Issue Focus: Bearing Lubrication

TIP #1

Reasons to use bearing grease of higher consistency (NLGI numbers):

- to avoid water washout
- to avoid bleed/separation
- to avoid leakage
- high ambient temperatures

TIP #2

In a humid environment, condensate can form in rolling element bearings and cause corrosion, leading to a reduction of the bearing life. With careful choice of the grease lubricant, the effect of the condensed moisture can be reduced. Greases thickened with sodium soap will absorb (emulsify) large quantities of water, but may, however, soften it to such an extent that the grease flows out of the bearing. Lithium soap greases do not emulsify water, but with suitable additives can provide good protection against corrosion. There are also a number of greases available which have synthetic thickeners that offer excellent protection against corrosion, prolonging the bearing life.

TIP #3

When running grease-packed bearings at higher speeds (in excess of 5000 rpm), experiment with the quantity of grease in the bearing. A 10 percent change in the quantity of grease can drastically affect the amount of heat generated by the bearing (even as much as 40 degrees F depending on how close to optimum it is). If there is too much grease for the bearing to push out to surrounding pockets, the bearing will heat up quickly. Often the optimum amount of grease is less than you might think.

TIP #4

Grease lubricated bearings should not be kept idle for long periods. The base oil in the greases could separate out and get drained from the thickener, which does not have any lubrication properties by itself.

TIP #5

Polyurea greases have very good oxidation resistance, because they don't contain metal soaps (such as calcium, lithium, etc.) which are pro-oxidants to varying degrees. They are therefore widely used in lubed-for-life bearings.

TIP #6

Over lubricating rolling element bearings causes churning and generates excess heat, especially on higher speed applications.

Silent Assumptions of Bearing Reliability

Jim Fitch

There are several important silent assumptions of bearing reliability. However,

before I address these assumptions, some even more basic assumptions and statements of fact must be established. While it might be a bit of a leap, I'm going to assume that the bearing is well-designed, well-manufactured, properly handled and stored, and finally, correctly selected for the intended application. With that said, we're now ready to talk about those silent assumptions that are in the maintenance function's domain.

These assumptions relate to the internal environment and duty cycle to which a bearing is exposed. Bearing manufacturers will frequently report that only a small percentage of bearings reach their fatigue limit (catalog life). According to one major supplier, typically only 10 percent of rolling element bearings reach their L10 life (it should instead be 90 percent by definition). The old saying that bearings don't just die, they're murdered, is rooted in fact. For a bearing to have a normal life expectancy, it is assumed that the following, often unspoken, root causes of failure (our silent assumptions) will not occur at any time after commissioning.

Mechanical Causes

Exceeding a bearing's dynamic load rating translates to a disproportionate reduction of fatigue life. For most bearings, doubling bearing load can reduce bearing life to roughly one-eighth of its normal life. Mechanical assaults on bearings by misalignment (Figure 1) and unbalance can produce similar consequences.

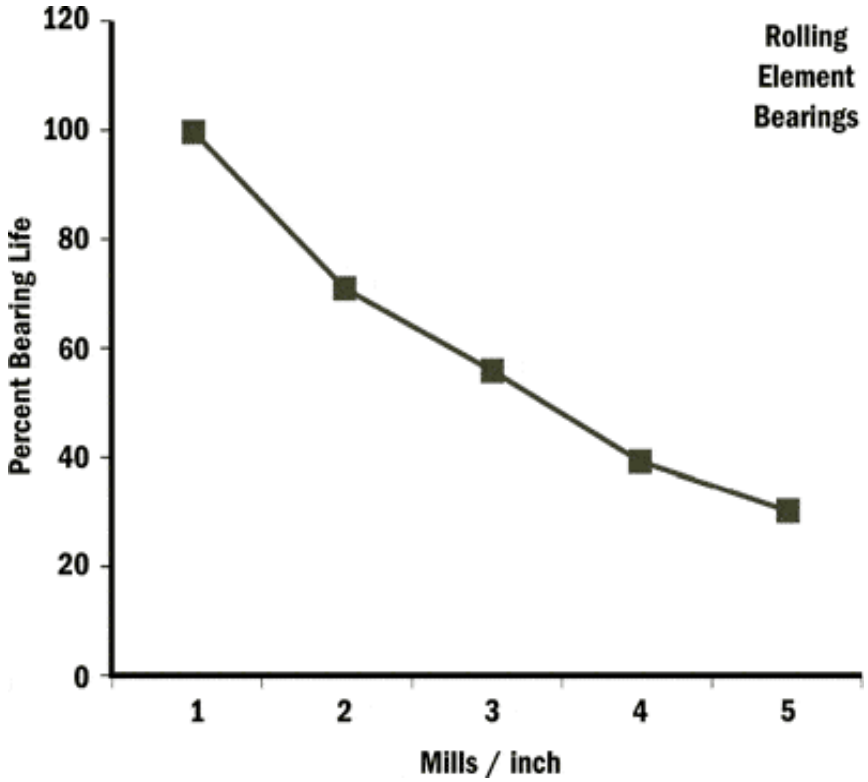

Figure 1. Alignment
Reference: Maintenance Technology Magazine

Impaired Fluid Properties

There are many vital lubricant properties that when altered or impaired can sharply diminish bearing life and reliability. These include such things as additives (AW, EP, etc.), acid number, lubricity, viscosity, pressure-viscosity coefficient and viscosity index. Using the wrong lubricants, degraded lubricants, mixed lubricants (including incompatibility) and/or contaminated lubricants can cause a loss of fluid properties.

Fluid Contamination

The “most wanted” fluid contamination assassins include dirt, water (Figures 2 and 3), fuel, glycol and soot. However, there are many others - too long to list here.

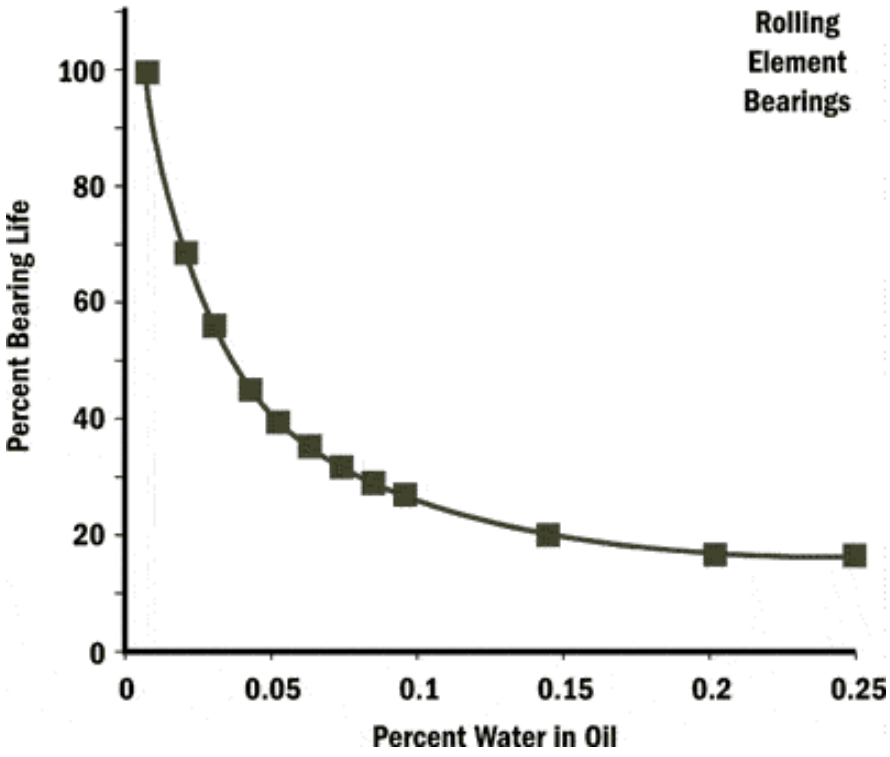

Figure 2. Water Contamination
Reference: SKF

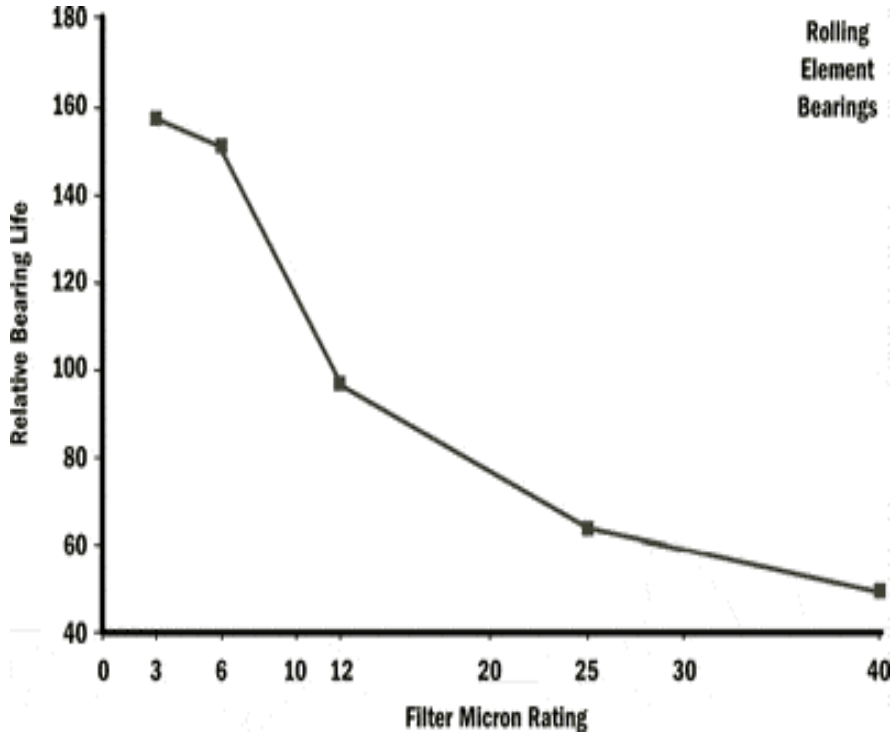

Figure 3. Particle Contamination
Reference: Pall Corp

Heat

Heat too is a contaminant. Its aggressive tendencies can be dependably viewed as both a cause and effect of most types of fluid and mechanical problems - including many of those found elsewhere on this list. Overlubrication (too much grease) is a common cause of heat in grease-lubricated bearings.

Starvation

A surprising number of bearings are simply starved to death. Over time, they run dry of lubricating oil or grease unless properly and frequently relubricated. The wrong relubrication intervals are often the culprit, but such things as cold starts, dry starts and grease bleed problems can also contribute to starvation. ...

Other contributors of starvation relate to the failure of lubricating mechanisms such as flingers, slingers, rings, single-point devices, oil mist, oil pumps, centralized systems, etc.

While it is true that a bearing damaged from fatigue or wear won't heal over by itself, it also won't tell you where it hurts unless you ask. To be attentive to bearing reliability you must tune into these silent assumptions and their symptoms. This is where oil analysis can play an important life-extending role.

If you review each item in my list of silent assumptions, you will discover that, surprisingly, oil or grease analysis can in almost every instance call attention to these concerns, either directly or indirectly. When things go wrong, both the causes and symptoms of a problem are often revealed by the oil's properties and contaminants. In fact, the alarms are silent only when you choose not to listen. To listen, you must:

- sample correctly,
- sample at the right frequency,
- run the proper slate of tests,
- set alarms and limits correctly,

- possess suitable knowledge of data interpretation, and

- timely and appropriately respond to nonconforming conditions.

Too often, oil is changed without real cause. Imbedded in the oil is a message about its health, the bearing's health, contamination and other vital properties. We lose this message when the oil is changed without sampling. After all, problems such as misalignment or coolant leaks are never solved simply by an oil change alone. In such cases, changing the oil results not only in ultimately murdering the bearing but shooting the messenger as well.

Jim Fitch

Please reference this article as:
Jim Fitch, "Silent Assumptions of Bearing Reliability". *Practicing Oil Analysis* Magazine. July 2003