
4. Plumbing: check valve, on/off valve, throttle valve, piping. Does the wash-down hose work properly, system nozzle, etc.?

The "annual" machine cleaning is typically either a five (5) or a seven (7) step process. Depending on what the specifics of the situation are will dictate how you do each of these steps:

1. Add machine cleaner to the sump at the desired concentration. If the machine is not too dirty and the machine cleaner is "coolant compatible" (we typically recommend Master STAGES™ Whamex) the machine cleaner can be added to the coolant working solution and parts run for several shifts. If the system is really dirty it is advisable to pump the current fluid out for disposal or recycling, remove as many of the chips, etc., as possible; and then charge the system with machine cleaner and allow it to circulate through the machine for as long as possible (3 hours minimum).
2. While the fluid is circulating, wash down the outside and working zone of the machine to remove residue and chips. If there are particularly difficult-to-remove residues, "brush on" either machine cleaner concentrated or a water-miscible solvent cleaner, like Master STAGES™ AMO™. Allow the material to soak in and then rinse area with the circulating cleaner. If you choose to use a pressure washer or steam wand to speed this job along, be very careful around gear boxes, electrical panels, etc.
3. Open the machine up as much as possible to remove guarding, conveyers, etc., so that it is possible to completely clean the machine. Cleaning conveyers is particularly nasty but critical work. Typically 100% of the fluid put up into the cutting zone passes through the conveyer before it reaches the sump. If the conveyer is "loaded" with bacteria and sludge it will only serve to repeatedly inoculate the fluid. Without a clean conveyer, you don't have a clean machine!
4. Rinse off machine surfaces and then pump out the machine sump and properly recycle or dispose of the waste. If the machine was not too dirty at this point you may want to skip step 5 and go directly to step 6.
5. Refill the sump with the minimum amount of

water necessary to have the system circulate and add additional machine cleaner. Allow the machine cleaner to circulate. Pump out machine cleaner. Repeat as necessary.

6. Refill sump to the minimum level necessary to circulate with fresh water. Allow water to circulate through all the machine plumbing. Pump out rinse water and proceed to step 7 as quickly as possible. (The cleaning process has stripped all the oil and rust protection off of the machine.)
7. Recharge at the desired concentration. Catch the first few gallons of flow out of each coolant nozzle to catch the last of the cleaning fluid and/or rinse water so that you don't contaminate your fresh charge.

While the above process is tried and true, and when followed gives very good results, the process is not what is important but rather the result. To have a long-term successful coolant management program one of the pillars on which it will stand is a clean machine tool sump and fluid delivery system. Get and keep the machine sumps clean and you will be a long way in your goal of extending your sump life and controlling your metalworking fluid processes.

Notes:

1. The term "annual cleaning" comes from that on average doing this preventative maintenance cleaning once a year on every machine gives a very good "planning number". However, in reality this "annual cleaning" should be scheduled as often as necessary. When "necessary" is dictated by: what the machine is cutting or grinding, how heavily it is used, the machine sump design, how it is maintained, and how much "stuff" comes out during the periodic pump out.
2. On a practical basis it is often advisable to schedule the annual cleaning in conjunction with other "heavy" machine maintenance. This means that the machine cleaning can be done when the machine would be down anyway and gives maintenance a "clean" machine to work on. Once the machine is back up it can be recharged and production resumed.
3. When cleaning central systems or very dirty individual sumps, it is sometimes advisable to make a series of small Whamex™ adds over a period of several days rather that try to do it with one big add.