Purchasing Gear Lubricants: Be Careful When Playing the Numbers Game

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Introduction

When it comes to purchasing gear lubricants, many people on both the sales and purchasing side decide to play the numbers game. The person with the most numbers, or the biggest numbers, or the lowest numbers, must have the best product — right? Wrong; gear oil selection is not a game, and numbers alone cannot determine the right product for an application. Too much information can be just as much a problem as too little. A purchaser can be tricked into selecting the wrong oil if he does not completely understand what the numbers mean.

As the old saying goes, "Figures don't lie, but liars do figure." This is not to suggest that gear lubricant sales representatives are liars, but rather that too often neither the sales rep nor the purchaser completely understands what the numbers on a technical sheet or price list really mean. An attempt will be made here to explain what you should consider when choosing a gear lubricant for a specific application and to show why choosing based solely on the numbers is not the best bet.

Background

Gears are a unique application for lubrication in that they provide a different challenge than other lubricant applications. In non-gear applications, the moving surfaces are in sliding motion or rolling motion. Gear teeth, however, experience both rolling and sliding motion at the same time. With these interesting conditions in mind, the formulator has numerous ingredients available to build a gear lubricant that provides proper protection. See Table 1 for a list of common ingredients used in various combinations for gear oil formulas. A formula does not have to contain every one of these additives, and there are multiple additives available to provide specific functions. As seen in Figure 1, gear oils are categorized first based upon the application, as either an open gear lubricant or an enclosed gear lubricant. As these names would suggest, an open gear lubricant is not enclosed in a gearbox or oil sump. As such, open gear lubricants are generally formulated as either high-viscosity fluids or greases. This paper will focus on enclosed gears only.

Enclosed gears are generally contained within a gearbox or some other device in which the gears can be bathed or showered with a coating of fluid lubricant. Enclosed gear oils are categorized next as either automotive or industrial gear oils. Both types can be subcategorized as synthetic or mineral oil, which describes the base fluid. Automotive gear oils are then broken down into a final set of subcategories that describe the application in which it will be used, while industrial oils are subcategorized based upon the type of additives used in the formula.

10-Step Gear Oil Selection Process

For years, many have stated that when selecting a gear lubricant — or any lubricant for that matter — one need consider only temperature, speed and load. More recently, however, this advice has been expanded to include environment. An easy way to remember this is L-E-T-S, i.e.: load, environment, temperature and speed. While this advice is simple and easy to remember, it still doesn't provide

Table 1 Gear oil ingredients

Ingredient	Function
Base Fluid	Mineral oil or synthetic fluid (PAO, ester, PAG) makes up 50-98% of the formula.
Viscosity Modifiers	Viscosity index improvers or polybutene polymers used to increase the base fluid viscosity; becoming very common today to replace high viscosity bright stocks often used in gear oil formulas.
Rust & Oxidation Inhibitors (R&O)	Rust inhibitors coat metal surfaces to protect against rusting. Oxidation inhibitors defend the oil against degradation due to reactions with oxygen in the air when the lubricant is exposed to elevated temperatures.
Copper Deactivators	Gear systems can contain some yellow, copper-containing metal elements that can be tarnished by gear oil ingredients. These additives protect the metal.
Anti-wear Additives (AW)	Some gear applications operate in the mixed film lubrication regime, meaning slight metal-to-metal contact. The base fluid isn't sufficient to protect the surfaces from wear, so additives are included to form a sacrificial surface that decreases the friction between two metal surfaces.
Extreme Pressure (EP)	Heavily loaded gear applications can operate in the boundary wear regime, meaning the oil film is squeezed out completely. EP additives put down an aggressive coating that carries the load and protects the metal surfaces in lieu of the lost oil film.
Dispersants	These surface-active additives grab onto and disperse contaminants in bulk oil so that they do not collect in the gearbox, but instead can be carried to the oil filter for removal. They are used more often in automotive gear oil than in industrial gear oil.
Emulsifiers	These are not common, but some gear oils are formulated to mix with water and stay mixed, such as when water contamination is impossible to avoid.
Demulsifiers	Surface-modifying components are used to promote the separation of water.
Defoamants	Surface-tension-reducing polymeric compounds are used to inhibit the formation of foam on the surface of the oil that could result in housekeeping, oxidation and wear issues.
Tackifiers	Sticky polymers with high molecular weight are added to increase a gear oil's ability to climb and cling to gears.
Solid Lubricants	These are not common in lower viscosity enclosed gear applications, but are often used for lubrication of open gears. EP additives lay down a layer of solids that keep the metal surfaces from rubbing. Common examples include molybdenum disulfide and graphite.
Pour Point Depressants	Polymeric ingredients are added to modify wax crystals that form in oils at low temperatures. They keep the oil from gelling up, thereby expanding the oil's operability range on the low end.
Compounding Additives	A vegetable or animal fatty acid is put into formulations as a friction modifier in formulas for gear applications sensitive to most EP additives.

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sufficient direction to make an educated decision. Instead, the following 10-step process is recommended to anyone who is responsible for purchasing enclosed gear lubricants.

1. Set lubrication goals. As with most things in life, it is very important to have a goal. This is even important when it comes to selecting a gear lubricant for use in a specific piece of equipment. Most maintenance groups have a broad goal of increasing the reliability of the equipment for which they are responsible. In trying to improve reliability, one thing that is often reviewed is "uptime." The higher the percentage of uptime, the more reliable it is considered. Lubrication has often been traced to reliability. Also, many maintenance individuals would like to reduce the amount of time they have to spend performing lubricant-related maintenance projects. High-performance lubricants are available that can be used to help improve reliability. Lubrication has also been traced to improved energy efficiency, an area that has been given much attention in recent years. Improved heat removal and friction reduction in a gear application can result in decreased energy consumption.

So the question remains, what is the goal for selecting a gear lubricant for a specific application? Is the one currently in use not performing as needed? Is there a desire to change from one supplier to another? Is it a new piece of equipment that needs to be filled for the first time? Are there availability issues with the lubricant currently in use? Does the company have an edict to reduce energy consumption? Is there a desire to increase the maintenance intervals? Goals must be personalized and they must be specific. Without a specific goal, there is little reason to push ahead to steps 2–10.

2. Seek professional advice and consultation. Ideally, a lubricant sales professional or consultant is available to serve as a value-added member of the team. It used to be that many companies would employ a lubrication engineer or at the very least have a person whose job was focused on equipment lubrication. Today, most maintenance departments have been forced to work with fewer people. As a result, a lubrication specialist on staff is considered a luxury. Instead, lubrication duties have been added to the existing workload of maintenance staff. As a result, time spent on improving equipment reliability through lubrication has been decreased.

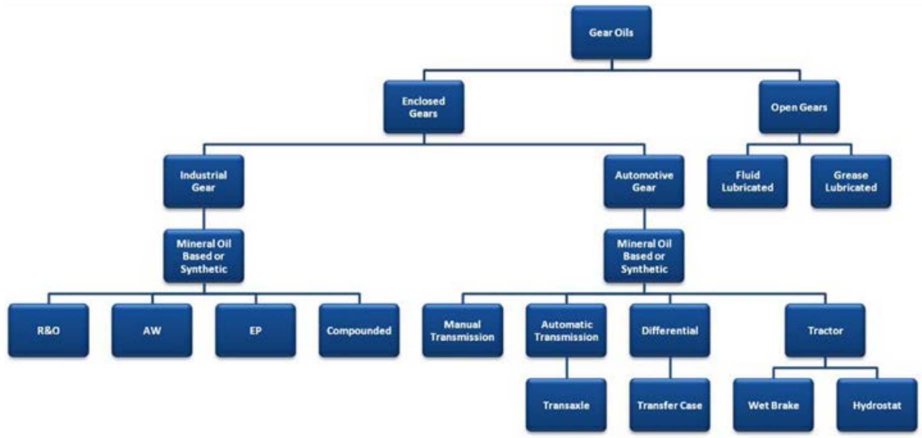

Figure 1 Gear oil categories.

The gear purchasing process should start with evaluating the experience, knowledge and services offered by the individual or company providing the lubricants. Today, groups like the International Council for Machinery Lubrication and the Society of Lubrication Engineers offer certification programs for lubrication professionals. It is a good idea to ask your lube provider whether they or somebody on their support staff has been certified by one of these organizations. If all your potential gear lubricant supplier can provide is a price list and specification sheet, it should raise an immediate red flag. The price paid for the lubricant should include the physical lubricant as well as professional service to go along with it. Ray Thibault, a lubricant consultant, trainer and author, provides this great segue from Step 2 to Step 3:

"While a product data sheet provides useful information, the true test of gear oil is how it works in the system. Adhere to OEM guidelines and consult your lubricant supplier for further information." (Ref. 1)

3. Review OEM recommendations, including compatibility. The next step is to consider the recommendations of the original manufacturer of the gear equipment. Ask any potential gear oil suppliers if they are able to provide evidence that their products are either approved by, or meet the requirements of, the OEM.

Often the OEM has determined — through field experience or extensive testing — what the lubricant requirements are for the equipment. Some will publish a specification that lists the physical and performance requirements for the gear lubricants. Some gear OEMs even take it a step further by creating their own approval system, including approvals and the publication of a list of approved products. It is important to become familiar with these specifications or approval lists so as not to void any warranties provided by the OEM and to maximize the reliability of the equipment.

Many lubricant purchasers fail to consider the compatibility of the lubricant with the equipment in which it is going to be installed. Some OEMs use coatings or paints to protect the insides of a gearbox from corrosion. Unfortunately, some lubricants can compromise these coatings. Another compatibility issue can be the use of certain elastomeric seals in a gearbox. If the lubricant is incompatible with these elastomers, the seals could start leaking. If not caught soon enough, these leaks can result in lubricant starvation. Oil leaks also can result in safety issues if the oil collects where it causes a slip hazard.

Based upon specific end uses of a gearbox, there are circumstances in which the OEM-recommended oil does not provide adequate protection. In these cases, it is extremely important that the professional advisor mentioned in Step 2 is consulted for other recommendations, and that proper testing be conducted to ensure a successful change to a new, better-performing product.

4. Determine type of load. Figure 1 illustrates how gear oils are characterized according to their formulation and/or usage application. It especially shows how industrial gear oils are characterized according to their additive type, specifically the wear-related chemistry used.

For example, a gear lubricant may be described as R&O, EP or AW. Certain enclosed gear applications have little to no load applied. The appropriate oil in this case might be R&O oil only. As the amount of loading increases, so will the amount of metal-to-metal contact between the gears. For gears operating in the mixed film wear regime, AW oil may be needed, while for those operating in the boundary regime, EP oil may be needed.

Sometimes the OEM specifically describes the type needed either in the equipment user's manual or on a plate attached directly to the gearbox itself. If not, then it is up to the user to determine whether the application subjects the gearbox to either heavy loads or shock loads during operation. In that case, it will require EP oil that contains active sulfur and phosphorous compounds that form a protective chemical layer on the gear surfaces when the fluid is compressed out of the meshed gears. In extreme loading cases, it might be helpful to use gear lubricant that contains solid EP additives. However, it is important to note whether fine filtration is in use, because it can remove solid additives and make this specific product ineffective. Some OEMs specifically recommend against the use of solid additives, so it is important to know this.

5. Know gearbox construction and capacity. A gearbox contains various components, including — but not limited to — the case, gears, bearings, shafts and seals. The construction of the gearbox, including its geometric configuration, is often contingent upon how the gearbox is required to transmit power within the given application. As described by Tim Cooper of Lubrizol:

"Today's gearboxes often are smaller and made from new materials; they are getting pushed to produce more power and at the same time be more durable and reliable than before. To meet these increasing demands, today's industrial gear oil must contain high-performance additive chemistry (Ref. 2)."

You must know the construction of the gearbox and use this information as part of the lubricant selection process. This includes the metallurgies, gear geometries and the cuts of the gears (rough or smooth). Table 2 illustrates the part that gear geometry plays in the lubricant selection process.

The gearbox capacity is a subcategory of construction that merits its own discussion. As noted previously by Cooper, many gearboxes are getting smaller. In a small gearbox, less oil is present. As such, it could run hotter, be sheared more by the gears and be affected more dramatically by contamination. The corollary is that in a large box, the oil may circulate less, run much cooler and last much longer. Although this sounds like an endorsement for larger gearboxes, they are not suitable — or even possible — with some applications.

Many lubricant additives activate at certain temperatures. With that in mind, it is possible that a large gear set might experience elevated wear because the oil never gets hot enough for the additives to activate. On the other hand, the wrong additive system employed in a small, hot gearbox could result in an aggressive gear additive prematurely activating, oxidizing and leaving behind deposits. The oil capacity of the gearbox can have a dramatic effect on the gear oil. As such, capacity must be considered as a part of the selection process. Also, if the goal determined in step 1 was to extend the interval between lubricant drains, the size of the gearbox case is very important. The more lubricant there is in the gear case, the more additive reserves there are to extend the life of the lubricant.

6. Minimize effects of operating environment. A gearbox could be operating in an environment that is hot, cold, dusty, wet or various combinations of these conditions, all of which can have significant effects on the gearbox. To minimize these effects, you can take precautions such as using air breathers, sight glasses and filtration devices. The lubricant itself also may be required to compensate for some of the challenges caused by the operating conditions.

Extreme temperatures. For an application operating at either extremely high or low temperatures, it may be necessary to choose a synthetic-based lubricant instead of a mineral-oil-based lubricant. For low temperatures, oil should have a pour point that is 5°C (9°F) below the startup temperature. Operating temperatures can also determine the chemistry needed in the gear oil. Very aggressive EP gear oils might result in heavy deposit formation in the gearbox during operation. Non-EP oil used in an EP oil application can result in high oil temperatures due to excess frictional heating of the oil.

Particulate contamination. In a coal or rock crushing plant, it is inevitable that dust and dirt will be in the air, and it is very difficult to keep the particles from finding their way into the gear oil. Filterable gear oil would allow filtration to remove harmful contaminants without removing valuable additives.

Water contamination. In water treatment facilities, it is nearly impossible to keep water out of some gearboxes, making it extremely important to choose a gear lubricant with excellent water separation properties.

7. Identify viscosity recommendation. The viscosity of a gear lubricant is a measurement of its ability to flow in an application. This is a very important consideration in selecting gear oil. If the oil is too thick, it will not flow into the gear contact zones. If the oil is too thin, it will be compressed out of the contact zones or fling off the gears while they are in motion. In either case, lubricant starvation will occur, which can result in premature wear-related failures. The primary means of gear lubricant selection, with regard to viscos-

Table 2 Effect of gear type on lubricant chemistry selection

Lubricant Chemistry	Gear Geometry Type				
	Spur	Helical	Worm	Bevel	Hypoid
R&O inhibited	Normal loads	Normal loads	Light loads & slow speeds only	Normal loads	Not recommended
EP gear lube	Heavy or shock loading	Heavy or shock loading	Satisfactory for use in most applications	Heavy or shock loading	Specified for most applications
Compounded	Not normally used	Not normally used	Preferred by most OEMs	Not normally used	Lightly loaded applications
Synthetic	Heavy or shock loading and/or extreme temps	Heavy or shock loading and/or extreme temps	Heavy or shock loading and/or extreme temps	Heavy or shock loading and/or extreme temps	Heavy or shock loading and/or extreme temps

ity, is to use the OEM requirement. If an OEM recommendation is not available, there are two other methods to obtain viscosity recommendations. The first is to use the viscosity ranges recommended by the American Gear Manufacturer's Association, per its 9005-E02 standard (Ref. 3), illustrated in Table 3.

The second method is attributed to renowned gear expert Robert Errichello (Ref. 4), and is based upon a calculation method that employs the following equation:

$$V_{40} = 7000 / \sqrt{V_1} \quad (1)$$

where:

V_{40} is the viscosity at 40°C, in cSt;

V_1 = pitchline velocity of the lowest speed gear in the gearbox in feet-per-minute = 0.262 × speed (pinion rpm) × pinion diameter (inches)

If there is no oil cooler on the industrial gear drive, it is best to determine the maximum expected ambient temperature during operation and:

a. Increase one ISO viscosity grade if the ambient temperature exceeds 35°C (95°F).
b. Increase two ISO viscosity grades if the ambient temperature exceeds 50°C (122°F).

If there is an oil cooler, the maximum ambient temperature is less important because the oil's temperature can be controlled. Therefore, the oil's temperature should determine the viscosity.

c. Increase one ISO viscosity grade if the oil temperature exceeds 65°C (150°F).
d. Increase two ISO viscosity grades if the oil temperature exceeds 85°C (185°F).

If the oil temperature exceeds 90°C (194°F), use a cooler such as a fan or a heat exchanger (Ref. 5).

8. Consider gear speed. Viscosity often is related proportionally to the speed at which the gearbox is operating. The general belief is that high-speed applications require low-viscosity lubricants, and low-speed applications require high-viscosity lubricants. AGMA provided a general guideline in its 9005–94 specification, which serves as a good rule of thumb. When referring to its viscosity grades shown in Table 3, AGMA stated:

Table 3 AGMA viscosity grades for gear oils

AGMA Number	ISO Grade Equivalent	Kinematic Viscosity at 40°C min / max cSt		Kinematic Viscosity at 100°C min / max cSt	
0, 0S	32	28.8 /	35.2	- /	-
1, 15	46	41.4 /	50.6	- /	-
2EP, 25	68	61.2 /	74.8	- /	-
3EP, 3S	100	90 /	110	- /	-
4EP, 4S	150	135 /	165	- /	-
5EP, 5S	220	198 /	242		
6EP, 6S	320	288 /	352		
7 Comp, 7EP, 7S	460	141 /	506	- /	-
8 Comp, 8EP, 8S	680	612 /	748	- /	-
8A Comp, 8A EP	1000	900 /	1100	- /	-
9EP, 9S	1500	1350 /	1650	- /	-
10EP, 10S	-	2880 /	3520	- /	-
11EP, 11S	-	1440 /	5060	- /	-
12EP, 12S		6120 /	7480	- /	-
13EP, 13S				190 /	220
14R				428.5 /	857.0
15R	-			857.0 /	1714.0

"These guidelines are directly applicable to… gears that operate at or below 3,600 revolutions per minute, or a pitchline velocity of not more than 40 meters-per-second (8,000 feet per minute)… and worm gears that operate at or below 2,400 rpm worm speed or 10 meters-per-second (2,000 feet-per-minute) sliding velocity (Ref. 6)."

Anything above these gear speeds is considered a high-speed gear, and it is best to consult the OEM recommendations for lubricant recommendations. Figure 2 is a simple schematic that summarizes how load, speed and viscosity come together during the lubricant selection process (Ref. 7).

9. Ensure fluid durability for extended drains. Today, people are realizing that there is a hidden cost to using inexpensive, lower performance lubricants. The less time a lubricant lasts during service, the more maintenance it takes to change the lubricant. In addition, the more frequently the lubricant is changed, the more waste lubricant there is to be disposed. While there are plenty of companies specializing in waste oil disposal, they do charge for their services. With these hidden costs in mind, many users are looking to extend their drain intervals.

Gear oil durability requires that a proper synergy exists between the base fluids and additives chosen for the gear product. The user must consider the gearbox application to know what type of stresses it will put on the lubricant. Improper selection will accelerate the demise of the lubricant's physical and chemical properties. For example, as mentioned in Step 6, filtration tools can overcome some of the issues caused by the operating environment. However, filters also might remove some of the additives, such as tackifiers and defoamants. Consult the manufacturer of the gear lubricant to verify if it has experience in these cases. If not, request testing or continue searching for another supplier.

10. Evaluate price. Evaluating the price is the last step in this process for a reason. Unfortunately, many gear oil purchasers evaluate price first, and sometimes it is the only number they evaluate. This can be a costly mistake. According to Mike Johnson, lubrication consultant, trainer and author:

"Performance lubricants are often not considered for use because of price objections. Maintenance costs range from 5–15 percent of a plant's cost of manufacturing, depending upon the industry. Lubricant purchases represent only 1–3 percent of maintenance expenses. Yet, the portion of the budget that can be directly impacted by lubricant expenditures can represent about 35 percent (20 percent from parts replacement, plus 15 percent from lube program routine and overtime repair labor). The cost-to-cost leverage fac-

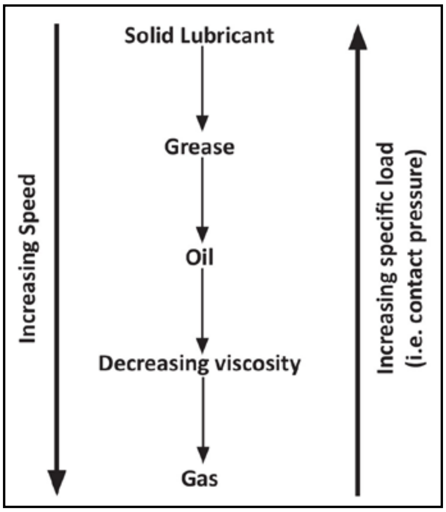

Figure 2 Effect of speed and load on lubricant selection.

tor for lubricant savings opportunity vs. lubricant expense is an astounding *35:1*. Investment in either process or product improvements can produce returns at several hundred percent investment with just a little effort (Fig. 3)." (Ref. 8)

While consideration of price is a valid part of the lubricant selection process, it should always be the last step.

By the time steps 1–9 have been completed, it is likely that the most appropriate lubricant for the gear application has become apparent. Yet, if there are still several products that appear to be equivalent, then price should play into the selection process. The highest-priced lubricant is not necessarily the best for a given application. For example, if a gearbox has leaking problems, it is not likely that an expensive synthetic lubricant will provide value. On the flip side, this does not mean you should purchase the least expensive gear oil and ignore the leaking gearbox. In a case such as this, it is a maintenance issue and not a lubricant issue. As described by Johnson, leaving a problem like this unresolved can cost the company much more in the long run than initiating good maintenance practices and choosing high-performance lubrication products.

Important numbers. Assuming that steps 1–10 have been considered, and that the final decision comes down to a comparison of data sheets, the question still remains: What numbers should one consider important? A review of various gear lubricant supplier data sheets will show that there can be dramatic differences between the claims made. Without knowledge, the tendency might be to go with the product with the most numbers and OEM claims on the data sheet. While this shows that the supplier was willing to put a sizeable investment into product development testing, it still doesn't necessarily prove that one product is better than the other for the application. Be wary of the lubricant sales person who just points out one specific data point and emphasizes this for the sale. There are other factors that affect the significance of those numbers, such as applicability to the application, test precision and units portrayed. Let's take a look at just a few.

Many companies will show the Timken test: ASTM D2782 (Ref. 9). What is not widely known outside of the laboratory is the precision of this test. Most ASTM test methods include a repeatability and reproducibility statement. Repeatability is a measure of error between multiple test runs, on the same sample, by the same operator running the same instrument, while reproducibility is the error between multiple test runs conducted on the same sample by different operators on different instruments.

For the Timken test, the repeatability is 30 percent of the mean on one of 20 samples and the reproducibility is 75 percent of the mean on one of 20 samples. This means that the error from the same lab on 20 runs will likely produce at least one run with up to 30 percent error. The rest of the runs may be somewhat better than that, but expect the possibility of at least 30 percent error. When different labs are running this test, it is even worse. Imagine a sample that has a 50 lb Timken result. If the same lab runs this test, at least one test in 20 will deviate by as much as 15 lb. Within the precision of this test, the same operator could produce a 35 lb Timken result or a 65 lb Timken result, and statistically these would be the same result. Now, seeing that the reproducibility is 75 percent, two different labs could produce a 12.5 lb result or 87.5 lb result —and these would be considered statistically the same result for the average of this imaginary 50 lb sample.

Next, it is a good idea to pay close attention to the units reported on a product data sheet. Once again using the fictitious 50 lb Timken result, a lab in the U.S. might report that data as 50 lb, while a lab in Europe might present it in metric units as 22.6 Kg. Both of these are correct, but the U.S. lab number looks much higher. One might mistake the U.S. result as a better result when they are actually the exact same number. As a sideline to this, there are various standards groups active throughout the world. They might publish very similar methods, yet there can be subtle differences. One cannot just assume that results published using the same instrument are comparable, because the various methods used can cause differences in results. For example, an ASTM method might produce different results than an ISO method on the same instrument.

There are two common corrosion tests used within the lubricant industry: ASTM D665 (Ref. 10) and ASTM D130 (Ref. 11). Both have nuances, depending upon the application. The D665 has an A and B version of the test method. The A version uses deionized water for the testing, while the B version uses standard saltwater. Traditionally, the saltwater version is more severe, so when considering results one should ensure that the same test conditions were employed. The D130 test employs two different test temperatures. This can make a big difference depending upon the EP package used in the gear oil's formulation. The same result published on two competitive data sheets might not mean the same thing if the temperature is not published.

The gear lubricant features that should be evaluated when comparing data sheets depend upon the application. See Table

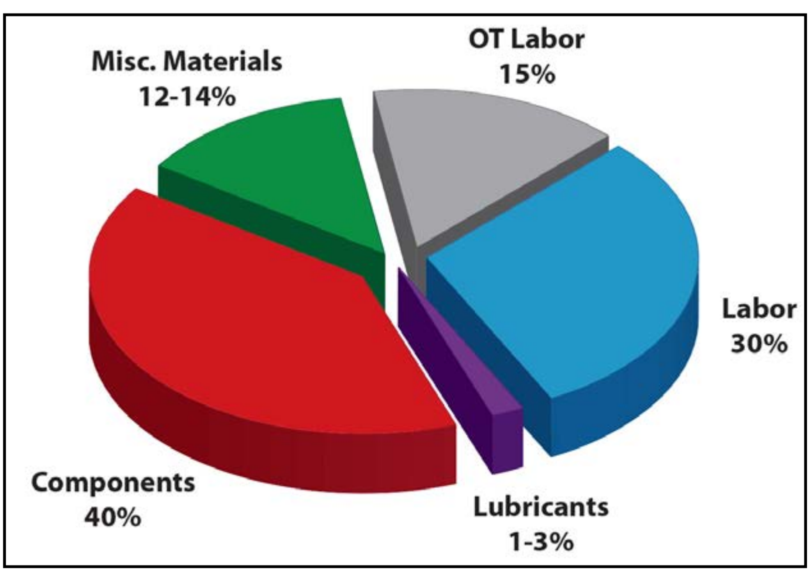

Figure 3 Typical maintenance budget divisions.

Table 4 Important information to look for on product data sheets

Application	Lubricant Feature	Common Tests	Optimal Results
All	OEM Approvals		Check for any approval that is required.
All	Viscosity	Viscosity, ASTM D445	varies by grade
		Viscosity-Brookfield, ASTM D2983	varies by grade
Extreme temps (extremely low startup: <-26°C (-15°F) or continued exposure to extremely high: >82°C (180°F))	Synthetic	NA	NA
Lightly loaded or high-temp operation	R & O	Oxidation @121°C, ASTM D2893B	<6 max
		Oxidation Rig Test, viscosity increase, L60-1	<100%
		Rust Test, ASTM D665B	pass
Light-to-medium loading	Anti-Wear (AW)	Four-Ball Wear, ASTM D4172	<0.50 mm
Medium-to-heavy loading	Extreme Pressure (EP)	Four-Ball EP Weld Point, ASTM D2783	250 Kg
		Four-Ball EP LWI, ASTM D2783	>60
		FZG Scuffing, DIN 51354	>12
		FVA 54 Micropitting Load Stage	>10
		Timken OK Load, ASTM D2782	>60 lb min
Release of air for lubrication or housekeeping issues	Anti-Foaming	Foaming Characteristics, ASTM D892	0/0/0
		Flender Foam Test	<10% increase
Water removal when necessary	Water Separability	Emulsion Characteristics @ 82°C, ASTM D1401	40-40-0 / 10
		Demulsibility Characteristics EP, ASTM D2711B	Max 2% H_2O in oil, 80 ml free H_20, 1 ml of emulsion
Rust or yellow metal protection	Anti-Corrosive	Rust Test, ASTM D665B	pass
		Copper Corrosion, ASTM D130	1a or 1b

4 for a list of common lubricant features cross-referenced with application conditions and optimal test results indicating a lubricant's suitability for that application.

While the lubricant industry is considered a relatively mature industry, there are still areas of active research. The leading edge for lubricant manufacturers is to formulate products that can be used in the challenging wind turbine gearbox applications.

Over the years, wind turbine OEMs have found that their gear sets are notorious for micropitting, also sometimes called fatigue scoring, flecking, frosting, glazing, gray staining, microspalling, peeling or superficial spalling. (Ref. 12)

The FVA 54 test evaluates this phenomenon. This test, which is specific to base fluid, viscosity and additive chemistry, is not easy to pass. This is why some wind turbine OEMs have come to respect the data from this test and have now incorporated it into their specifications. Several OEMs also require a passing result for their general industrial gear specifications.

Conclusion

Several resources are available to help the end user select the right gear lubricant. Some have focused only on speed, temperature and load, while others have added operating environment to the mix. Still others have added lubricant and equipment compatibility. All of these tend to confuse the end user. The result is that many end users look to their lubricant suppliers for assistance. This is a good plan, but it can sometimes result in a mere comparison of price or data sheet numbers; in other words — a numbers game. Instead, try using this 10-step process for lubricant selection to make the process easier and more systematic, resulting in improved equipment reliability. Remember: Be careful when playing the numbers game. Most players end up losing.

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