LUBE-TECH

NO.36

STRATEGIES FOR EFFECTIVE CONTAMINATION MONITORING AND CONTROL

It has been estimated that the exclusion of system contamination costs about one-tenth what it would cost to remove the contamination once it has entered our system. Therefore, we must evaluate the options associated with the exclusion of contamination vs. the removal. Advances in proactive maintenance have produced numerous products that will prevent the ingression of contamination. We need to look at the proactive options for maintaining lubricant and mechanical reliability and for sealing our systems from their surrounding environments. First, we need to take a detailed approach to identifying what is appropriate for our equipment.

We need to look at:

- What is contamination and how do we identify it?
- How can we get a qualitative or quantitative measure of the contamination?
- What are the effects associated with the different states of contamination?
- Where are the entry points for contamination on our systems and what are the options for exclusion at these locations?

Contamination is often defined as anything that, pollutes, infects or has an undesirable affect something else. This is a very broad definition when referring to lubricant and equipment reliability. The most common forms of contamination in hydraulic and lubricated equipment are solid particles, air, heat and water. Other forms of contamination found in hydraulic and lubricated equipment include, but are not limited to fuel, glycol and radiation. Though contamination can exist in several states, they all have detrimental effects on our lubricant and our machine surfaces in one way or another. Generally, oil contamination will modify the physical and chemical properties of the lubricant and chemically attack and destroy machine surfaces.

Solid Particle Contamination

Solid contamination is the most common form of contamination and exists, at some level, in virtually every hydraulic and lubricated system. Solid contamination also exists in brand new lubricants before they are even put into your equipment. Solid contamination is the most common because it has the opportunity to enter our system at several locations. Because we will never be able to remove all the solid particles, we have to set limits to determine how many particles we are willing to allow in our lubricant. Our oil analysis program should dictate an ISO 4406 Solid Contamination Code target level that we are trying to maintain.

Solid contamination can be built into our system, it can be airborne, it can enter your system in new oil top-ups, through defective seals and through cross contamination from filter carts. We want to be able to minimise the amount of solid contamination that is ingressed into our system and be able to remove the dirt that is already in our system.

The biggest culprit for letting dirt enter your system is the air breather. Most systems come with a standard paper media breather with a nominal rating of about 40uM. This means that the smaller, more destructive particles are able to get into your system very easily. Upgrading a standard breather to a high-efficiency filter is easily done using commercial bayonet adapters and quality synthetic hydraulic filters.

Adding new oil to a system is a very common practice that can also yield high concentrations of contamination. Industry has no guidelines for new oil cleanliness which means that it may end up at your plant with a cleanliness code of up to 23/20 or higher. Pre filtering your new oil before it enters your system is a very efficient way of minimising the particle contamination and reducing the damage those particles will cause. Even opening our system fill port to add new oil is a cause for concern in many plant environments. Adapter manifolds are available that maintain a closed system, even when filtering the oil, topping up the fluid or draining the tank.

Cylinder rod seals also let solid contamination pass by into our system. Quality rod boot bellows are an effective way of covering the rod on extension and keeping it clean.

Solid contamination can also be generated within our systems as mechanical components come in contact with each other. When this happens we need to ensure that we have an efficient means of removing the particles before they have the opportunity to generate more wear?

Size, shape, colour and hardness are key characteristics of identifying where the solid contamination originated. The analysis of a particle will lead to the identification of the component that is wearing if we have properly identified the metallurgy if our system components. Depending on the type of metal, some metals, like copper, lead, steel and iron will act as a catalyst and accelerate the natural tendency of the lubricant to become acidic and oxidise.

There are several filtration options available for the removal of solid particle contamination in our systems. We have to consider location of our filters, media type, cost and beta rating. Our goal is to include a filter on our system that has a beta rating that will allow us to achieve an ISO cleanliness code equivalent to our target setting.

The beta rating of a filter indicates the overall efficiency of that particular filter when tested as per ISO 4572 Mutipass Test. This test measures the amount of particles at a specific size and those greater than the indicated size, upstream of the filter, in relation to those same particles downstream of the filter. This value gives us a % efficiency that we can assume our filter has. For example, a filter with a Beta 10 = 100 rating means that this filter will remove 99.00% of all particles 10um and larger.

There are three ways we can quantify the particle contamination in our lubricants. Optical Microscopy, Automatic Optical and Automatic Pore Blockage. When quantifying solid particles in lubricants, the international standard is the ISO 4406 Solid Contamination Code. This standard gives us a three number code, which corresponds directly to the concentration value for particles at 2um, 5um and 15um per ml. The relationship of the ISO code we get from our particle count is extremely important because it indicates the size distribution of solid particles as well as the quantity. Usually we can conclude that the larger the particle, the newer the wear. If the particle count indicates high concentrations of large particles, action should be taken to identify the characteristics of these large particles.

Water Contamination

Water can be introduced to your lubricant much the same way as solid contamination. The difference is that many of us do not recognise water as a harmful or destructive contaminant or a root cause to mechanical and lubricant failures. We unknowingly put lubricants contaminated with water into our systems every day. Therefore, it is important to make a proactive effort to minimise the amount of water ingression before and after the lubricant is put into service.

Water in our oil can be the root cause of many destructive by-products. Water by itself in oil can increase the rate of oxidation by six to as much as ten times. A combination of water and a metal catalyst such as copper will increase this level even further. Water in oil encourages rust, loss of lubricant film strength, change in viscosity, foaming, acid and sludge formations. Water will also deplete our lubricant's additive packages such as rust inhibitors, anti-moisture and de-mulsifying agents and create by-products such as sludge, bacteria, acids and sediment. Water also has undesirable effects on our machine surfaces. Corrosion, cavitation, sticky valves and filter plugging are all moisture-related effects.

Water ingression begins at the manufacturing level. Most new lubricants will have some level of dissolved water in them. Though we can't control the amount of water ingressed into the lubricant before it reaches our plant, we seldom recognise the opportunity for moisture ingression when it does reach our plant. When new oils are in storage the change in surrounding temperature will cause the oil in its container to expand and contract. When the oil contracts in cooler temperatures it will draw in anything surrounding the container seal, including air, dirt, debris and moisture. This ingression will

(Continued on Page II)