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INDUSTRIAL GEAR OIL FOAM CONTROL

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ABSTRACT

When a gear oil customer calls for help with a foam problem, he wants help right away. Many times, foam is the visible symptom of one or more other lubrication problems. You can't fix the foam problem until you find the root cause and take corrective action. The problem may have started with a bad batch of new oil. Contaminants could have entered the gearbox system. Perhaps the sump residence time is too short to allow entrained air to be released from the oil. Root cause determination and remedial action to achieve and maintain acceptable gearbox foam control will be discussed.

INTRODUCTION

Persistent foam in an industrial gearbox is possibly the most frequent complaint reported to gear lubricant support staff. Foam doesn't pump or circulate. It is not an effective lubricant. It can find its way onto the floor or ground and cause an environmental or safety hazard. But visible foam is not always a "foam problem". The first step is to define the problem, then determine the root cause, and finally, eliminate the problem.

EXTENDED ABSTRACT

Problem Definition

Not all foam is a problem. If the foam breaks into islands within minutes of stopping the unit, it is generally considered a cosmetic issue. The customer doesn't like to see it, but it is not causing a problem. If the oil is foaming out of the air vent, then it is definitely a problem.

Sometimes foam fills the sight glass and prevents visual determination of the oil level. This must be corrected because excessive foaming can result from improper oil level, either too high or too low.

A creamy or milky appearance is sometimes incorrectly attributed to foam. Poor air release and the resulting persistent entrained air will cause the oil to look creamy, as will emulsified water. Water can be removed, but there is no easy solution to poor air release.

Gearbox configuration sometimes results in too short a residence time to allow air to be released from the oil. The inlet or outlet may be located so as to allow excess air to be churned into the oil.

Check the New Oil

Anti-scuff (EP) gear oil should meet the requirements of ANSI/AGMA 9005-E02 Industrial Gear Lubrication. Testing according to ASTM D892 should give maximum Tendency/Stability results of 50mL/0mL for Sequences I, II, and III. It is a prudent practice to take a retain sample of every oil delivery. ASTM D892 uses about 15oz of oil. Retain samples are usually insufficient for the test, but visual inspection can provide information about the new oil condition.

How does the sample look compared to retain samples from other deliveries? Check color, odor and presence of phase separation or deposits. In particular, look for droplets or "fish eyes" clinging to the glass. This could be water, an incompatible lubricant, or defoamant additive that has separated from the oil. Bulk delivery tanks and repackaged containers can be a source of contaminants such as detergent solutions, water or solvents used for cleaning and flushing.

Defoamant/Antifoam Additives

For this discussion, the two terms are used interchangeably. Some people use antifoam for additives that keep foam from forming and defoamant for additives that collapse foam after it has formed.

Defoamant additives are polymeric materials of two basic types: silicon-containing, such as polysiloxanes, and non-silicon, such as polyacrylate and polymethacrylate. They are not oil soluble. They are typically dissolved in a carrier fluid before adding to the oil. The defoamant solution must be properly dispersed in the oil. If the dispersed particles are too large or there is too much added, the defoamant can separate from the oil. Defoamant particles merge and grow, eventually settling to the bottom or clinging to the sides of the container.

Customers often ask for a foam control additive that can be sprayed on foam in a gearbox. This is not a good practice. Determining how much to add is not easy, and getting an

adequate dispersion in an operating gearbox is nearly impossible.

In-Service Oil Condition

Know your oil. You should regularly look at both new and used oil sample in order to be able to spot abnormalities. Compare the problematic sample to non-problematic samples, as well as to unused oil. Check color, odor, dropout and deposits. Look for signs of contamination with water or another immiscible fluid, and for any solid particles. Compare metals content by ASTM D5185 for the new oil vs. the in-service sample for evidence of contamination. Topping-up with the wrong oil is a frequent cause of contamination for in-service oil.

Foam concerns merit taking a larger sample and running ASTM D892 Foam Test and determining ISO particle count. If the particle count is high, consider doing additional work to determine the nature of the particles. Potential sources include: wear metals, dust and dirt being sucked in through an unprotected air vent, and material entering around a damaged seal.

Continued Use of the Oil

The oil should be replaced with fresh oil that meets specification if (1) the problem is due to lack of defoamant additive or (2) the oil is contaminated with another oil.

The oil can continue in service if the issue was due to a mechanical problem or incorrect oil level that was corrected. You can also filter the oil until particulate contamination has been reduced to an acceptable level, and continue to use the oil.

Filtration can bring its own set of problems. Defoamant additives are chemically similar to filter media, and are mutually attracted. Since the defoamant exists as a dispersion of particles in the oil, and since filters are designed to remove particulate matter from the oil, the defoamant may be removed along with other particles. Laboratory examination of used filter medium may show an accumulation of defoamant additive. There is currently no standardized filterability test available for industrial gear oils. Traditionally, those tests that are used for hydraulic oil emphasize flow rate and filter plugging, not retention of oil performance after filtration.

Foam Problem Prevention

Suggested steps include:

- Take a retain sample of every delivery. Visual inspection and ASTM D5185 metals analysis are minimum recommendayion.
- Use desiccant air breathers on vents to prevent ingestion of air-born debris and moisture.
- Take steps to prevent topping-up with the wrong lubricant.
- Keep the oil dry during storage, transfer and use.
- Don’t over- or under-fill the gearbox.
- Monitor the unit for wear particle generation and oil condition, and take appropriate steps.