Grease Characterization: Are All Greases Lithium Greases?

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Abstract

Lithium soap base lubricating greases are the most commonly used grease type. Yet, it must be understood that they are not the only type. Greases are generally characterized and sold according to their thickener type and/or base fluid composition. Historically, Lithium and Lithium complex thickened greases have been the thickeners of choice for high performance grease applications. Recent advances have been made allowing for the use of various other thickener types as well. This paper and presentation will provide a brief primer on grease thickener systems and base fluid types which are used to characterize greases. Next, using an Aluminum Complex grease as an example, several field applications will be discussed to show that other greases can be considered multi-purpose; not just Lithium greases.

INTRODUCTION

Since being introduced in 1942, the use of Lithium soaps as a grease thickener base has expanded, making up 73.4 percent of today's worldwide market (3). Because Lithium soap greases have been found to possess multipurpose characteristics, they have been the thickener of choice for high and low temperature applications and enhanced performance under extreme pressures and speeds. However, as with every industry, there is always a desire to update and introduce newer technology that provides equal or greater performance under the same conditions. The use of different thickener systems along with synthetic type base stocks has provided a way to continue to push grease technology further. Greases are usually characterized by their thickener composition or base fluid type. The following will provide a brief overview on many of the common base fluid and thickener types, but the emphasis will be mainly on Lithium complex and Aluminum complex greases.

BACKGROUND

Generally, there are three broad categories of thickener systems used to make grease. The first category uses insoluble powders which are introduced into the base fluid under high shear conditions, until they are thoroughly dispersed and a thickened grease is formed without any real chemical reaction. Common solids include organo-clay, fumed silica, carbon black, and many different types of pigments (2). The next category is the polymer thickened greases. Examples of polymer thickened greases are polyureas, dimethylsiloxane, and polyflouroethylene greases. Like solid thickened greases, these greases are composed of a base fluid with a polymeric material with gel-forming capability properly dispersed to produce the proper thickness of grease. Generally, the thickener is a low-molecular weight organic polymer which is usually formed "in situ" in the base fluid and yields no by-products that must be removed (such as water or alcohols produced in the formation of soap greases) (2). The most common category of greases used in industry today, however, are soap-thickened. Soap-thickened greases are formed when an organic acid is reacted with a metallic base in a percentage of base fluid which results in the formation of a crystalline soap dispersed in the fluid (2). From this soap base, additives and the appropriate amount of oil are added to form a semi-solid or gel-like material. Most soap-type greases are sheared, or "milled," to form a consistent thickness throughout the material. The soap category of greases, along with the careful base fluid selection, will be the main focus of this paper.

GREASE APPLICATIONS

Three categories of greases were discussed, but what are the main applications for some of the above-mentioned categories and why? This question can be answered by discussing some of the applications, strengths, and weaknesses of some of the most common ones.

Insoluble-Solid Thickened Greases

Most greases thickened by insoluble powders, such as bentonite clay, are normally "non-melt" greases. In other words, they have extremely high or non-observable dropping points. This means these greases are typically used in high temperature applications, such as kiln cars, ladle cars, and furnace door bearings (2). The way the thickener functions in these greases is that enough solid is mixed into the base fluid to cause thickening. Often, the solids are treated with an organic substance to create polar interactions between the solid particles and strengthen the gel structure. However, a downside of these greases is that they only have a fair to good mechanical stability rating so they are not recommended for applications where high shear is inevitable. Another downside is that certain additives can interfere with the weak interactions between the solid particles and make the mechanical stability even worse. Therefore, it is often difficult to formulate these greases with very high concentrations of corrosion prevention or wear reducing additives. Finally, because this thickener system is composed of solids, they can eventually leave behind heavy amounts of residue in applications where the base fluid is driven off by evaporation.

Polymer Thickened Greases

Many polyurea thickened greases are extremely oxidation-stable, because they contain a thickener that is composed of organic polymeric materials, almost like rubber. One of the exotic polymeric thickeners is polytetraflouroethylene, commonly known as PTFE. PTFE is used in kitchen pans and has been shown to withstand high temperatures and oxidizing environments because it is extremely unreactive once it is formed. As described above, soap-thickened greases contain metals, and metals can act as oxidation catalysts which lead to reduced oxidation stability. Since polymeric thickener systems do not contain any metals they have the ability to provide good continuous service in applications that are subjected to high temperatures or are used in an oxidizing atmosphere (2). The most common polymer thickened grease-type is polyureas. One strength of polyureas is their excellent shear stability. This means they have the ability to stay in place in applications operating at fairly high speeds and temperatures without having to be re-applied. For this reason, a very common application for this particular type of grease is small to medium size roller bearings used in electric motors (3). Typically, these are closed systems where it is nearly impossible to administer any additional grease once the motor has started to run. Probably the largest drawback to most polymer-thickened greases is that they are expensive to produce, and thus to purchase. One more drawback from the producers standpoint is most of them include having to use hazardous materials to produce them (2). They are not hazardous once completed, but still precautions have to be taken to protect the production personnel who are making them.

Soap-Thickened Greases

Soap-thickened greases are the most common type, and have also been proven to be the most versatile. The term "soap" comes from the type of reaction that results in the thickener which is called saponification (soap is much easier to say isn't it!). Depending on the type of metal used to form this thickener (Lithium, Lithium Complex, Aluminum, Aluminum Complex, Calcium, Calcium Complex and so on), a grease can be formulated for almost any application from this category alone. With a slight dependence upon on which metallic base is used, soap-thickened greases have been found to be very versatile, safe, and easy to work with. Without going into detail about base fluids just yet, certain types of soap-thickened greases naturally possess properties such as: rust protection, water resistance, worked stability, and good thickening efficiency with lower amounts of thickener than the other categories. With the help of some additives, most can have acceptable to excellent EP performance and oxidation stability as well (2). Most of the remainder of the discussion will be focused on two specific soap-thickened grease types, Lithium and Aluminum.

Lithium and Aluminum Greases

Every year, an independent production survey is conducted on behalf of the National Lubricating Grease Institute (NLGI) and the results are distributed to the participating members. According to the most recent results compiled from data collected in 2005, Lithium grease is by far the most widely used grease in the industry today. The data for the last 4 years, presented on a percentage basis, is summarized in Table 1 (1).

Table 1

% of Total Grease Produced for the Last 4 Years

Thickener Type	2005	2004	2003	2002
Aluminum	4.63%	4.91%	5.04%	4.86%
Conventional	0.20%	0.22%	0.24%	0.20%
Complex	4.42%	4.68%	4.81%	4.66%
Calcium	10.63%	11.46%	14.54%	12.68%
Conventional	7.60%	8.37%	11.39%	9.70%
Sulfonate	1.21%	1.26%	1.12%	0.92%
Complex	1.82%	1.84%	2.04%	2.05%
Lithium	73.41%	72.29%	68.45%	70.03%
Conventional	57.91%	57.50%	53.89%	56.16%
Complex	15.50%	14.79%	14.56%	13.86%
Sodium	1.16%	1.48%	1.83%	1.86%
Other Metallic	1.57%	0.70%	1.06%	1.37%
Polyurea	4.83%	4.46%	4.63%	4.57%
Organoclay	2.34%	2.48%	2.75%	3.04%
Non-Soap except clay	1.42%	2.21%	1.70%	1.59%
Total	100.00%	100.00%	100.00%	100.00%

From what is shown on the table, one must assume that the Lithium and Lithium Complex greases are superior to their counterparts. Although it is true that Lithium and in particular, Lithium Complexes, have excellent worked stability, low temperature pumpability, high temperature bearing performance, and good water resistance, it is important to look at the unique properties of other types of soap thickened greases as well. One such thickener type is the Aluminum Complex soap.

Aluminum Complex Grease is made from suitable proportions of Stearic Acid, Benzoic Acid (organic acids), and Aluminum Isopropoxide (metallic base) heated and reacted in oil (usually some type of napthenic mineral oil) (2). Additives and oil are then added and the grease is milled for smoothness. The amount of oil and milling time of the grease depend on the NLGI grade needed for a specific application. This type of grease can also have excellent worked stability, low temperature pumpability, superior water resistance, and enhanced extreme pressure properties. Aluminum Complex greases are also reversible, which means in applications where they are heated above their dropping points for short periods of time, they will return to their respective NLGI grades when returned to their normal operating temperature (1). Lithium complex greases are not reversible. When they are heated above their dropping points, they often liquefy and not regain their original consistency even when cooled.

It has been found that both Lithium and Aluminum greases can be produced in various base fluid types, including napthenic and paraffinic mineral oils, as well as in synthetic fluids such as polyalphaolefins (PAO) and esters. Although, there is no real definition for a multi-purpose grease the NLGI provides a rating system that uses acronyms to describe the performance properties of a grease. They allow for grease manufacturers to register their greases according to this system. Often greases that are labeled as being registered as LB-GC greases are considered to be multi-purpose greases. This description means that they are recognized as passing a variety of tests that prove they will be acceptable for use for wheel bearing and general chassis lubrication on automotive vehicles. For most industrial users, this is a good starting point, but multi-purpose should include more than wheel bearing and chassis lubrication. Instead of multi-purpose grease, the industrial user should be looking for "versatile use grease." Aluminum complex greases fit this description.

Although the total for the year 2005 of both conventional Aluminum and Aluminum complex grease was only 4.63% compared to the whopping 73.41% for conventional Lithium and Lithium complex grease, Aluminum greases have found favor in various industries (1). One such industry is food processing. Although Aluminum complex greases are not the only greases which can be approved for use in government inspected food plants, they are one of the most common. Lithium greases cannot be approved for use in food plants where incidental food contact may occur. Along with incidental food contact applications, Aluminum thickener has been found to function quite well in environmentally friendly greases (1). Evidence can be found that illustrates the positive properties that Aluminum greases provide when used in steel mill applications. Based on this evidence and the experience of the authors, it would seem that the Aluminum complex thickener system may actually be more versatile than the Lithium thickener systems. Evidence exists that Aluminum complex thickener can be used along with synthetic base fluid to formulate a truly high-performance grease.

Comparison Testing

Currently, synthetic-based greases are not as prevalent in the marketplace as mineral oil-based greases. Yet there are demanding applications in which they are needed. A lab study was conducted comparing two different Lithium complex synthetic-based greases to an Aluminum complex synthetic grease. Overall, the Aluminum complex performed as well as or better than the Lithium complex greases (1). This grease was also found to perform quite well in the field as will be illustrated in three different case studies where it was used in places where other greases were found deficient.

In lab testing, the following properties were evaluated:

1 Selection of Base Fluids
2 Consistency and Mechanical Stability
3 High Temperature Functionality/Dropping Point
4 Corrosion Inhibition
5 Extreme Pressure
6 Fluid Separation/'Bleed'
7 Water Resistance
8 Wear Resistance
9 Miscellaneous other tests

Selection of Base Fluids

Normally, the selection of fluids for a thickener system depends on the application. For instance, one would typically use low viscosity mineral base fluid for low temperature grease applications and high viscosity fluid for better mechanical stability and shear resistance. All of the products studied were based in high viscosity, ISO 460 cSt, synthetic base fluids, composed of either PAO, ester, or a combination. The thickeners were found to be either Lithium complex or Aluminum complex. Both thickener systems formed good grease in a synthetic thickener system.

Consistency & Mechanical Stability

Consistency (penetration) and mechanical stability are often measured using the penetration test. Thickener solubility in the synthetic base fluid and excessive fluid separation or 'bleed' in the final lubricant are difficult obstacles to overcome when formulating greases (1). In this study, properly processed Aluminum complex thickened grease was found to possess better mechanical stability and less fluid separation than both similarly formulated Lithium complex greases.

High Temperature Functionality / Dropping Point

Increasing environmental operating temperatures was a keystone for the advancement of both Lithium and Aluminum complex greases. Aluminum and Lithium stearate greases could not compete with the increasing demands for greases to operate for longer periods of time at higher temperatures. As a result, complex soaps along with synthetic base fluids were pushed into service. The dropping point test became a quick evaluation determining if a thickener system was suitable for elevated temperature applications. Although not an absolute benchmark of a high dropping point, the goal of 260°C (500°F) is frequently the target for product design of a premium high temperature thickener system (1). The greases studied appeared to be properly balanced and processed as they all readily achieved dropping points at or above 260°C (500°F) (Table 2).

Corrosion Inhibition

For industrial greases of any thickener type, the ability to prevent corrosion in machine bearings is critical. High temperature greases are operating in environments at temperatures well above the boiling point of water. This means that high levels of moisture and steam are encountered in these extreme temperature applications. Some examples of such applications are: corrugators in the cardboard industry, calendar rolls in the paper making industry, coilers in steel mills, and other similar industrial applications (1). Frequently, chemicals other than water are also encountered. These chemicals can have an extremely high or low pH. It is critical that any lubricant functioning in these applications have the ability to prevent bearing corrosion in these extreme conditions (1).

Table 2 indicates that formulating either Aluminum complex or Lithium complex greases to prevent bearing corrosion is possible. All of the products tested provided 'Pass' in the static ASTM D1743 Bearing Corrosion test which uses deionized water. Likewise, both thickener systems produced a 'Pass' in the dynamic ASTM D6138 Emcor rust test using deionized water (1). Yet, it was found that the Aluminum complex grease provided better performance when tested in the more demanding ASTM D5969 Bearing Corrosion test with dilutions of synthetic sea water. Grease formulated using both thickener systems produced a 'Pass' in initial screenings utilizing 1% synthetic sea water (1). As the concentration of sea water used in the D5969 test is increased to 3%, the Aluminum complex grease provides better corrosion protection. It is possible that the Lithium complex greases could be tweaked to pass this test as well, but this shows that the Aluminum complex thickener system has no incompatibility with corrosion prevention additives. This is really a negative for certain grease thickener systems, as these additives cause them to de-gel.

Extreme Pressure

Wear prevention and the ability to carry a load are important characteristics of industrial lubricants. Both of the evaluated lubricants contain heavy ISO 460 viscosity grade synthetic base fluids. This helps when the greases operate in a hydrodynamic regime, However, functionality of the lubricants under elastohydrodynamic (EHD) and boundary lubrication regimes is also important. EHD and boundary lubrication are often more dependant upon the chemicals used as extreme pressure additives in a lubricant rather than a function of the thickener system (1).

No attempt was made to evaluate similar EP additives in different thickeners. Only commercially available lubricants of different thickener systems whose promotional literature indicated anti-wear/extreme pressure characteristics were evaluated. Cursory chemical analysis of the different greases indicated they had significantly different elemental composition. This data points to different types of EP additives. 4-Ball Wear, Timken OK Load, and 4-Ball EP (ASTM D2266, ASTM D2509 and ASTM D2596 respectively) were used to evaluate the anti-wear and extreme pressure characteristics of the greases (1).

In the 4-Ball Wear test, both thickener systems displayed similar anti-wear characteristics with essentially similar scar diameters (Table 2). In the Timken OK Load, there were slight variations in the OK Load (Table 2). However, given variability of the Timken test, the variance between 45-55 pound lever loads is within the repeatability of the test and would be considered equivalent results. There is some differentiation between the thickeners in the 4-Ball EP test. The Aluminum Complex thickener produced one load stage higher weld point (which is not significant), but did have a considerably higher Load Wear Index than the Lithium Complex grease (Table 2) (1).

Overall corrosion inhibition and extreme pressure performance for EHD and boundary lubrication regimes are usually achieved with different chemical components. While these performance enhancing additives have different chemical compositions, they are normally 'surface active' chemistries that seek out and attach themselves through polar bonding to the metal surfaces being lubricated. Without careful additive selection, rust inhibitors and EP additives can compete with each other and result in diminished effectiveness of one or both additives. In both the thickener systems, there is a good balance between additives as the greases display both above average rust inhibition and moderate to good EP characteristics (1).

Fluid separation / 'bleed'

The phenomenon of fluid separation from bulk grease products is also known as 'bleed.' There is no consensus of opinion on what is a desirable characteristic for fluid separation. Bleed could be categorized as "the good, the bad and the ugly" of grease. A little bleed is sometimes good, a lot of bleed is bad, and a whole lot of bleed is an ugly housekeeping problem. There is no black and white between what is good and what is bad. The good or bad is application-specific (1).

The phenomenon of bleed is a complicated characteristic for the grease manufacturer to control as there are many factors the can affect bleed. Some of these controlling factors are:

- Types of grease thickener—Lithium-has moderate bleed, Aluminum-has moderate to high bleed.
- Amount of grease thickener (soap)—higher base grease content has less bleed.
- Type of base fluid—the lower the VI, the less bleed. Most synthetics have more bleed.
- Base fluid viscosity—higher viscosities have less bleed.
- High molecular weight polymers—if present there is less bleed.
- Maximum processing temperatures during manufacturing—the higher the temperature, the more bleed.
- Temperature and speed of addition of fluid to a thickener during processing affects bleed.
- Grease homogenization or milling affects bleed.

Minor variations in any of these factors can greatly affect the extent of bleed (1).

Separation, or 'bleed,' can be evaluated by either ASTM D1742 Pressure Bleed or ASTM D6184 (FTM 321.3) Cone Bleed. Both methods measure the amount of fluid separation from the bulk grease over a period of time under the conditions of that test (1).

Even though both the Aluminum Complex and Lithium Complex samples had synthetic base fluids of similar viscosity, there were significant differentiations in the amount of bleed. The Lithium sample had results that would be considered low to moderate and the Aluminum Complex had very low bleed (Table 2) (1).

Water resistance

In moist applications, how grease reacts to the presence of water will greatly influence how effective the lubricant is in a given application. Lithium thickened greases are not inherently resistant to removal by water, but can be formulated to have low water washout from bearing sites and low water spray-off. Usually the improvement in resistance to water is accomplished by incorporating high molecular weight polymers to give the grease a tenacious tacky texture that adheres well to metal surfaces. The negative aspect of the addition of high molecular weight polymers to the grease is that low temperature characteristics and grease mobility (pumpability) will suffer (1).

Unlike Lithium thickeners, Aluminum Complex thickeners have shown a natural resistance to water washout and water spray-off.

As seen in the comparison table, Water Washout (ASTM D1264) and Water Spray-Off (ASTM D4049), there is a variation in resistance between the two thickener systems. Both thickeners perform well in the Water Washout, but there is a 5-7 fold higher result in water spay-off in the Lithium thickened grease when compared to the Aluminum Complex thickened grease (Table 2) (1).

None of the evaluated greases seemed to include high molecular weight polymers to improve water resistance. They already did well in the US Steel Mobility testing at low temperatures. Both thickeners performed very well in the Low Temperature Torque Test (ASTM D4693) which is part of ASTM D4950 NLGI GC-LB classification testing (Table 2) (1).

Miscellaneous tests

When using lubricants containing synthetic base fluids, compatibility with the seals of the equipment being lubricated is always a question. Most seal materials are compatible with mineral oils. The ASTM D4289 Elastomer Compatibility procedure is a suitable evaluation tool for synthetic fluids. The Aluminum Complex thickened grease was evaluated against the seal material specified by ASTM D4950 NLGI GC-LB and the results were within the acceptable limits (Table 2) (1).

Table 2
Aluminum Complex vs. Lithium Complex
Comparative Data

Test	Aluminum Complex "Gold" Tested	Lithium Complex "Red" Literature	Lithium Complex "Red" Tested	Lithium Complex "Blue" Literature
Thickener Type	Al Complex	Li Complex	Li Complex	Li Complex
NLGI Grade	2	1 ½	1 ½	2
Color	Gold	Red	Red	Blue
Texture	Stringy	-	Slight String	Slightly Tacky
Penetration, 0 Strokes	285		292	
Penetration, 60 Strokes	287	305	297	280
Penetration, 10K Strokes	290 (+3, +1%)	-	315 (+18, +6%)	300 Max
Base Fluid Type	PAO/Ester		PAO/Ester	
Base Fluid Viscosity @40°C, cSt	460	460	471	460
Dropping Point, °C (°F)	273 (523)	255 (491)	278 (532)	232 (450)
Copper Corrosion, D4048, 24 hr @ 100°C	1b	-	2a	1b
Oil Separation (Pressure Bleed), D1742, 24 hrs @ 25°C, % Separation	<1	-	6.3	-
Timken OK Load, D2509, lbs	55	50	45	50
Bearing Corrosion, D1743, DI Water	Pass	Pass	Pass	Pass
Bearing Corrosion, D5969, 1% Sea Water	Pass	-	Pass	-
Bearing Corrosion, D5969, 3% Sea Water	Pass	-	Fail	-
Emcor Corrosion, D6138, DI Water	0.0	0	X	-
4-Ball Wear, D2266, 75°C, 1200 RPM, 40 kgf, 60 minutes, mm Wear Scar	0.49	-	0.45	-
4-Ball EP, D 2596 Weld Point, kgf	315	250	250	250
Load Wear Index (LWI), kgf	69.7		40.2	
Wheel Bearing—Life, D3527, hours	120.5	-	X	-
Wheel Bearing—Leakage, D4290, % Loss	0.92	-	X	-
Water Spray-Off, D4049, % Spray-Off	7	35	46	-
Water Washout, D1264, @ 79°C, % Loss	0.45	3	X	8
Low Temperature Torque, D4693, @ -40°C, N-m	<10	-	<10	-
Lincoln Ventmeter @ -1°C (+30°F), PSI	300	-	X	-
US Steel Mobility @ -18°C (0°F), g/minute	2.4	5	2.4	
Elastomer Compatibility, D4289				
AMS 3217/3A (CR)				
Volume Change, %	+14.7	-	X	-
Hardness Change, Duro. A, Points	-5	-	X	-
AMS 3217/2B (NBR-L)				
Volume Change, %	+9.13	-	X	-
Hardness Change, Duro. A, Points	-5	-	X	-

X = Not Tested - = Not Reported

In order to evaluate 'multipurpose' aspects of the Aluminum Complex grease the complete GC-LB test regime was performed. All of the tests with the exception of ASTM D4170 (Fretting Wear) were within the requirements of the GC-LB classifications (Table 2). The failure of the Aluminum Complex grease in this test is somewhat predictable as greases that contain moderate to high bleed, thinner fluid viscosity, and low VI naphthenic base oils perform well in the Fretting Wear test. If good performance in Fretting Wear is an essential element of the performance specification for selecting a lubricant, then greases with a synthetic base fluid in the ISO 460 viscosity range would not be the apparent lubricant of choice (1).

First Case Study

Harborlite Corporation

The Harborlite Corporation has a plant located in Vicksburg, Michigan that processes high quality volcanic glass into insulating bubble. This process uses high heat with a special technique that creates a non-flammable, low cost insulating mineral. To properly mill their product, Harborlite uses a hammer mill they designed themselves. Heat and dirt combine to create a harsh environment that caused frequent failures to the hammer mill shaft bearings.

In an effort to minimize these failures, the Harborlite maintenance team tried various commercial grade and some specialty grade greases, including some synthetics. Unfortunately, the average bearing life never increased beyond four to five days, with some failures occurring in as short as 24 hours. Finally after another

disappointment with a Lithium complex thickened grease, they tried an ISO 460 synthetic based Aluminum complex grease.

They were then able to go four weeks without having to replace a single bearing. This lubricant allowed them to realize savings of over $40,000 in parts and labor costs in only four months, because they were able to buy less replacement bearings and reduce bearing repair related overtime. One unexpected benefit, a reduction of amperage draw of approximately 4.0 amps, was also experienced. Based on their electrical rates this results in savings around $600 in a year for less electrical consumption.

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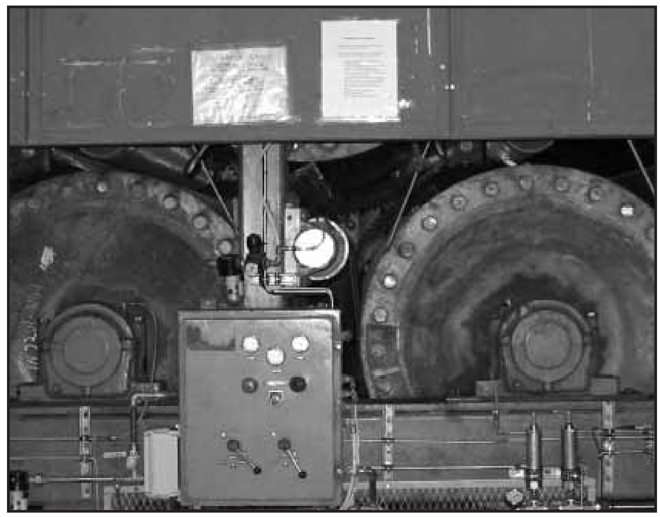
Second Case Study

Southworth Company is a privately-held corporation based in Agawam, Massachusetts. Its premium business papers, resume papers, and related products are marketed under the Southworth® and Eaton® brands through major national retailers, office product dealers, and international distributors. Through a recent acquisition of Esleeck Paper Company in Turners Falls, MA they have now increased their operational capabilities in their core retail and office products market. In addition, the Esleeck Papers customer base provides a new platform for growth in technical, specialty, and art paper markets.

Their growth plan includes increasing reliability by lengthening paper machine run time. In regard to lubrication, two areas were initially focused on: the size press and after-dryer, both of which represent different challenges. The size press consists of two rolls with four large bearings that are exposed to contamination from the size, a starch-like chemical used to create specific surface properties desired in Southworth's premium papers. The after-dryer application consists of eight steam can dryers with sixteen supporting bearings along with forty-six felt carrying roll bearings. The high temperatures seen in the after-dryer, coupled with no accessibility to lubricate the bearings while the machine was running, presented the second challenge. Previous Lithium Complex thickened lubricants used in the size press bearings emulsified when contaminated with the water-based size chemical. This then caused the grease to liquefy and run out of the bearings in the high temperatures seen in the after-dryer.

A decision was made to install an automatic lubrication system that would serve all of the bearings on the after-dryer as well as the size press which is located directly adjacent to the after-dryer. The challenge then became the selection of a lubricant with sufficient pumpability capable of being metered through a series of progressive lubrication systems without experiencing any thickener/oil separation under the 3,000 psi plus pressures the system design demands. This lubricant must also be capable of dealing effectively with the potential for washout seen in the size press and staying in the bearings in the after-dryer.

Along with an automatic lubrication system an Aluminum Complex grease containing an ISO 460 synthetic base oil was installed. This has provided the necessary mix of excellent pumpability along with no thickener/oil separation to date. The Aluminum Complex thickener system possessed superior water management properties. As a result, it tended to resist water and sizing contamination. The synthetic base fluid helped to protect the bearings during exposure to high temperatures.



Third Case Study
Advanced Design & Packaging, Incorporated

Located in Atlanta, Georgia, Advanced Design & Packaging, Inc. is a company that produces high quality corrugated boxes. To achieve this, they employ a Peters Corrugator that continuously operates between 360° and 400°F in two areas known as the B-flute and C-flute corrugation rolls. Generally speaking, the industry standard lubricants used for these bearings are synthetic polytetraflouroether type greases. These greases are used because they are recognized for their resistance to oxidation even in applications operating in oxidizing atmospheres and/or at continuous high temperatures. The main drawback to these products is their cost. They were paying over $100 per tube for this type grease.

Advanced Design & Packaging, Inc. decided to take a chance and try an ISO 460 synthetic based Aluminum complex grease in this application. To their surprise, they found that not only was the grease they were using very expensive, it apparently was not providing sufficient lubrication. They had always monitored the amperage draw in the corrugator rolls. After installation of the Aluminum complex grease, they experienced a measurable amperage drop.

Based upon this success, they decided to try this grease in two other bearing locations on the same corrugator where they had been using a Lithium complex grease. These applications were the pre-heat roll bearings and the glue roll bearings. The pre-heat bearings operated around 360°F and they found that the Aluminum complex withstood the heat better than the Lithium complex. The glue rolls provided a different challenge. The bearings on the glue rolls often get contaminated with water-based glue. The Aluminum complex grease provided superior water-handling properties, thus performed better in these bearings as well.

Conclusion

Lithium based greases are the most common grease. Many have considered them to be a multi-purpose grease. Yet, that does not mean that they are necessarily the most versatile grease thickener. In fact, an argument could easily be made that this crown should be worn by the Aluminum complex thickener grease system. It can be used to formulate in various base fluid types, for numerous applications, and provides exceptionally high performance. Although Lithium greases should and will continue to enjoy use in many lubricant applications it is the hope of these authors that a little more light has been shed on the Aluminum complex greases and increased confidence has been gained by lubricant users.

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