FOAM CONTROL WITH HIGH PRESSURE COOLANT SYSTEMS

Many machine centers are equipped with high pressure through-the-tool coolant systems. These systems can cause foam in the coolant sump which can eventually foam out of sumps or cause pump cavitation. Some steps can be taken to ensure the high pressure coolant systems do not disrupt production due to these issues.

HOW THEY WORK

Through-the-tool coolant systems are typically an add-on feature to machine centers. They deliver the coolant through the spindle, tool holder and tooling in most cases. The coolant pressure coming out of the tool typically runs in the 800 – 2000 psi range. These delivery systems typically come with a high pressure pump, a separate coolant holding tank and a canister filter system.

In cutting operations, the through-the-tool coolant delivery system aids in tool life and part finishes. They achieve this by putting coolant right at the cutting edge of tooling which helps cool the tool and workpiece much faster than remote coolant delivery systems. This aids in making chips break off quicker and producing smaller chips which are quickly evacuated from the workpiece surface. The high pressure coolant also helps to prevent BUE (built up edge) on the tooling by delivering coolant right to the cutting edge which in turn increases overall tool life.

Another advantage to this type of coolant delivery is that the metal chips are quickly evacuated from the cutting area. This aids in surface finish in that the chip is not dragged on the part surface by the tool. It also helps keep the tool edge from chipping, as machined chips are not in the cutting area where they can get recut and chip the tool.

HOW THEY AFFECT FOAM

High pressure coolant systems cause foam from making smaller coolant particles that entrain air more readily into the sump. It takes time for all the entrained air to come out of solution. When this entrained air comes out of solution, it produces foam on the surface of the sump. Depending on the type of coolant, the entrained air release can be fast or slow. Typically, synthetics are faster to release air than straight oils which are in turn faster than water soluble technologies.

The sumps normally will build 1 to 2 inches of foam, but if the coolant is slower to release air, this can build to multiple inches of foam. This can cause the sumps to overflow leading to a slip hazard for workers. Another issue of slower release or entrained air is the possibility of pump cavitation. This is very hard on pumps and can burn them out in a short period of time leading to costly repairs. Finally, if entrained air remains in the coolant during delivery to the point-of-cut, it can interfere with the coolant's lubricating and cooling abilities which can create significant machining issues.

HOW TO REMEDY THE FOAM

There are a few things that can be done to help keep the high pressure coolant from causing issues. The first recommendation is to fill the high pressure sump all the way to the full line, but only fill the machine coolant sump to the 75% mark. This will allow enough room in the machine sump for the extra coolant from the high pressure system plus any foam that is generated. For example, many sumps are only 80 gallons and the high pressure coolant tank is about 20 gallons. When the sumps are both filled all the way, there is no room for the extra coolant plus any foam that might be generated in the machine sump. Normally there is room for an additional 10 – 15 gallons of coolant in an 80 gallon sump. But adding in the additional 15 gallons from the high pressure system causes it to fill all the way up leaving no head space for foam. Therefore, it is recommended that the sump only be filled to 75% capacity.

Another way to help reduce issues is to make an adjustment to the high pressure coolant delivery system. When these add-on systems are initially set up, they are programed to fill when the level gets down to 25 – 35% capacity in the sump. This will add 12 to 15 gallons of additional coolant to the machine system and with smaller sumps this could be too much coolant. These can be adjusted by reprograming via the control panel on the CNC. You may need to contact the machine manufacturer to get a code to make that adjustment. The adjustment should be made to fill the high pressure sump when it gets to 50 – 60% level.

Flush lines in a machine are often used to keep the insides clean and ensure chips are flushed away. These lines may be numerous and may greatly agitate the coolant. Check these lines and adjust them down to the lowest level that maintains adequate cleanliness of the machine. This will remove excess agitation and reduce the overall coolant flow, allowing for longer residence time in the sump for air release.