

Petr Vavruch – Foam vs Air Entrainment

With reference to some recent Newsletters, I believe that there is a need for a clarification. It concerns foam and air entrainment. While "foam" is often used loosely to describe any air bubbles in the oil or at the surface of the oil, this simplification can lead to dangerous maintenance practices namely adding anti-foam additive into the oil when it should not be done.

Let me quote from technical literature (slightly edited):

"Air can exist in oil in three different states: dissolved, entrained, and foam. Air dissolved in oil exists as individual molecules which are similar to CO₂ dissolved in soda water. This type of air is invisible and impractical to detect.

Entrained air in oil is comprised of tiny air bubbles suspended in the oil. This type of air contamination is arguably the most damaging, and can often be identified by the oil having a cloudy appearance. Although there are several common causes for cloudy oil, this can be identified by taking a sample of the oil and observing whether or not it clears up over time (after the bubbles have moved to the surface and burst).

If the cloudiness was caused by water or another water-based contaminant, an aqueous layer should form at the bottom as the sample clears.

Foam is another common type of air in oil. Foam typically refers to the stable layer of relatively large bubbles that accumulate at the surface of a reservoir. Foam at the surface may not cause any damage, but the presence of a foam layer normally indicates extensive air entrainment."

<https://www.machinerylubrication.com/Read/1397/air-contaminant> by *Noria*

"Entertained air in lubricating oils can cause, for example, problems in pumps, increased wear of high-speed thrust pads in flooded chambers and oxidation of the oil.

A distinction is drawn between lubrication systems in which air has to separate under relatively tranquil conditions in the reservoir which benefit from oils without silicone ant-foam additives and those in which air has to separate under turbulent conditions which do benefit from anti-foam additives."

"The importance of minimizing air entrainment and enhancing air release in hydraulic fluids has been recognized for over 60 years. These properties are dependent on the composition of hydraulic fluids, especially on the presence of contaminants which inhibit air release."

Unfortunately, one of the worst "contaminants" in this regard is the anti-foam additive.

"Laboratory and practical experiences concerning foaming and air entrainment problems with steam turbine oils demonstrated the adverse effect on air entrainment in oils due to silicone anti-foam agents."

Air release is the laboratory test for air entrainment behaviour. A good test result for ISO VG 46 hydraulic fluid is 7 minutes.

In summary, it is the entrained air that causes problems, not the foam. If a circulation system has a reservoir and you see foam on the oil surface, leave it alone. It is cosmetic but it must be treated if the foam spills over the sides of the tank onto the floor creating both a safety hazard and waste, or if it is sucked into the circulation causing the foam to be circulated instead of oil – then you have to add a defoamant.