

industrial gear oil Measure Up?



Historically, industrial gear oils that met the standard specification provided sufficient lubrication performance. However, with the trend toward smaller systems, higher performance expectations and operating conditions as brutally toilsome and varied as they are today, there are more factors to consider. Gone are the days when any ol' oil will do.

If it were possible to guarantee that an industrial gear oil system always ran in controlled, “cool, clean and dry” conditions, choosing a lubricant with special chemical properties wouldn't be much of an issue.

It's too bad “cool, clean and dry” doesn't describe the conditions of gear-driven operations in steel mills, mining, construction and agriculture equipment, manufacturing plants and other strenuous industrial applications. The reality is that heat, contaminants and water are the nemeses of gear systems even if a plant maintains its operations well above OSHA standards.

Present-day gearing equipment—and the lubricants that protect it and allow it to perform properly over a long period of time—must withstand increasingly harsh environments. This is due to trends toward smaller machines, diverse settings and dynamic operating conditions, not to mention higher performance expectations among savvy maintenance and plant managers who demand less downtime and more productivity to decrease maintenance costs and improve bottom lines. These factors introduce higher temperatures and pressures, as well as more water and other contaminants. Gear oil additives get used up more quickly in the process. The more dynamic and harsh the environment, the more these additives come into play.

Today's industrial gear oil (IGO) must have special-performance additive chemistry that is thermally stable and robust enough to ensure the lubricant lasts longer, protects better and performs more efficiently, while it keeps the system clean and carries away heat and contaminants. No easy task. An IGO that once was widely acceptable for a given application may not stand the test of time or elements in today's world, even if technically it meets the minimum industry specification. Maintenance directors and plant managers need to consider the unique operating conditions of their specific applications to determine which types of IGO are best for them.

Although many consider industrial gear oils to be mere commodities, the industry can't afford to view them that way. Lubrication is an actual component of the gear system, much like the metal parts themselves.

Under Pressure, Feelin' the Heat, Constantly Battling Contaminants

Of course, the move to smaller gear sets requires systems to crank out the same amount of work as their larger predecessors in a more compact mechanism with tighter tolerances (space between parts). This translates to higher speeds and pressures. Throw a smaller sump reservoir into the

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equation and the system has to cycle the fluid more often, which means there is less time to dissipate heat, release foam, settle out contaminants and separate out water. In addition, while the oil cycles, it carries with it heat, contaminants and water.

Constant rolling and sliding of gears creates frictional losses and increases temperature. Heavier operating loads, also commonplace in industrial settings, increase metal-to-metal contact or boundary lubrication, which mean even more heat and pressure. Also, seal quality on modern equipment has improved, which keeps the fluid in the system longer, so the oil needs to do its job for the entire life cycle. Fluid cleanliness and performance retention suddenly become more important.

As if that weren't challenging enough, water can creep into components—namely the reservoir—in several ways, whether it be through overspray from routine plant maintenance (hosing down surrounding equipment) that allows mist into the reservoir breather; an atypical, yet feasible, leak in a steam-controlled heat exchanger; or other sources, like

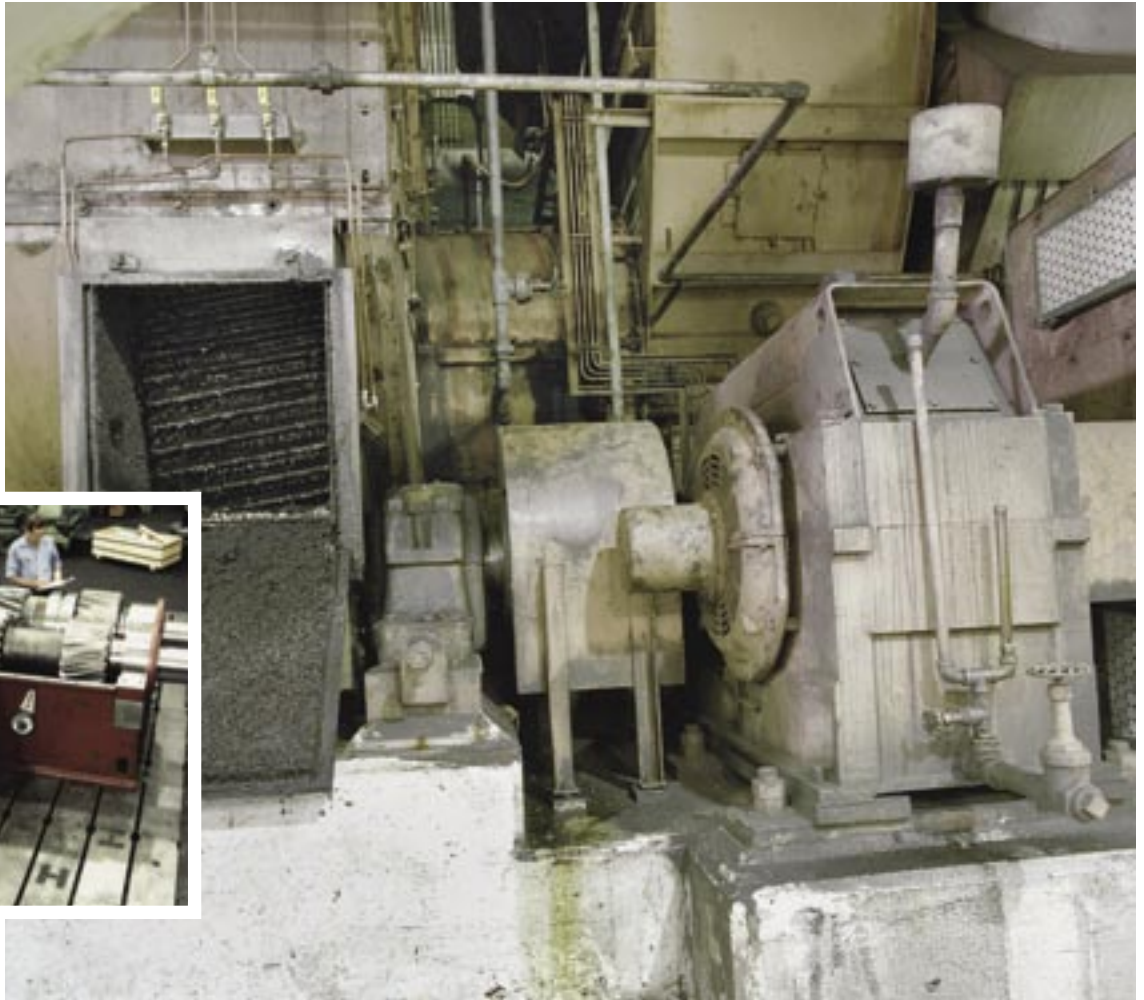
condensation that forms in the reservoir after hot-running equipment cools in the night air.

Then there are non-aqueous contaminants. These include any number of foreign particles that find their way into a gearing operation during the normal course of a day's work from outside the unit, due to wear on the inside of the equipment or line sediment from a system that has not been flushed properly. Microscopic dirt and other contaminants can also invade the once-pristine oil while a maintenance tech adds new fluid to the system. Other system fluids themselves, if they're not compatible with the industrial gear oil, can act as contaminants if they mix.

Good Thermal Stability, Durability and Demulsibility Integral Properties

There are, however, options for protecting your equipment, maximizing performance and achieving longevity of gear and lubricant life with the right oil formulation, provided you're aware of the necessary performance properties and additive components. Here's how to beat the heat:

Using a thermally stable base oil and additive combination helps lengthen the time between oil drains and helps keep filters unblocked.





In today's industrial environments, the demand has increased for antiscuffing agents, rust inhibitors and other gear oil additives.

It's important to have both a thermally stable additive package and a thermally stable base oil. Formulators can achieve thermal stability by incorporating the proper balance of higher-performing, thermally stable industrial gear oil technology. For example, there are various sulfur-phosphorus components that formulators use to give finished fluids anti-wear properties. Some are thermally stable, but most are not. The potential benefits of using thermally stable technology include longer intervals between oil drains, lower operating temperatures and filters that remain unblocked by deposits.

The base oil should be a good quality stock. There are many base oil sources around the world that are used to make industrial gear oil. All these base oils have their own inherent characteristics, some substantially better than others, whether in API Group I or Group II type products. However, high-caliber, versatile additive chemistry can help less expensive stocks work better. It may not result in a premium product, but it can provide the basic performance requirements for an industrial gear oil.

The oil must have the proper viscosity. The general rule of thumb is that the higher the speed and the lighter the load, the lower the viscosity of the fluid should be. The opposite is also true. That is, the lower the speed and the heavier the load, the higher the viscosity of the fluid should be.

Finally, it's key to introduce the right combination and treat rates of additive components, including "antiscuffing" agents (formerly called extreme pressure, or EP, agents), friction modifiers and oxidation and rust inhibitors. Other components, such as defoamers and viscosity modifiers, are also important for general fluid functionality. In today's environment, the demand for these elements is up.

Antiscuffing agents ("extreme pressure" agents)—Arguably the most important aspect of an IGO, antiscuffing (EP) agents differentiate IGOs from other types of oils. They activate at the highest temperatures and prevent accelerated wear in situations of metal-to-metal contact.

Generally speaking, as loads increase and become more severe, gear teeth encounter metal-to-metal contact, frictional losses, and extreme heat. The potential danger here is welding of surface asperities and transfer of material between the mating gear teeth.

The antiscuff agent acts during boundary lubrication, when there is metal-to-metal contact. The chemistry will react with the metal surface to form a sacrificial solid film to prevent damage that could result from excessive friction, heat and subsequent welding. Antiscuff agents (usually composed of some derivative of sulfur/phosphorus) are activated by heat that typically is generated by high temperature conditions.

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One caveat to consider: Applications such as worm drive operations, where there's all sliding and no rolling, generate more friction and heat than other types of gear systems. If heat-activated chemistry is used in this setting, it's likely to activate constantly, which actually can be detrimental, instead of protective, because it's at the expense of the metal itself. So, depending on the application, less active (yet thermally stable) chemistries that lower frictional losses can be used.

Friction modifiers—While they are not heat- or extreme pressure-activated, friction modifiers may be used to provide basic lubricity. They supplement the base oil's lubricity characteristics.

Oxidation inhibitors—Simply put, these components battle heat to "break the chain" of oxidation in the oil to prevent unwanted thickening and sludge. Oxidation inhibitors prevent this process, which will shorten the life of the oil.

To fight the presence of water and other contaminants, there are several additive components and maintenance checklist items that apply:

Demulsifiers—There are so-called "universal lubricants" and then there are "dedicated lubricants." Dedicated IGOs are tailored for industrial applications, whereas universal gear oil additives are used in automotive and industrial gear applications and may contain components that are not necessary or that actually compromise performance. For instance, demulsifiers are not necessary in automotive gear oil, but they are crucial in an industrial gear oil. Demulsifiers allow IGOs to maintain hydrolytic stability, or separate water from the oil.

Corrosion inhibitors—Chemical contaminants can eat away at yellow metal parts. Corrosion inhibitors prevent this decay.

Rust inhibitors—Rust is a result of water and oxygen chemically attacking metal, and it forms that infamous, unwanted brittle coating. Rust inhibitors stop this from occurring.

Proper filtration and a well-maintained, good-quality reservoir breather—There are steps that you can take on the maintenance side that aren't necessarily related to fluid choice but are helpful in controlling moisture and keeping contaminants from fouling up your works. While the reservoir breather is doing its job to let air into the tank and prevent creating a vacuum, it's also what stands between dirt and clean oil. The same might be said about the gear oil filtration system. Both should be good quality and well-maintained to keep foreign substances out, where they belong.

Industrial gear oils need to be durable enough to withstand the conditions to which they'll be exposed and retain performance over a longer period of time. This will ensure the fluid keeps gear operations running properly. Also, it'll curb excessive/accelerated wear, protect investments by extending equipment life, prevent catastrophic failures and minimize downtime to maximize productivity and save on maintenance costs.

While cool, clean and dry may be the ideal, it's just not a practical reality among the myriad harsher settings of the here and now. Consider your particular application to decide what type of additive package its IGO should have in order to protect your equipment from accelerated wear, damage or catastrophic failure, as well as prevent downtime and maximize production, while saving expenses in the process. ■

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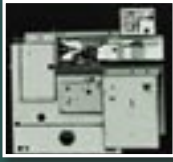
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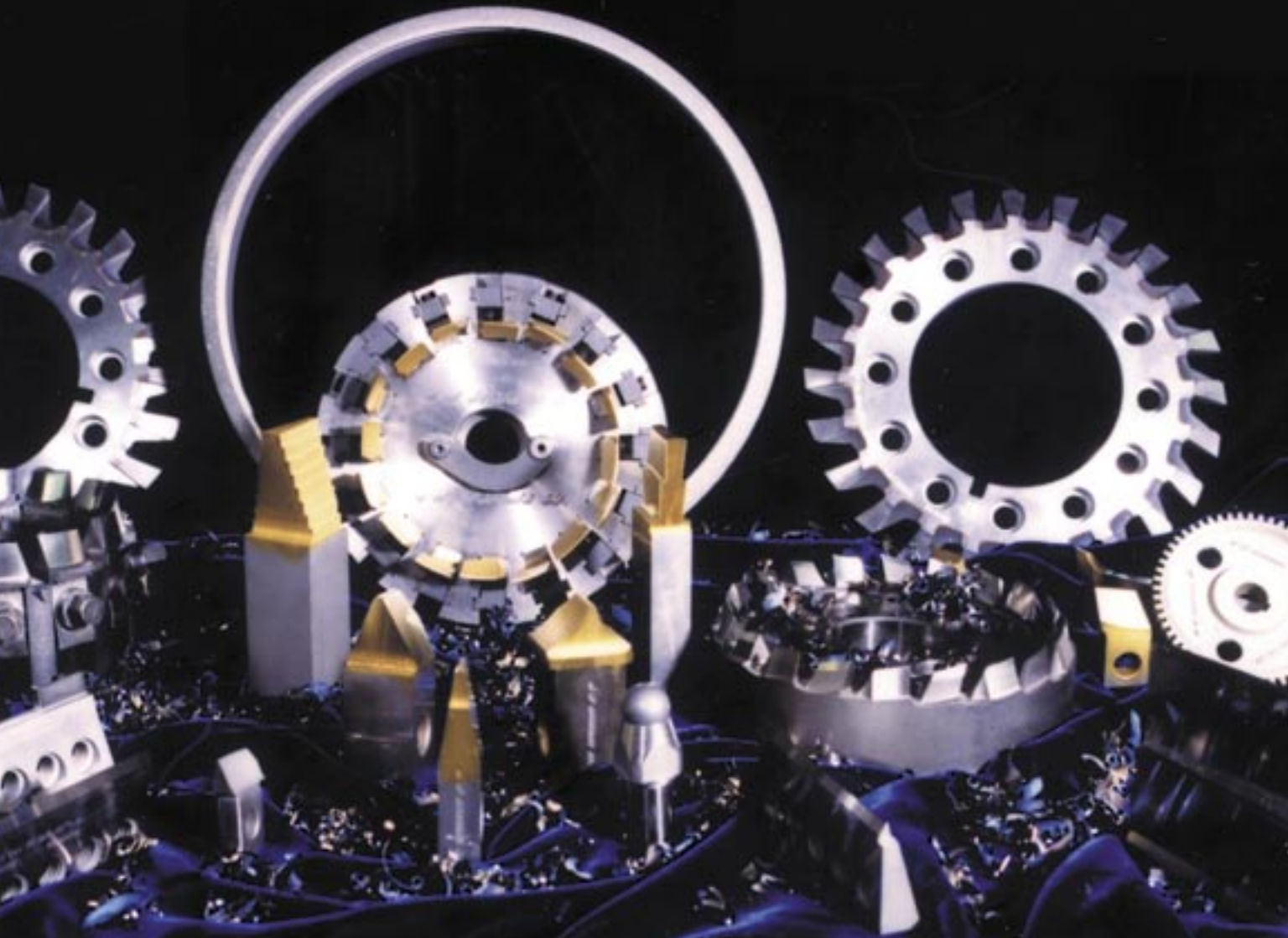
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