CONTAMINATION-FREE

Equipment Cleaning Begins Where We Can't See It…Inside

By Preston Ingalls

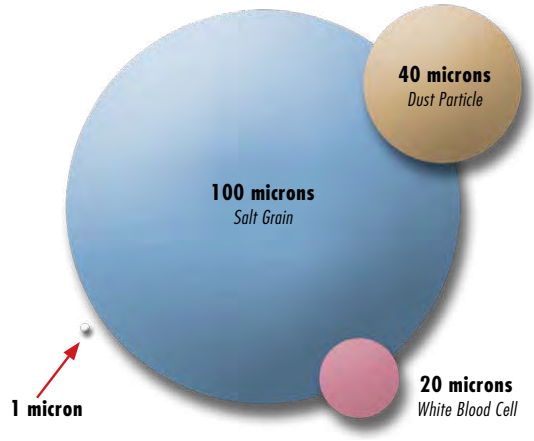
As robust as construction equipment is, it is not resistant to the impacts of contamination. The facts regarding the control of contamination, both external to the equipment but more importantly internally, are pretty stark. The relevance of this maintenance strategy is emphasized below:

- According to the bearings division of TRW, "Contamination is the number one cause of bearing damage that leads to premature removal."
- Chevron reports, "Following a sound hydraulic system cleanliness program can reduce hydraulic fluid purchases by 20 to 25 percent."
- Caterpillar states, "Dirt and contamination are by far the number one cause of hydraulic system failures."

The problem is that we are unable to see some of the most damaging origins. Particulate contaminants are microscopic and are not visible to the human eye. The human eye is only good for particles that are 40 microns and larger. A 20-micron particle is the size of a white blood cell *(see diagram 1)*. But with very small tolerances between moving surfaces, these minute particles can easily cause abrasive wear and eventual failure over time.

Mark Barnes, vice president of Des-Case's Equipment Reliability Services team, has some observations on contamination. "Compared to fixed equipment, where meantime between rebuilds is measured in years, most diesel engine original equipment manufacturers (OEMs) recommend an engine overhaul or rebuild every 12,000 to 15,000 hours. Even with oil analysis, which allows the rebuild interval to be optimized, 20,000 to 25,000 hours is about as good as it gets for engine life in off-highway applications."

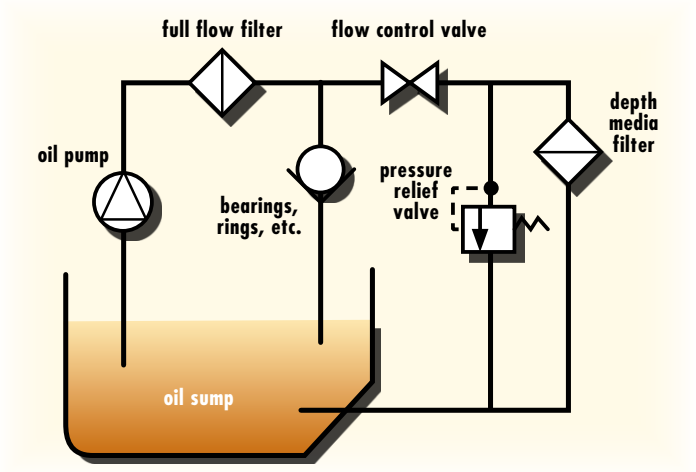
Diagram 1



Mark then asks, "So why is it that an engine has such a short life expectancy? The issue is less about maintenance than it is about the operating conditions and environment of a typical engine. With temperatures close to 200 degrees Fahrenheit, severe duty and shock loads, internal contaminants like soot, acids, and wear debris, and the possibility of fuel or glycol leaks, engines have a tough life."

Mark went on to say, "But perhaps the biggest engine killer is external contamination in the form of dust and dirt, sucked into the engine each minute of operation through the air intake. Particle contamination can be lethal for engines—even microscopic particles no bigger than a red blood cell can result in a significant reduction in an engine's life expectancy. In fact, studies by General Motors, Cummins Inc., and other engine OEMs have proven that particles in the 0 to 5 and 5 to 10 microns size ranges are three times more likely to cause wear in critical piston rings and bearings than larger

Diagram 2



ABOUT THE AUTHOR

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Note: Mark Barnes, vice president with Des-Case, has more than 17 years experience. He can be reached at mark.barnes@descase.com.

particles *(see diagram 2)*. To put that into context, particles that are less than a tenth of the diameter of a human hair are enough to reduce an engine's life expectancy by one half or more! These particles, which are often called silt-sized particles, are so small that a large percentage of those ingested into the engine air intake manifold pass straight through the air filter, which by comparison is really only equipped to take out rocks and boulders."

SECONDARY FILTRATION SYSTEM

One solution, according to Barnes, is to use a secondary filtration system. Without changing the flow of oil within the engine, a small slipstream of oil is taken after the oil flows through the full-flow filter using a flow control valve. By regulating oil flow through the valve, only 10 percent of the total oil flow is removed at any given time, which is not high enough to cause any harm to the engine. This side stream of oil is passed at normal engine oil pressure through a depth media filter with an efficiency rating of 99.9 percent at 3 microns. The oil is then returned to the sump. For safety, a relief valve is included to avoid over pressurization of the bypass filter during startup. Barnes stated that case studies have shown amazing results in keeping the fluids contamination-free.

STORAGE AND HANDLING

Another major issue is poor handling and storage of lubrication and hydraulic fluids. Fifty-five gallon storage barrels sitting on their ends outside are an excellent source for contamination. Thermal expansion and contraction on hot days and cool nights causes a vacuum effect, sucking in the contamination from the lid through the bung plug, pumps, and chimes. In addition, water in the form of condensation collecting under the lid can reduce bearing life by 50 percent or more. For example, many bearing manufacturers recognize that if you have water concentration at 400 ppm, you reduce the bearing life by half.

The challenge is to store lubricants properly, take oil samples and understand what the analysis is saying and recommending, change filters often, consider a secondary filtration system for critical equipment, and develop a standard operating procedure (SOP) to control the intake, storage, distribution, and control of these fluids.

BUY THE BEST

Using superior quality hydraulic fluid adds enormous value because it tends to *last longer* as it is filtered with contamination removal equipment. Cheaper fluids are not filtered with contamination removal equipment and are, therefore, more prone to contamination issues. Don't save a dollar at the outset only to have to spend a fortune later on. If you were in the hospital and needed a plasma transfusion, you certainly would not want the doctor to use the cheapest and easiest plasma to get. You would most likely want the right type in the right condition at the right time. Think about it. ■