

Self-cleaning for multiple paybacks

The use of an unsuitable lubricant led to high gear temperatures and cement ingress in a North American cement mill. A change in lubricant led to a cleaner gear, reduced operating temperatures and avoided costly mill shutdowns.

■ by **Kevin Chapin**, *Lubrication Engineers Inc, USA*

In 2015 Italcementi's Essroc plant in Nazareth, Pennsylvania, US, operated five FLSmidth finish mills, all of which were experiencing cement ingress. Finish Mill 3 was of particular concern as its location made it especially vulnerable to the issue, primarily during blade changes.

To lubricate Finish Mill 3 and the other ball mills, the plant was using a black asphalt-based product and an industry standard Farval spray system with four nozzles. The plant's standard procedure for removing the cement required a production shutdown, followed by a separate cleaner provided by the same manufacturer that made the asphalt-based lubricant. The equipment was then restarted until the next ingress. This lost production occurred weekly.

The gear temperatures were running at 74 °C (165 °F), with spikes to 85 °C (185 °F) that would automatically shut down the mill. The cycle time was six minutes between spray intervals. The gear was covered with cement and lubricant, making it difficult to see or check wear patterns and alignment. The lubricant had also built up on the shroud, leaving no air circulation and further contributing to higher operating temperatures.



Prior to its conversion, the gear on Finish Mill 3 is covered with cement and asphaltic lubricant, making it difficult to check wear patterns and alignment

In addition, disposal costs were an issue at the plant because removing the asphalt-based product requires special handling by waste oil companies.

Pyroshield conversion

The maintenance team at Essroc had prior knowledge of the clear gear technology offered by Lubrication Engineers (LE), so they called their local LE representative to request a test on Finish Mill 3 with Pyroshield Syn XHvy Open Gear Lubricant (9011).

Maintenance manager, Patrizio Peronne, together with maintenance inspectors, Mike Heller, Bill Kaminski and Craig Fritz, met with the LE representative and discussed the capacity for Pyroshield 9011 to help them with their finish mill lubrication issues.

The new product had to meet three requirements:

- improve the cleanliness of the gear in case of cement ingress due to blade switches
- decrease the amount of gear oil being sprayed



Prior to conversion to Pyroshield, the spray pattern test shows that the third nozzle from the left is clogged and not spraying properly

Mill sizing

Diameter (ft/m):	11/3.35
Length (ft/m):	16/4.88
Bull gear diameter (ft/m):	15/4.57
Speed (rpm):	50
Face width (in/cm):	16/41
Pinion diameter (ft/m):	2/0.61
Pinion width (in/cm):	46/117

- reduce downtime by eliminating the need to shut down production when running a separate cleaner through the system and again when switching back to the lubricant.

LE's conversion process allows for checking the entire system's functionality and reliability. The process consists of three key steps.

Step 1: L-X cleaner

LE's L-X Heavy Duty Chemical Supplement cleaner was applied in the Farval spray system to remove the black asphalt-based product and check the spray pattern. It was discovered that one of the four nozzles had not been spraying correctly, but the L-X cleaner immediately corrected this.

It is commonly known within the industry that such lubricants can clog the spray nozzles or prematurely wear them out, leading to inadequate lubrication and increased operating temperatures. Therefore, it is considered 'best practice' to have periodic production stoppages to check spray patterns. However, this step is often overlooked in ball mill applications.

Step 2: Duolec gear oil

LE's Duolec Vari-Purpose Gear Lubricant (1608), an ISO 680 gear oil, was used next to lubricate the gear and pinion while removing the asphaltic product from it. This gear oil also removed any cement or



After five months of Pyroshield use, the pinion gear is clear of contamination and easily viewable for alignment and wear detection. Temperatures have maintained levels as first seen after conversion



contaminants mixed in with the old gear oil. The amount of asphalt-based product build-up on the gear determines how long the Duolec 1608 needs to be used.

To monitor the progress of the removal, temperatures and photographs were taken every 30 minutes during the process.

After cleaning out the spray system lines with L-X and running the Duolec gear oil for approximately one to two hours, the temperatures dropped from 85 to 64 °C (185 to 147 °F) and the cement was cleaned off the gears, allowing for a much better visual of how much asphalt-based product was left.

Step 3: Pyroshield

Once the gear was sufficiently cleaned, Pyroshield 9011 was introduced and allowed to run for 24h at the same six-minute spray interval used previously to continue cleaning the old product off, and to allow the Pyroshield to penetrate and coat the gear set. Temperatures continued to drop and the team began extending the spray intervals. Gear temperatures were continued to be measured using two-hour windows as the amount of lubricant sprayed on the gear was gradually reduced.

LE's Pyroshield product is able to withstand high loads and run at lower temperatures, preventing contaminants from sticking to the gear. It runs clean and does not require over-treating the gear with too much lubricant and too-frequent spraying intervals. Pyroshield is also 'self-cleaning' as it does not require any supplemental cleaner to remove contamination.

An additional significant benefit is that the Pyroshield conversion process can be carried out without stopping production, and not losing any valuable manufacturing time.

Results

As technicians continued to clean and extend the spray intervals, the gear eventually became easily visible. The final result was 23min spray intervals (extended from the original six) and a temperature range from 50 to 62 °C (122-144 °F). This represents an almost four-fold reduction in lubricant consumption and a gear temperature drop of more than 23 °C (41 °F).

The spray nozzles now flow freely with complete spray patterns as clogging has been eliminated. Cycle counts are consistent on the Farval system with no variations based on cold-temperature flow issues.

Approximately one week after conversion, a large amount of cement ingress occurred. The plant manager called the LE representative concerned about a shutdown in production and that he would have to revert to using a cleaner on the gear. However, LE provided instructions to cut the spray interval in half and run for one shift. The manager called back after the shift and to his delight the gear was clear again. The plant was able to return to the 23min spray interval.

Since the introduction of Pyroshield on the finish mill, the Essroc plant has not had one temperature- or contamination-related outage or shutdown. Personnel have remarked on the ease of use, better flow, reduced maintenance and cleanliness of the product. Five months after the conversion, the temperatures have stayed at the same lower levels seen immediately following the Pyroshield conversion. The gear is cleaner without the use of a cleaner and visibility is improved. Moreover, environmental impact is lessened as the waste oil is not only a fourth of its previous level but also does not require special handling for disposal any longer. ■