



SAG mill increases productivity, reduces unscheduled shutdowns via proper liner bolt installation, lubrication

Case study: MOLYKOTE® P-74 Assembly Paste aids in prevention of liner bolt failures by reducing friction from tensioning of critical parts

Industrial milling of mined ore – from large rocks and boulders to fine particles – is a demanding process. Massive semi-autogenous mills – commonly known as SAG mills – use milling balls, as well as the weight of the ore itself, to break down the ore into smaller particles – a process known as comminution. The turning and tumbling of tons of ore within these mills creates a harsh environment with high heat and constant vibration. Downtime for these mills is costly, and repairs can be dangerous – which makes preventive maintenance and proper lubrication extremely critical.

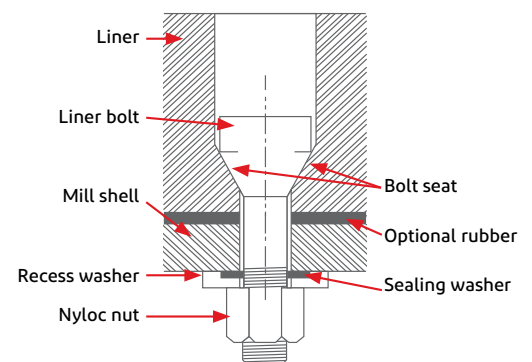
The customer

Relining Minerals – a distributor of specialty industrial bolts for mining operations, with locations in Peru and Panama – was in search of a lubricant to protect SAG mill liner bolts from extreme environmental conditions, including high temperatures and harsh vibrations. With the help of Mining Products and Service (MPS) – an Australia-based company specializing in the design, supply and optimization of wear components for the mining industry – Relining Minerals launched studies to determine the solution that would best protect the bolts from elongation beyond the stress yield threshold that was causing bolt deformation and failure.

In these trials, the companies sought to achieve consistent bolt tensions by standardizing the type of lubricant used, how the lubricant was applied to the fastener assembly and correct operation of the torque tools. They tested several different types of lubricants, including MOLYKOTE® P-74 Assembly Paste. Because Relining Minerals provides not only the bolts, but also the lubricant and the technical support, the distributor wanted a solution it could rely on – not simply as a recommendation to customers, but as its own preferred solution.

The challenge

To meet mill MRO expectations and the heavy industrial demands of these large-scale ore-processing plants, the lubrication solution needed to help control maintenance costs by reducing unscheduled stops due to loosened bolts and bolt failure. The optimal solution also needed to protect the bolts from the dusty and abrasive by-products of the comminution process.



Mill liner bolts secure the protective liner to the inside of the mill. Proper lubrication is essential in ensuring the applied torque is converted to elongation and clamping force, minimizing the risk of tension loss and fatigue failure.

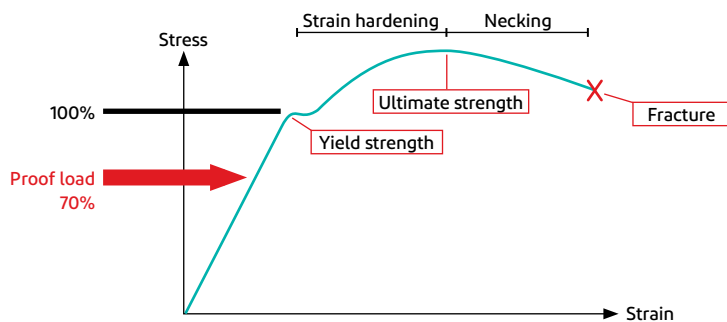
MOLYKOTE®



Photo courtesy of Relining Minerals.

The solution

During the research and testing process, Relining Minerals and MPS put MOLYKOTE® P-74 Assembly Paste – selected for its low coefficient of friction – to the test by comparing it to other leading lubrication solutions.



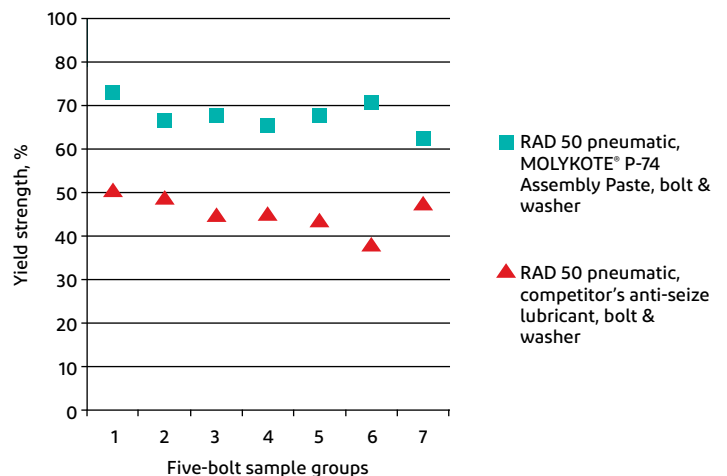
During bolt tensioning trials, MPS brought in a pulp lifter liner, configured with M48 liner bolts, from a 36-foot SAG mill. The test jig was used to calibrate actual torque/bolt load and, through proper lubrication, get it closer to the calculated torque/bolt loads to reduce the variation in the bolt loads achieved.

In the trials, which compared MOLYKOTE® P-74 Assembly Paste with the most commonly used lubricants on mine sites, MOLYKOTE® P-74 Paste consistently outperformed the best of the competitive lubricants by at least 10%. The trials also demonstrated that the method of lubricant application to the assembly also was important. If the liner bolts aren't correctly installed and are under-tensioned, they become fatigued and fail. MOLYKOTE® P-74 Paste helps reduce friction so a higher percentage of the applied torque is converted to elongation and clamping force.

In the graph below, MOLYKOTE® P-74 Paste was compared to the most commonly used anti-seize lubricant. This trial was done using a RAD 50 torque multiplier and best practices established from the tensioning trials, including:

- Hardened cup washer
- Lubricant applied to bolt thread and washer face
- Taking the torque multiplier to stall, releasing the trigger, then reapplying the trigger until the gun stalls again

MOLYKOTE® P-74 Assembly Paste was able to increase the proof strength of the bolts and more reliably prevent deformation of the bolts under stress. In tests that averaged the results of seven different five-bolt sample groups, MOLYKOTE® P-74 Paste was able to maintain a yield strength much closer to 70% than the competitive lubricant.



A clear choice for demanding environments

After seeing the results of the testing, Relining Minerals and MPS began recommending MOLYKOTE® P-74 Assembly Paste as its preferred specialty lubricant for mill liner applications. The company found that the paste kept bolt elongation in the optimal range with minimal tension loss, resulting in reduced bolt failures and downtime.

By preventing the bolt and liner from loosening, the distributor found that the lubricant helped reduce unscheduled stops – which increased productivity at the plants, which often are the entry point in the ore-refining process. It also resulted in reduced risk of accidents, as the calibration and adjustment work required to address loosened bolts or bolt failure commonly is a source of physical danger.

Another added benefit to the distributor and its customers was that the paste's lack of metal content helped minimize environmental impact.

Get the reliability you need to avoid costly unscheduled maintenance

Not only is MOLYKOTE® P-74 Assembly Paste able to prevent bolts from loosening and hold the mill liners in place, but the specialty lubricant also is suitable for the assembly and fitting of a wide variety of threaded connections across heavy industrial applications, such as:

- Bolted connections
- Sliding contact bearings
- Linear sliding guides
- Splined shafts
- Press-fit joints
- Exhaust bolts
- Spark plug threads
- Flanges and flange seals
- Door hinges
- Brake mechanisms

MOLYKOTE® P-74 Paste offers high load-carrying capacity, good corrosion protection, a wide service-temperature range, and a low and constant coefficient of friction. The paste can help:

- Facilitate disassembly, even after extended periods and after demanding and unfavorable conditions of service
- Avoid fastener brittleness or environmental contamination, courtesy of its metal-free formulation

With a coefficient of friction similar to oiled bolts, tightening torques can be calculated and applied uniformly – even upon repeated loosening and tightening – meaning the paste can aid in:

- Uniform clamping force on flanges, valves, housings, etc.
- Increased protection against bolt fractures
- Increased protection against loosened screws due to vibration

Typical properties of MOLYKOTE® P-74 Assembly Paste

Specification writers: These values are not intended for use in preparing specifications. Please contact your local MOLYKOTE® sales representative prior to writing specifications on this product.

Standard ⁽¹⁾	Property	Result
	Color	Grayish black
	Physical form	Paste
CTM 191	Unworked penetration	280-310
	Density at 68°F (20°C)	1.21 g/mL
	Service temperature range As paste	-40 to 392°F (-40 to 200°C)
	As dry lubricant ⁽²⁾	2,732°F (1,500°C)
DIN 51 350 pt. 4	4-ball weld load	4,800 N
	SRV oscillating wear tester, 300 N load, 1,000 µm elongation, 20 Hz, 194°F (90°C), duration	90 min

Coefficient of friction

	M12, 8.8, blackened surface	
CTM 1153	Thread/head	0.14 µ/0.08 µ
CTM 394	Press-fit test	0.12 µ

Corrosion protection

ISO/R 1456	Salt spray test at 50 µm	140 h
DIN 51 802	SKF-Emcor method (degree of corrosion)	2

⁽¹⁾CTM: Corporate Test Method; copies of CTMs are available on request.
DIN: Deutsche Industrie Norm. ISO: International Organization for Standardization.

⁽²⁾Some of the raw materials still act as separating agents at 2,732°F (1,500°C).



Photo courtesy of Relining Minerals.

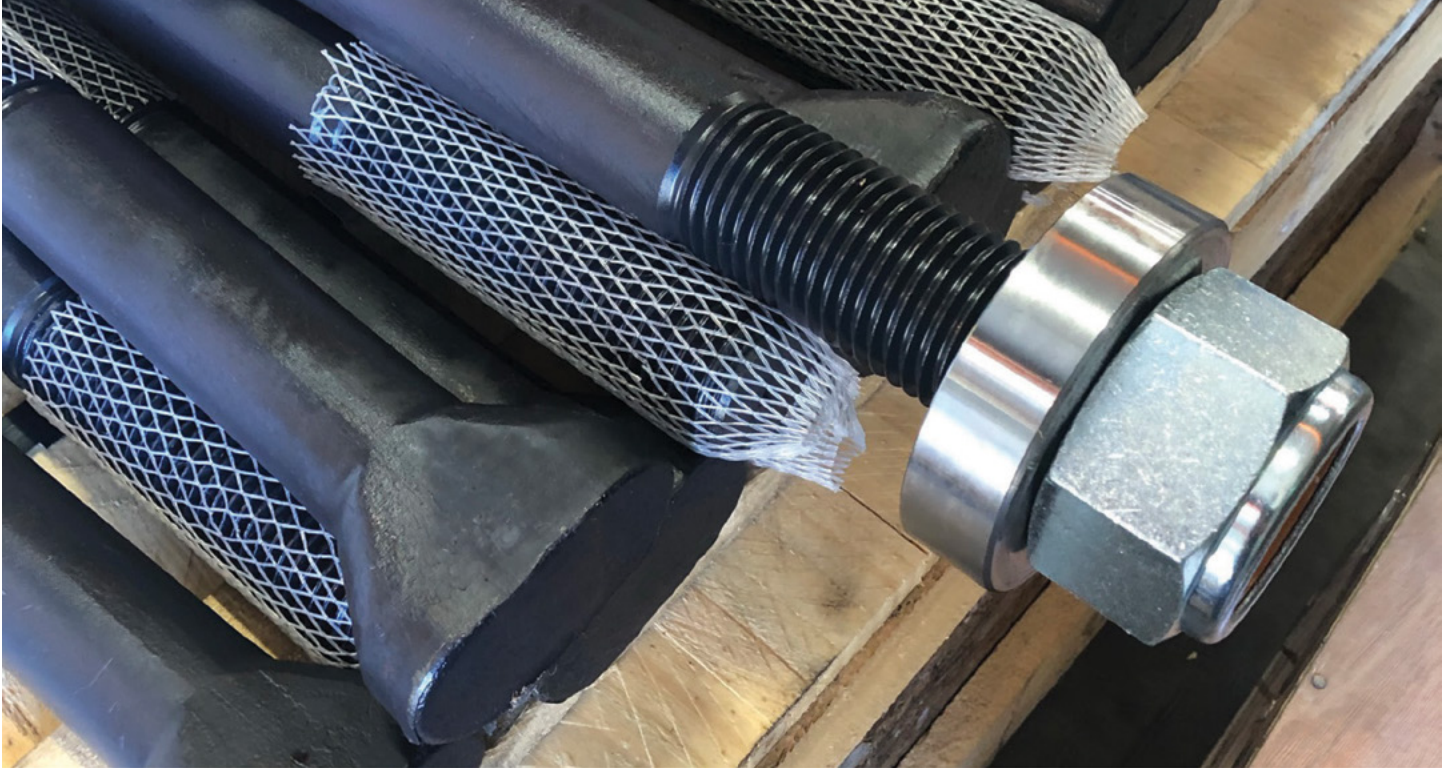


Photo courtesy of Relining Minerals.

About MOLYKOTE® Specialty Lubricants

For more than 70 years, customers around the world have trusted the MOLYKOTE® brand for performance and expertise to solve or prevent virtually any lubrication problem and to save energy. Available through a global network of more than 3,000 channel partners, MOLYKOTE® brand lubricants – which include well over 500 anti-friction coatings, compounds, dispersions, greases, oils and fluids, and pastes – serve the automotive market and industrial/maintenance, repair and overhaul (MRO) markets. To learn more about our extensive product and service offering or to locate a distributor, visit molykote.com.



Contact us

MOLYKOTE® has Contact Centers around the globe. Find the phone number for the center nearest you at www.dupont.com/molykotecontact.



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