Entrained Air Tip of the Week:
Courtesy of Dave Scheetz ExxonMobil

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Entrained Air—How reduction in oil reservoir size is leading to oil-aeration problems

Through my work with ExxonMobil's Equipment Builder group, I have partnered with leading equipment builders around the world to ensure that they have tailored maintenance solutions available for their latest product innovations. In the past few years, we have seen a number of trends in equipment technology design that will influence traditional application maintenance practices.

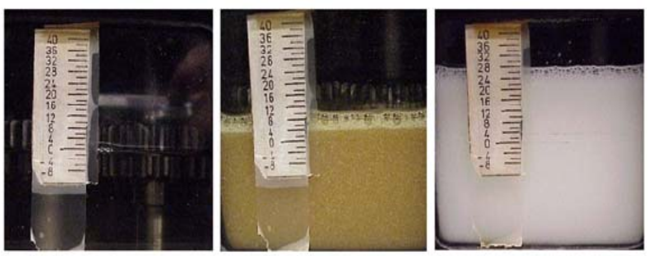
One major trend that we have identified is a reduction in the size of hydraulic systems.

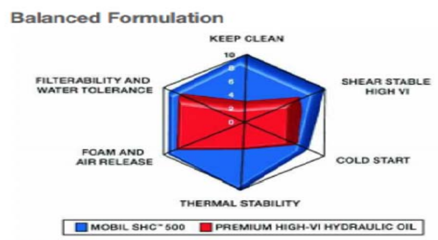
Traditionally, hydraulic systems were built to include reservoirs with strainers and baffles to separate out solid impurities and allow for the release of air and foam from the oil. However, the smaller the reservoir, the less space it takes up within the system and the less material required to manufacture the parts.

So, it logically follows that in the past few years, the size of hydraulic systems has decreased dramatically—going from a capacity of- on average- 150 gallons to only about five or ten gallons. This change in size holds significant implications for effective hydraulic lubrication. One major issue that these new hydraulic systems have spotlighted is **entrained air**.

Entrained air refers specifically to air bubbles with diameters smaller than 1 mm that are dispersed through the lubricating oil during instances of agitation, such as when the oil is churned in the pump. And, these little bubbles are no small problem.

Air entrainment is a big risk in these new hydraulic systems, as the smaller reservoirs result in shorter residence time. This means a reduction in the amount of time during which contaminants can settle out of the fluid and entrained air can rise to the surface of the fluid before it goes back into circulation.





Compared with premium high-Viscosity Index (VI) hydraulic fluids, Mobil SHC™ 500 Series helps provide added protection for severe applications at both high and low temperatures.

The images above show varying levels of air entrainment in a gearbox. However, the appearance would be the same in a hydraulic system. Now, entrained air affects the oils ability to transmit pressure. Air is more easily compressed than the surrounding fluid, so air bubbles entrained in hydraulic fluid reduces the fluid's resistance to compression which, in turn, reduces the fluid's ability to transmit pressure. This will cause the lubricants reaction to increased pressure to slow—resulting in major problems in systems that rely on hydraulics to control emergency stop valves or trip systems. And, these new, smaller hydraulic reservoirs are reaching higher pressures than ever before- often between 2,000 and 4,000 pound per square inch (we're even seeing pressures moving as high as 6,000 PSI). So, entrained air in hydraulic systems is poised to be a leading maintenance consideration for future hydraulic performance. In addition to pressure transmission considerations, entrained air can alter a fluid's thermal conductivity properties, thus the hydraulic fluid's ability to dissipate heat. This characteristic, in addition to the shorter residence time that reduces the time when the lubricant can cool, can cause increases in operating temperatures. Under additional stress, traditional hydraulic fluids can experience increased oil oxidation and reduced in-service life.

So, what does this mean for effective hydraulic system maintenance?

As operators across industries seek light weight and high reliability equipment that will maximize power while minimizing component size, we will likely see the industry begin to move toward synthetic fluids that are still formulated to handle higher PSI and operation at higher temperatures, but additionally exhibit improved air-release and aeration-resistance properties. And, hydraulic fluids with low air-entrainment and rapid air release properties will allow hydraulic pumps to operate at higher speeds and higher flow rates. But, while good air release properties are important, balanced performance is crucial for any fluid to ensure robust operation under various conditions, as illustrated in the image above and on the right.

However, reducing instances of air entrainment doesn't need to involve complete overhauls in lubrication programs. Routine maintenance, as simple as checking strainers and filters for clogging, replacing flexible intake hoses before they become brittle, ensuring proper sizing of pump inlet lines and maintaining recommended fluid levels to reduce air intake can go a long way to eliminating these tiny bubbles from the fluid.

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