



Krytox™

Performance Lubricants

Improving Equipment Reliability with Krytox™ Lubricants

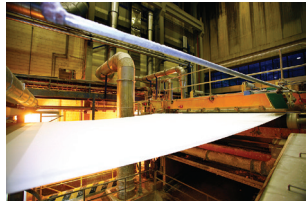
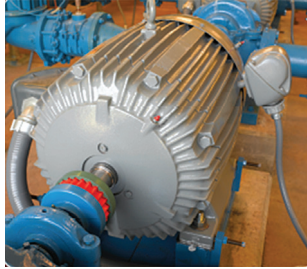
“Lubed-for-Life” Electric Motor Bearings Simplify Maintenance, Reduce Downtime

Thousands of Motors to Maintain

With thousands of electric motors on-site, Cariboo Pulp & Paper faced a problem: it was becoming increasingly more complex to economically service each motor under a standard operations and maintenance plan. The reliability superintendent at the mill had heard from several experts in the field that the industry was moving towards a more sophisticated re-greasing program for electric motor bearings. However, he still had his doubts. “Reliability is always based on making the simplest concept work,” the reliability superintendent confirmed, so any new lubrication solution used by the mill would have to be implemented without overcomplicating the mill’s current operations.

Typically, the mill had chosen to run their electric motors without a re-lubrication process, knowing that electric motors in the harsh environment of pulp and paper mills usually lasted no longer than 4–6 years, with over 60% of breakdowns attributed to bearing lubrication failure. When motors would unexpectedly fail, the plant would often need to repair them in-house, usually resulting in overtime pay and costly downtime.

Even given these repair expenses, the mill had been cautious when it came to re-lubrication, because of the potential for over-greasing and bearing contamination; in addition, a new maintenance program would mean more manpower and added overhead costs.



A Formula for Change

So, the reliability superintendent and his team did the math and determined that a state-of-the-art re-lubrication process would have meant hiring more full-time lubrication technicians. They estimated that any new re-lubrication process would have incurred between \$100,000 and \$200,000 in additional costs, even without taking into account the additional re-greasing equipment, such

as grease pumps and extended grease lines, they would have to buy and/or install.

The mill knew they had to find a way to extend the life of the electric motors, but they also recognized that a full-on re-lubrication system would be expensive, as well as adding to the complexity they were already experiencing, with so many motors to maintain. Fortunately, they knew where to go for help.

A History of Collaboration

The failure of the electric motors was not the first lubrication issue that this plant had faced in recent operations. Just a few years prior, the mill had encountered a similar greasing problem with their pulp dryer, from which they were losing at peak 10–11 bearings every year. Similar to the situation with the electric motors, the downtime costs of each bearing failure could reach nearly \$170,000. They decided to look outside of their organization to solve the problem and eventually connected with Carl Walther, a lubrication professional at Krytox™ Performance Lubricants. “I was excited to work with them,” noted Carl, “because I knew that Chemours was the perfect company to help with their lubrication challenges.” Carl collaborated with them

to develop a unique blend, Krytox™ XHT 299 EP grease, formulated specifically to resolve the issue in the pulp dryer. As a result, they were able to eliminate the production issues that were leading to unpredicted failure, as well as the resulting downtime and labor costs.

At a later date, they would again turn to Chemours when they encountered a lubrication challenge with their sootblowers. An important cog in the manufacturing process, the sootblowers used a gear box to keep boiler tubes clean and running efficiently. The high duty cycle and operating temperature of the sootblowers resulted in significant maintenance requirements and regular failures. The reliability team once again worked with Carl to test Krytox™ lubricants in the most difficult sootblowers and found that there was nothing else in the marketplace that could compete with the longevity of Krytox™ grease and the ensuing maintenance-free operation.

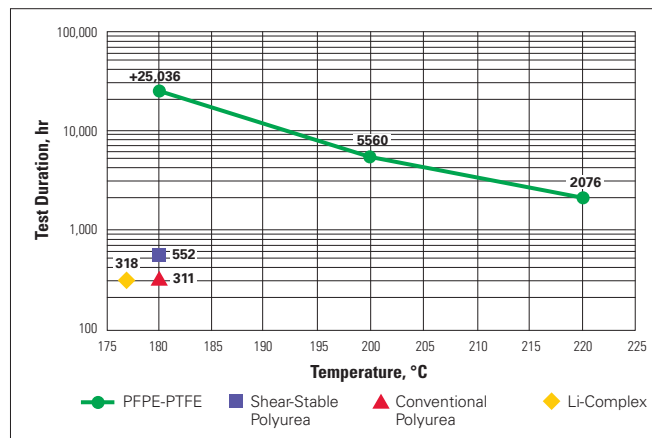
At this point, the reliability team had high confidence in Chemours and in Krytox™ lubricants, so when the plant decided to extend the life of their electric motors, they called Chemours.

Lubed for Life

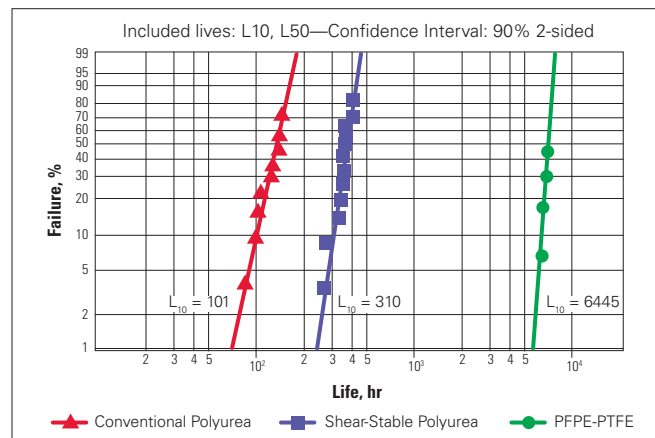
When it came to the issue of lubricating electric motor bearings, the mill had two primary objectives: to increase the life of their electric motors—and do it without adding a complex re-lubrication process.

The reliability superintendent had heard about the potential for “lubed-for-life” lubricants, but was skeptical of their reliability without a consistent maintenance program in place. So, he decided to reach out to Carl for more information. Carl recommended Krytox™ AUT 2E45 grease, which had been used to solve problems in applications similar to electric motors. “I told him that AUT 2E45 was best-in-class,” explained Carl, “and that in-house testing had shown that AUT 2E45 could eliminate premature motor failures associated with bearing lubrication for the average lifetime of the mill’s electric motors.”

ASTM D 3336—Grease Life in Ball Bearings



Weibull Probability Plot



Still skeptical, the reliability superintendent asked to run an ROF test to compare Krytox™ AUT 2E45 to comparable offerings that were available. The results of the test demonstrated that Krytox™ lubricants were more effective and lasted from 21 to 64 times longer than competitive lubricants. After seeing the data, the reliability superintendent and his team were ready to implement a Krytox™ lubricants “lubed-for life” solution at the mill.

Conversion

Over the next seven years, the mill began to cycle in bearings pre-filled with Krytox™ AUT 2E45 grease for their electric motor rebuilds. The employees of the plant were energized and excited. Reliability of the electric motors was of great concern, with the electric motor repair team going so far as to build a clean room to ensure the chances of success with each rebuild. The team had heard about the effectiveness of Krytox™ lubricants; they were hopeful that the ongoing implementation would increase the reliability of each rebuilt motor and enable the motors to last even longer than before.

The first hurdle the mill addressed was to prepare the bearings they were receiving from their current supplier for Krytox™ grease application. The bearings came with pre-packed grease, so the mill had to carefully and completely wash out the hydrocarbon grease before adding Krytox™ lubricant to ensure the bearings would last as long as possible. To further simplify the process, the reliability superintendent decided to reach out to bearing manufacturers to see if he could create a supply chain through which the mill could directly order new bearings that would come pre-packed with Krytox™ grease. Fortunately, this proved to not be a problem. The reliability superintendent was able to find a bearing manufacturer that not only recognized the value of using Krytox™ lubricants in their bearings, but embraced the opportunity to create a relationship with both the plant and Chemours.

With the quality control problems associated with the previous bearings behind them, the reliability superintendent and his team were now able to move forward with the rolling implementation of Krytox™ lubricants in their electric motor

Benefits and Features

Krytox™ lubricants offer the following benefits and features.

Feature	Benefits
Unsurpassed oxidation resistance of base oil	PFPE will not oxidize and gum up with age and use. Will not break down with high temperatures experienced in electric motors. Operating temperature range from -44 to 200 °C (-47 to 392 °F)
Advanced PTFE thickener	Special high efficiency thickener will not oxidize or break down with shear
Lubed-for-life potential	Typically no need to re-lubricate bearings during lifetime of electric motor
Excellent corrosion resistance	Additives offer resistance to corrosion and rust during storage and in wet environments

bearings. The plant was both optimistic and anxious to see the fruits of their labor.

The Results

Seven years later, Cariboo Pulp & Paper had successfully converted bearings to Krytox™ lubricants in over 100 motors. They also now stock over 150 additional bearings filled with Krytox™ lubricants and plan to swap these into motors as the old bearings fail. Since Krytox™ lubricants have been applied, they have not had a single bearing failure, nor have they had to replace any electric motor that uses Krytox™ AUT 2E45 grease due to lubrication issues. On top of the reliability successes, the use of Krytox™ lubricants has helped provide a simple solution with less manpower. “To get a similar result with a competitive lubricant, we would have had to implement a complete re-lubrication process,” declared the reliability superintendent. Unlike existing re-greasing programs, Krytox™ lubricants eliminated the need for additional equipment, such as pumps, shields, zerks, and extended lines, that would have added to the overall cost.

The Savings

The results showed that Krytox™ lubricants were clearly the most cost-effective option for the plant. As of now, they have expectations of surpassing double the lifetime of their electric motors, and based on the average replacement cost, they are starting to see the results adding up.

By specifying Krytox™ lubricants, instead of a cumbersome re-lubrication process, routine maintenance costs can be projected up-front, saving on unplanned, continuous labor costs of up to \$200 an hour for lubrication technicians, additional management, and communication challenges associated with any new program. “With ‘lubed-for-life’ electric motor bearings, we got the most reliable and cost-effective setup, with minimal manpower,” the reliability superintendent observed. “It truly is the simplest thing that works.”

Support for Life

Cariboo Pulp & Paper continues to collaborate with the Krytox™ lubricants team. On a recent plant visit, the reliability superintendent and Carl had the opportunity to walk through the plant and see the lubricants in action. “After almost ten years of work on this project, it was great to see how much had truly been accomplished,” observed Carl. With the implementation of Krytox™ lubricants moving forward through the rest of the electric motors, they began to discuss a variety of other potential uses for the grease throughout the plant.



The Optimum Choice for the Pulp and Paper Industry

As demonstrated by their use at the Cariboo mill, Krytox™ lubricants can be used to move productivity at pulp and paper plants to whole new levels. On top of being highly endorsed by end users, Krytox™ lubricants are recommended by many major bearing manufacturers for long-life lubrication in severe applications.

Krytox™ lubricants are nonflammable and offer extremely high tolerance to heat and chemicals. They will not oxidize or gum up like other greases, nor can they be displaced by steam and water. In addition to these features, Krytox™ lubricants contain no VOCs or chlorinated materials.

The “lubed-for-life” grades of Krytox™ lubricants eliminate the need for frequent re-greasing, while virtually eliminating the rate of bearing failures attributed to lubrication. In the typical pulp and paper mill environment, employee exposure to dangerous, high temperatures and hard-to-access areas is dramatically reduced, and equipment uptime and motor lifetime can be extended.



And these benefits continue to add up—on the paper mill's bottom line.

Typical Properties

Property	Krytox™ AUT 2E45 Grease
NLGI Grade	2
Color	White
Base Oil	PFPE
Base Oil Viscosity, ASTM D 445	
cSt at 40 °C (104 °F)	100
cSt at 100 °C (212 °F)	12.5
Viscosity Index, ASTM D 2270	119
Thickener	PTFE
Anti-Corrosion Additive	Proprietary
Specific Gravity at 0 °C (32 °F)	2.0
Penetration Change after 100,000 strokes, ASTM D 217, mm/10	15
Bearing Life, hr, ASTM D 3336, 10,000 rpm at 180 °C (356 °F)*	25,000+
Operating Temperature Range, °C (°F)	-44 to 200 (-47 to 392)
Dropping Point, °C (°F)	N/A

Property	Krytox™ AUT 2E45 Grease
Oil Separation at 99 °C (210 °F), ASTM D 6184	4% typical
Low Temperature Torque, g-cm at -40 °C (-40 °F), ASTM D 1478	
Starting	5800
Running	1900
Low Temperature Torque, g-cm at -20 °C (-4 °F), ASTM D 1478	
Starting	650
Running	220
Emcor Corrosion, ASTM D 6138	0, 1 (no rust)
Rust Protection, ASTM D 1743	Pass
Copper Corrosion Resistance, ASTM D 4048	1B max.
Water Washout, ASTM D 1264, %	1.5

* The ASTM D 3336 at 180 °C (356 °F) test for Krytox™ AUT 2E45 grease was still running when discontinued at 25,036 hr. Actual run time would have been longer.

Note: For application in wide profile bearings (e.g., cylindrical, spherical roller) at $Dn > 70,000$ (bearing mean diameter x rpm), please contact your Chemours technical representative for application assistance.

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