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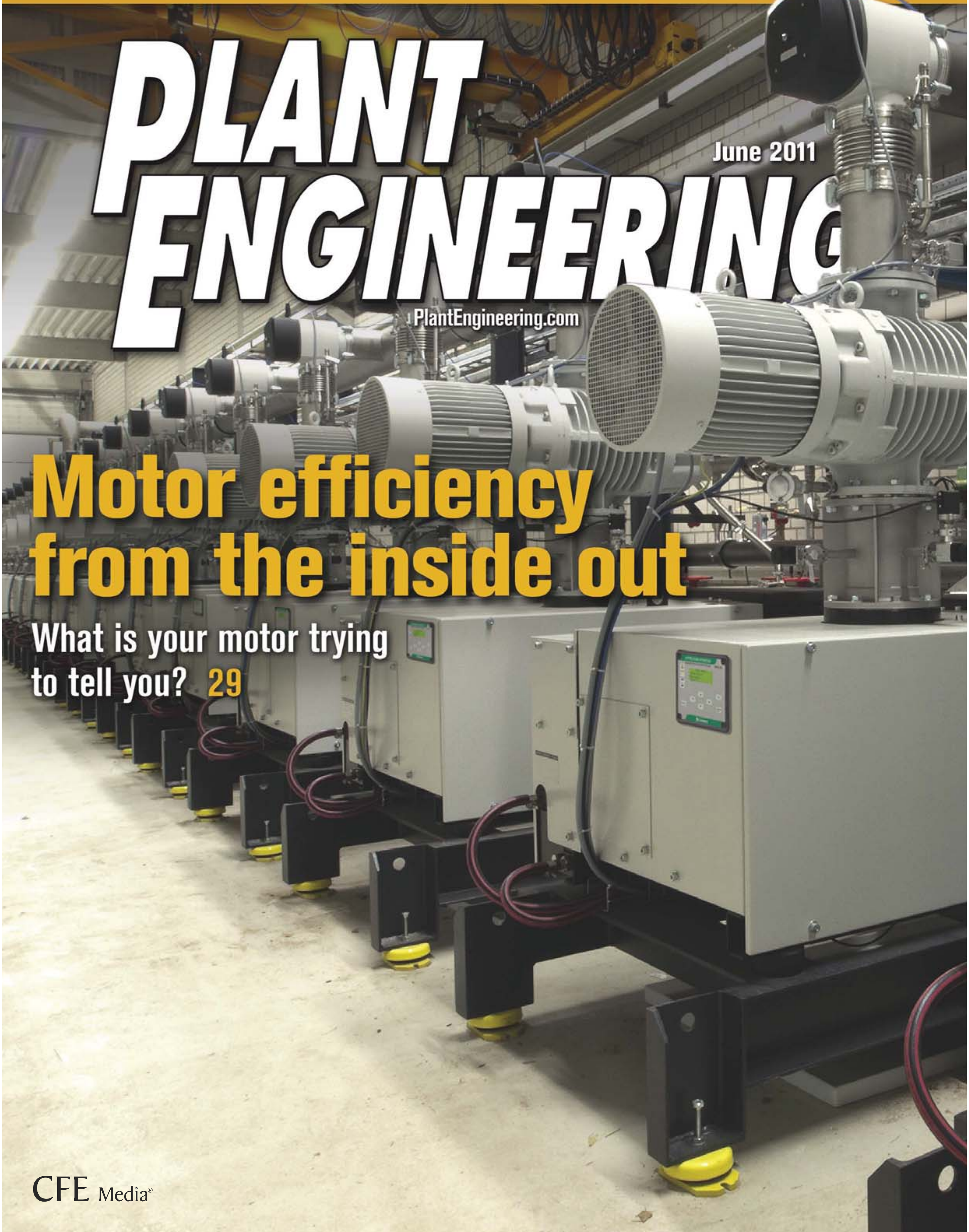

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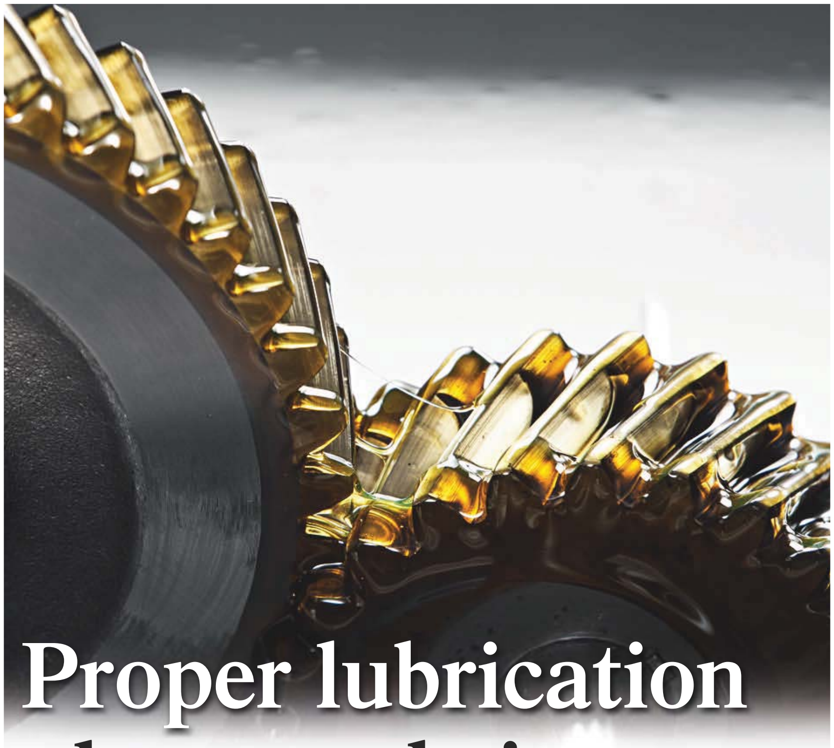

Proper lubrication plays a role in energy efficiency

Choosing the correct lubricant can improve energy efficiency and reduce costs.

By Hermann Siebert
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Many factors come into play when selecting a lubricant, including the projected life of a gearbox, its seals, and the desired performance of the gearbox within an application.

As manufacturers continue to push the limits of machine performance to increase productivity and reduce downtime for greater customer satisfaction, suppliers are called upon to offer increasingly creative solutions. Interestingly, one of the most effective ways to achieve these performance levels is also one most frequently overlooked: proper lubrication.

Choosing the right lubricant can be an especially tricky task. Not only do industrial lubricants come in many varieties and formulations, but many industries also have their own industry regulations and standards. As a result, choosing the proper lubricant for an application is critical.

Typically, end users rely on their OEMs to determine the best lubricant, so it is important for OEMs to value lubricant as a machine element much in the same way that they value hardness of the gears, bearing selection, materials, and geometry. Like all of these other physical components of a gearbox, the right lubricant will allow the gearbox to achieve optimum performance. As a result, end users will enjoy the benefits of lower wear rates, lower operating temperatures, and greater energy efficiency.

For decades, lubricant suppliers have been developing and manufacturing specialty lubricants tailored to the requirements of industrial applications. There are general technical requirements that all lubricants must meet, but, depending on the operating conditions and manufacturing processes in your plant, lubricants may also be expected to provide a host of additional properties.

Oils, greases, pastes, and waxes represent the most common categories of industrial lubricants. Typically, an oil lubricant contains 95% base oil (most often mineral oils) and 5% additives. Greases consist of lubricating base oils that are mixed with a soap to form a solid structure. Pastes contain base oils, additives, and solid lubricant particles. Finally, lubricating waxes are comprised of synthetic hydrocarbons, water, and an emulsifying agent, which becomes fluid when a certain temperature level is exceeded.

Choosing the best lubricant

The key requirement for selecting the proper lubricant is the base oil viscosity. To select the appropriate viscosity, consider the following information about your application:

- Operating speed (variable or fixed)
- Specific type of friction (e.g., sliding or rolling)
- Load and the environmental conditions
- Industry standards

For example, some lubricants, like polyalkylene glycol (PAG) oils, are good for sliding friction but are not well suited for rolling friction. Likewise, polyalphaolefin (PAO) oils are used for rolling friction and can handle some sliding friction, whereas silicon and PFPE lubricants are typically used for extremely high temperatures.

Synthetics and mechanical applications

When synthetic oil is selected, it is generally to provide mechanical and chemical properties superior to those found in traditional mineral oils.

Synthetic base oils have many benefits, including:

- Low/high-temperature viscosity performance

How often a manufacturer is required to change gear oil depends on the chemistry of the lubricant being used.

- Decreased evaporative loss
- Reduced friction
- Reduced wear
- Improved efficiency
- Chemical stability
- Resistance to oil sludge problems
- Extended drain intervals
- Reduced operating costs resulting from less downtime
- Improved labor utilization (less time required for lubrication and maintenance)
- Measurable energy savings and increased output.

Despite their many benefits, synthetic lubricants are also known for one distinct disadvantage: cost. But the cost may be mitigated by extended change intervals, as synthetic and specialty lubricants can last five times longer or more than nonsynthetic lubricants when a high-quality base oil is used.

The majority of oil lubricants, including many motor oils, are mineral oil distillates of crude oil (petroleum), while synthetic oil lubricants are also used. Synthetic oils, such as PAOs or synthetic esters, are produced artificially from other compounds. Because of this, the composition is quite different from petroleum oil. Their higher purity and uniformity provide for several enhanced properties, such as viscosity index, oxidation stability, and color.

There are also semisynthetic oils (also called synthetic blends), which are a blend of mineral and synthetic oil. This class of lubricants provides many of the benefits of synthetic oil at a fraction of the cost.

Most OEMs find that for ease of distribution, it is beneficial to use an H1 product because H1 synthetic gear oils are high-performance lubricants with the added benefit of being food-grade. Thus, they can be employed in both food and industrial environments. It is important to note that standards for food-grade gear oils are just as high as for other gear oils, and the synthetics perform better than standard mineral oils.

Synthetics and energy efficiency

With regard to energy efficiency, some gear oils are more energy efficient than others due to their lower coefficient of friction. Polyglycols, for example, absolutely shine as the most efficient and lowest wear type of oils, particularly in high-sliding applications such as worm and hypoid gears. In these applications, PAGs offer a lower coefficient of friction within the gearbox, resulting in less power loss.

Synthetic oils are more energy efficient because they have better oxidation and thermal stability, which means the gear oil lasts much longer. One could expect to change a mineral oil every 5,000 hours, whereas PAOs or synthetic hydrocarbon oils can last approximately 15,000 hours before a change-out. In addition, PAGs can last as long as 25,000 hours at the same temperature.

As you can see, how often a manufacturer is required to change gear oil depends on the chemistry of the lubricant being used. The 10K rule dictates that for every 10 degrees you increase the temperature of the lubricant, you halve its performance life.

Also, remember that oxidation causes degradation of oil over time. The Total Acid number changes, and the additives are being used up. While changing the gear oil replenishes these additives and removes wear materials, it also adds maintenance downtime to the equation. Choosing a high-performance gear oil from the start will automatically reduce the amount of oxidation within the oil and decrease the required number of oil changes and downtime for equipment maintenance.

For OEMs, gear oil affects several design considerations, including the reliability of their final product. How much a manufacturer will increase the energy efficiency of a gearbox by using high-quality gear oil depends on the gear type.

The biggest increase can be realized in gear types that are challenged in normally lower efficiencies such as worm drives. With the efficiency increases, the temperature of the gearbox drops. This decrease in temperature increases the life of the gear system. This may not sound like a big deal if you have one or two gearboxes in your plant, but if you have hundreds of gearboxes, then that energy usage really adds up.

In summary, most OEMs and end users find that the extra cost of high-quality gear oil is worth the investment and that synthetic oils are proven to be the best. By choosing high-quality synthetic gear oil, end users will save energy and reduce operating costs through reduced maintenance, longer oil change intervals, and less wear. PE

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