Understanding **Lubrication Failures**

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Fail·ure 1 a:
An omission of occurrence or performance: A failing to perform a duty or expected action b: A state of inability to perform a normal function

As a consultant in the field of lubrication, I've had discussions with hundreds if not thousands of maintenance professionals about the type and frequencies of the lubrication-related failures they experience. A disturbingly large percentage of the time I am told that they don't really experience many lubrication-related failures. This response always prompts another question: What is a lubrication-related failure? To those who think they have none or few, a lubrication-related failure is usually defined as one that occurs when a machine has no oil in it or someone puts the wrong oil in it. I would suggest that most manufacturers experience many lubrication-related failures and merely misclassify them. In fact, many failures are not even recorded as such because the problems were diagnosed and repaired before the machine ceased to function. In my opinion, any time a machine or component does not achieve maximum service life, a failure has occurred.

Consider the following example: A man buys a new car and drives it for a year without any problems. Then, after only 10,000 miles, the engine begins making an unusual sound. The man drives the car to the dealer for an inspection, and the mechanic informs him that the engine is irreparably damaged and he must replace the engine or buy a new car. Did the car fail? It could be argued that because the car was still functioning that it didn't fail. On the other hand, the engine is being replaced after only 5 to 10% of its expected service life.

According to an industry expert, as few as 10% of bearings ever reach their L_{10} life before failing or being replaced. By definition, 90% of bearings should reach this value, so what happened to the other 80%? Whether they ceased to function, or were replaced due to an identified defect, I would argue that they failed because they didn't reach their anticipated service life. I was recently in a paper mill that had an excellent vibration program that has, in recent years, been able to identify 100% of their paper machine bearing defects before they failed. When asked about the number of bearing failures they had in the past year, they replied "none," yet they had replaced 15. One of them had only been in service for 12 months.

To understand why so many failures are in fact related to lubrication, or more accurately, poor lubrication, one must look at typical root causes of failure. In an MIT study on "loss of usefulness" in machinery, it was determined that 50% of lost machine life was caused by mechanical wear, and an additional 20% was lost due to corrosion of machine surfaces. The mitigation of mechanical wear and corrosion are two of the primary functions of a lubricant. (Figures 1 and 2)

Figure 1

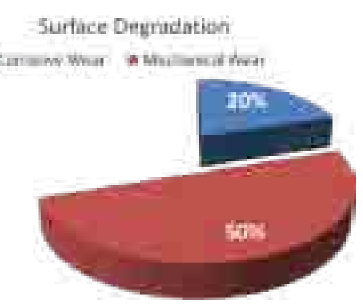


Figure 2

For those readers that still don't believe they experience lubrication-related failures, I would recommend that you take a critical look at the mean time between failures (or replacements) for common lubricated components and determine if you are truly getting the maximum life from these assets.

A more narrowly focused study was performed at the National Research Council of Canada in conjunction with the Society of Tribologists and Lubrication Engineers to determine the predominant wear mechanisms in wear-related failures of lubricated machinery. The study examined 3,722 failures across several industries, including pulp and paper, mining, forestry, transportation, and power generation. The results of this study indicate that the number-one cause of machine wear is lubricant contamination. (Figure 3)

Abrasion, erosion, and fatigue are most often caused by particle contamination in the lubricant. Adhesion is typically caused by using a lubricant with inadequate film strength. Furthermore, all of these wear mechanisms are exacerbated by the presence of water contamination in a lubricant. The point of all this is that most failures in lubricated equipment, whether catastrophic and sudden or just premature replacements, are caused by particle contamination, moisture contamination, or using a lubricant that is either incorrect for the application or has degraded beyond the point of being suitable for use. The good news is that all of these conditions can be prevented or at least controlled with precision lubrication.

Unfortunately, most maintenance professionals don't fully understand the very significant effects of lubrication on component life. Once you realize that only 1000ppm of water in the oil can reduce bearing life by 75%, or that increasing fluid cleanliness by one ISO code can extend the life of hydraulic components by 50%, it becomes apparent that much equipment life is wasted due to improper lubrication practices. Precision lubrication doesn't mean using more expensive lubricants or lubricating machines more frequently. It involves selecting the right type of lubricant for each application, identifying the correct application method, using the optimum PM frequency, and controlling the condition of the lubricant by keeping it clean, cool, and suitably free of moisture.

For those readers that still don't believe they experience lubrication-related failures, I would recommend that you take a critical look at the mean time between failures (or replacements) for common lubricated components and determine if you are truly getting the maximum life from these assets. Chances are that if you haven't put a lot of effort into developing a proper lubrication and contamination control program, you're probably not. Developing a precision lubrication program is a large undertaking, but it is totally worthwhile. Begin by ensuring that you have the proper lubricants specified for each application, and then establish cleanliness and dryness targets for each class of machines. Identify the necessary steps to reach these targets, implement them, and then measure the results. Remember, just because it didn't break, doesn't mean it didn't fail.

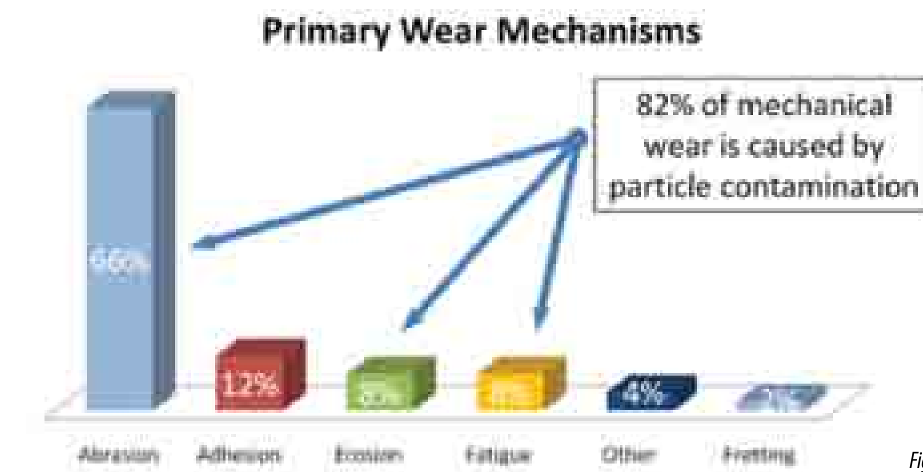
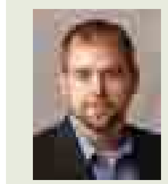


Figure 3



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