Ten Myths About Gear Lubrication

"Home truths" that can wreck your gears and your wallet.

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Myth No. 1: Oil Is Oil. Using the wrong oil is a common cause of gear failure. Gears require lubricants blended specifically for the application. For example, slow-speed spur gears, high-speed helical gears, hypoid gears and worm gears all require different lubricants. Application parameters, such as operating speeds, transmitted loads, temperature extremes and contamination risks, must be considered when choosing an oil. Using the right oil can improve efficiency and extend gear life.

Myth No. 2: Oil Never Wears Out. Oxidation limits the life of lubricants. At some point a lubricant will degrade, form acids, lose lubrication abilities and deposit sludge and varnish. At temperatures above 65°C, oils begin to oxidize. Each increase of 10°C cuts the oxidation life in half.

Antiwear, antiscuff, antifoam and anticorrosion additives can be depleted if the gears are repeatedly subjected to conditions requiring reaction of the additives.

Monitoring lubricant properties by laboratory analysis of oil samples helps to determine oil change intervals. Monitor viscosity and acid number. Changes in these properties indicate oxidation. Spectrographic and infrared analyses detect changes in additives.

In many cases contamination requires an oil change long before the oil oxidizes. Unless there is a filter, oil should be changed frequently to remove contamination.

Myth No. 3: Gears Do Not Require Fine Filtration. It is well known that rolling-element and hydrodynamic bearings require clean oil. Less well known is that gear teeth also require clean oil. The oil film separating gear teeth is often only a few microns thick. Solid contaminants indent and abrade gear teeth and significantly shorten gear life. Filters should be as fine as 3 µm to help prevent abrasion, polishing, micropitting and macropitting. We often hear the complaint: "A filter that fine will clog in no time." Our response is: "Good. That means the filter is necessary and doing its job."

Modern filters provide fine filtration without being too large or creating large pressure drops. By starting with a coarse filter, say 100 µm, and changing to progressively finer filters, a lubrication system can be cleaned in a relatively short time. Once clean, it should stay clean if seals, breathers and maintenance are adequate.

Myth No. 4: Snake Oil Additives Improve Lubrication. Major oil companies have some of the best research facilities, employing knowledgeable chemical engineers, material scientists and tribologists. It is unlikely that any of the many independent additive companies could develop beneficial additives that the oil companies have not discovered.

Oil companies have developed additive packages designed to meet gear requirements. Tampering with the balance of oil additives invites gear failure. Before purchasing additional additives, check to see if they are endorsed by any major gear manufacturer or oil company. We doubt it.

Myth No. 5: Oils Are Interchangeable. Additive packages vary from oil company to oil company. A gear oil from one company may have the same viscosity and basic properties as an oil from another company, but their additives may be very different. For example, one company may use borate as an antiscuff additive, and another may use sulfur-phosphorous. Sulfur-phosphorous is much more aggressive than borate and may be totally inappropriate for a particular application.

Oils should never be mixed or interchanged without careful investigation. Synthetic oils such as certain esters, ethers and halogenated hydrocarbons are incompatible with mineral oils and some elastomers. Problems may arise if these synthetics are used in systems that previously held mineral oils.

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Myth No. 6: Oil Selection is the Gear Supplier's or User's Responsibility. Many gear failures can be traced to confusion over responsibility for lubricant selection. To get the right oil, the gear supplier and the gear user must cooperate in selecting one that meets application and gear requirements. Gear suppliers should know as much as possible about the application, and gear users should understand what it takes to adequately lubricate gears.

Many times lubrication mistakes are made because the application is misunderstood. There is a long list of application parameters that must be considered. For example, what is the ambient temperature immediately surrounding the gearbox? Is there adequate air flow over the gearbox? Is contamination or corrosion an issue? What maintenance is planned?

There is a trend among system designers to consolidate lubricants and require low-viscosity lubricants, such as automatic transmission fluid (ATF), in slow-speed, heavy-duty gears. These practices will increase gear failures.

Gear suppliers and gear users should ensure that the lubricant complies with the requirements of ANSI/AGMA 9005-D94, "Industrial Gear Lubrication." If it does not, find out why and make changes.

Myth No. 7: Laboratory Tests Are Accurate. This may not be true. Lab tests may accurately measure a particular property, but the property may not be the one you are concerned with. For example, you may wish to know if unusual wear is occurring in a gearbox and send a sample of used oil to a laboratory. Unless you instruct otherwise, the lab will probably run a spectrographic analysis to measure metals. If the laboratory reports relatively low levels of metals, you would probably conclude that the gearbox is healthy. Unfortunately, the usual spectrographic analysis detects only particles less than 10 µm. Gears could be failing and generating only large wear particles that are missed by spectrographic analysis. Therefore, you need to understand the limitations of laboratory analysis to get meaningful data.

It is equally important to get oil samples that represent the true condition of the lubrication. Be sure you are familiar with the requirements for proper sampling.

It is best to visit the laboratory and witness its procedures before signing a contract. Ask the lab staff to demonstrate each of their tests. Watch their housekeeping carefully; the laboratory should be clean and uncluttered. Especially important is handling samples to avoid contamination or mislabeling. Talk to technicians and ask about their qualifications. Many tests require skill to perform them properly and interpret results correctly.

The laboratory should adhere to standard ASTM tests if possible. If the laboratory deviates from ASTM procedures, they should explain how the results relate to those obtained with ASTM tests.

Ask how the lab monitors itself. Reputable laboratories have in-house monitoring to continually check results. Many are accredited by independent auditors.

Myth No. 8: If A Little Oil Is Good, A Lot Is Better. Each gearbox has an optimum amount of oil it requires to run cool and efficiently. Too much oil will churn, reduce efficiency and cause the gearbox to run hotter than it should. Excessive oil may cause foaming and leakage. Cost should be considered. Why buy more oil than necessary, especially if there are many gearboxes or if the oil is expensive? There are also environmental concerns; the less oil used, the less used oil discarded.

Myth No. 9: Special Oils Can Repair Gears. Some oil suppliers claim that their products not only reduce wear, but actually repair damaged gear teeth! They may show you before-and-after photographs that look convincing.

The problem is, the only way to repair gear tooth damage is to remove material from surfaces of the gear teeth. An oil may be abrasive and capable of removing steel. Unfortunately, gear teeth wear in a very non-uniform manner, and gear teeth "repaired" by special oils may look better, but their accuracy has undoubtedly decreased.

Myth No. 10: Synthetic Oils Are Superior To Mineral Oils. Synthetic oils have many advantages, including low pour point, high viscosity index and long oxidation life. However, they are costly and may be a waste of money if temperature extremes are not encountered.

Even in high-temperature environments, the long life of synthetic oil may not be realized if the oil must be changed to remove contamination or to replenish additives.

Some synthetic oils improve efficiency. But except for worm gears, the increase in efficiency will probably not be significant.

The optimum lubricant is the product that is least expensive, considering both initial cost and maintenance costs, and meets the requirements of the application. ○

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