Gearboxes are one of the most widely used types of industrial equipment in the world. They are used as vital power transmission sources for nearly every kind of business operating in the broader industrial market sector. Today, as industrial gearbox applications continue to become more advanced, manufacturers are responding by producing an increasingly wide range of gearbox designs to meet their customers’ evolving needs. Advancements in gearbox technology, especially enclosed gearboxes, have allowed designers to decrease the overall size of a gearbox while maintaining the same amount of power transmission capability. These types of improvements result in systems that place much higher demands on lubricants.

So, how can customers ensure they are purchasing a lubricant that will help maximize the life of critical gearbox equipment? This article will describe important trends in gearbox design and offer insightful tips that can help any plant manager, maintenance professional, or purchasing agent make an informed decision in selecting the best gear oil for the needs of their business.

Gearbox Design Changes: The Past 10 Years

In recent years, gearbox technology has become significantly more advanced. Specifically, manufacturers have focused on developing systems that are more compact, more efficient, and deliver higher load capacities. These newer units offer significant advantages in terms of delivering better performance, and their reduced size ensures they occupy less space in a plant.

That said, it is important to note that, compared to previous models, these newer, high performance units typically require lubricants that offer more comprehensive protection. Therefore, it is critical that companies select a gear lubricant that can supply long-lasting protection for all gearbox components. What are some of the best ways to maximize gearbox performance? Regardless of whether one has an older or newer gearbox system, there are some key maintenance fundamentals that should be followed.

First, it is strongly recommended that plant managers use a premium, quality oil. Secondly, plant managers should work closely with their gearbox OEM and/or their lubricant supplier to proactively develop a preventive maintenance schedule. Specifically, it is important to carry out at least annual visual inspections, and also to conduct a thorough oil analysis on the oil each quarter for the most critical gearboxes in their production systems.

Common Signs of Inadequate Gearbox Lubrication

Without inspection and oil analysis, noise, vibration, and oil leakage are often the first signs of troubled gearbox operation. A common sign of inadequate gear lubrication that is often overlooked—but is critically important—is micropitting.

Micropitting is surface fatigue that is mainly observed in gears, but can also occur in rolling element bearings. Micropitting causes destructive wear that can occur within the first few hours of operation. If left uncontrolled, micropitting can lead to a reduction in gear tooth accuracy, and even gear breakage.

Micropitting is not a new phenomenon. However, it is much more prominent with the increase in the power density of gearboxes, and the subsequent increased use of case hardened gears (carburized, nitride, induction and flame hardened). Although a number of factors can affect the development of micropitting, it is directly related to the surface roughness and hardness of gears and bearings.

By choosing the proper lubricant, gearbox performance is improved. Read on to learn about ExxonMobil’s special formulation for gearbox applications.

By Jeff Biamonte and Tim Nadasdi, Ph.D.

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The surface roughness is usually due to asperities left from the finishing process. The generally accepted theory for micropitting is that, as two asperities from oppo-
-site surfaces collide, they each deform elastically and/or plastically, leading to metal fatigue beneath the asperity. Micropitting on gears may not only lead to problems with gears, but to bearings and seals as well. The main concern with micropitting is that this wear, which is often overlooked, can cause the shape of the gear teeth to change.

**Preventing Micropitting**

The selection of the appropriate viscosity grade is the first and most important step in choosing a lubricant for any application. To find the right viscosity, it is good practice to consult the OEM manual as a starting point. However, many OEM-suggested guidelines do not necessarily consider factors that come into play if the gearbox is operating under extreme conditions, such as heavy loads and high temperatures. Even under extreme conditions, simply increasing the ISO viscosity grade of the oil is not necessarily preferred. Instead, selecting a lubricant with a higher viscosity index, lower traction coefficient, or both should be considered. A higher viscosity index can provide a thicker lubricant film under operating conditions. A lower traction coefficient can help to reduce surface fatigue.

Due to the high viscosity index and low traction coefficient, moving to a synthetic gear oil can help control micropitting. In addition to viscosity and traction, the additive chemistry in finished lubricants can have a dramatic effect on micropitting performance.

For instance, it has been shown that certain additives, especially conventional extreme pressure additives, can have a negative effect on micropitting performance. Choosing an oil that is specifically designed to give micropitting protection will not only reduce the risk of micropitting, but it will often deliver other benefits, including enhancing the durability and performance of a gearbox system and its most critical components.

**Mobilgear 600 XP**

In November of 2006, ExxonMobil announced the worldwide introduction of its Mobilgear 600 XP Series; a family of premium gear oils that are formulated to deliver exceptional, long-lasting protection for industrial gearboxes. With its advanced and balanced formulation, Mobilgear 600 XP delivers exceptional performance over the long haul, exceeding the industry’s most demanding specifications, such as Flender BA Table 7300 A, DIN 51517 Part 3 and AGMA 9005 E02. It is formulated to reduce wear and enhance the performance of all critical gearbox components—including gears, bearings, and seals. (Please see micropitting test on the following page.)

By providing exceptional wear protection, this new series of gear oils help control micropitting and other forms of gear wear. Its balanced formulation improves bearing and corrosion protection, while remaining compatible with commonly used gearbox seal materials. Furthermore, it is designed to significantly reduce the formation of lubricant degradation byproducts that often lead to frequent oil changes.

**ABOUT THE AUTHORS:**

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Gear Teeth After Micropitting Test:
The boxed areas show micropitting formation. Test results in Fig. 1 show that Mobilgear 600 XP provides superior micropitting protection over generic oils.

**FIGURE 1:** 12 PERCENT AVERAGE MICROPITTING COVERAGE ON TEETH (ROOT ONLY)

**MOBILGEAR 600 XP**

**FIGURE 2:** 49 PERCENT AVERAGE MICROPITTING COVERAGE ON TEETH (ROOT AND ADDENDUM)

Typical Industrial Gear Oil not designed to protect against micropitting

**FIGURE 3:** CHOSING THE PROPER LUBRICANT HELPS GEAR TEETH RETAIN THEIR INTEGRITY

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