Lubrication moves up a gear

An unsuitable lubricant led to high gear temperatures and cement ingress in a US cement mill. The switch to a new lubricant led to a cleaner gear, reduced operating temperatures and fewer shutdowns. Three years later, the replacement lubricant continues to provide paybacks.

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In 2015 the maintenance team at the Lehigh Hanson (formerly Essroc) cement plant in Nazareth, Pennsylvania, allowed Lubrication Engineers (LE) to run a test on its Finish Mill 3 with Pyroshield® Syn XHvy Open Gear Lubricant (9011), a heavy-duty synthetic fluid designed to provide outstanding protection for high-load, heavy-shock applications. The results of this test were published in ICR's May 2016 issue in the article, "Self-cleaning for multiple paybacks".

In agreeing to the test with LE, the plant maintenance team had three requirements for the test to be deemed a success:

1. Reduce downtime by eliminating the need to shut down production and having to run a separate cleaner through the system with any contamination incident.
2. Improve cleanliness of the gear in case of cement ingression.
3. Decrease the amount of gear oil being consumed.

The results of the test showed that these three requirements were exceeded and, pleased with the outcome, the maintenance team continued to use the new lubricant.

Moreover, as a follow-up to the 2015 test, the company reported additional improvements beyond the original three, reinforcing its belief in LE's Pyroshield 9011.

Reduced downtime

Pyroshield does not require equipment to be shut down during the conversion process. The initial conversion process uses a lubrication system line and a spray nozzle cleaner, LE's L-X Heavy Duty Chemical Supplement, to free the system from any previously-used asphaltic-based product. This is followed by LE's Duolec® Vari-Purpose Gear Lubricant (1608), an ISO 680 gear oil that lubricates the bull gear and pinion while removing the asphaltic product from it. After the gear set is cleaned to the point where the previous product and any contamination have disappeared, Pyroshield Syn 9011 can be introduced.

Figure 1: pinion gear five months after conversion

Improving gear cleanliness

Despite the operating environment being the same as before, the maintenance team noticed a significant reduction in lubricant contamination with Pyroshield lubricating the gears (see Figure 1).

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

Reduced lubricant consumption

Beyond the original requirements laid out by the maintenance team, the lubricant switch led to a fall in gear temperatures and further reduced spray intervals, leading to lower lubricant consumption.

The previous lubricant, applied with a 6min spray interval, was producing gear temperatures of 74˚C (165˚F) with spikes to 85˚C (185˚F). After conversion to the LE lubricant, the temperatures were reduced initially to 60˚C (140˚F). Currently, temperatures are running at 55˚C (132˚F) with a 24min spray interval, representing a fourfold decrease in lubrication.

Extending the lubricant's use

With the impressive results during the original trial on Finish Mill 3, the maintenance team made the decision to continue converting the rest of the plant's finish mills. Four more finish mills were converted with nearly identical results:

- Temperatures were sufficiently reduced, with 4-6 times less lubricant used.
- Gears were cleaned completely and are clearly visible for inspections.
- Ingression or contamination of cement no longer sticks or builds up on the lubricant.
- No gear-lubricant-related stoppages or downtime in production have occurred since conversion.

Figure 2: spray pattern before (left) and following (right) conversion

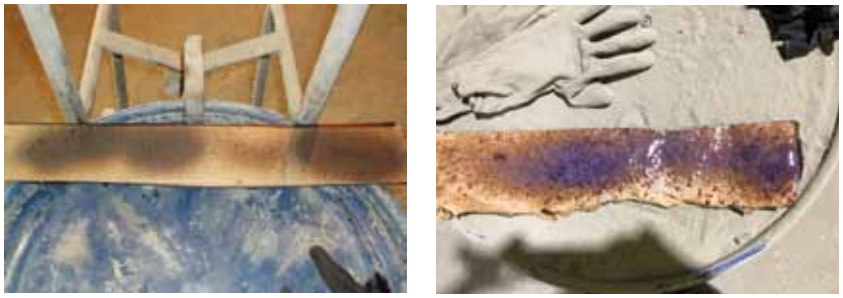

Figure 3: side door before (left) and following (right) conversion

Additional improvements

Reduced clogging

Correct spray patterns are vital to creating even distribution of the lubricant across the gear face. With the previous lubricant, spray nozzles were constantly getting clogged and causing poor to no spray pattern, although this issue was not always evident because of visibility problems with that lubricant and its build-up (see Figures 2 and 3). Changing to Pyroshield eliminated both issues. Follow-up results show this continues to be a success, with the additional unexpected result of not a single incidence of a clogged spray nozzle. Prior to Pyroshield, a clogged nozzle required at least an hour of downtime to change or clean.

Improved lubricant dispensing and cycling

A further improvement related to the lubrication system and its functionality in relation to proper dispensing and cycling. While performing a review of the system, LE discovered a further issue. When double-checking cycle counts from the controller to the block pin activating cycle switch, LE found they did not match. Farval controllers are set at specific cycle counts and number based on Falk specification by gear size and distribution block output. However, the block pin was cycling more than eight extra times when the system disengaged, allowing the lubricant to flow through without enough pressure to spray. This in turn caused lubricant to 'bleed' out of the nozzles, which was obviously a waste.

With additional analysis, LE discovered that the system did not have a way to bleed lubricant back to the drum after the controller completed its count cycle. Therefore, the pressure had to bleed out through the block. The solution came in adding a check valve or relief valve that senses the drop in pressure when the system disengages, allowing the reverse flow of lubricant back to the drum or container.

Figure 4: adding a check (relief) valve to the spray system (back of photo) saves Lehigh Hanson thousands of dollars

After some calculations, the volume of bleed or wasted lubricant equalled 0.17cc/cycle count – which varied. In the worst-case scenario, it was as much as 54.4/cc/h based on the previous 6min spray interval. Due to conversion to LE's high-performance lubricant and the ensuing discovery and solution for the lubrication system issue, the cement producer was able to save thousands of dollars (see Figure 4).

Conclusion

As a result of the change in lubricant, Lehigh Hanson's Nazareth cement plant was able to report several operational and maintenance-related benefits. Switching to LE's Pyroshield Syn XHvy Open Gear Lubricant cleaned the gear and helped the cement plant maintenance team ensure gear cleanliness throughout the time since the initial conversion without any contamination-related downtime. In use, Pyroshield has not built up on itself and continues to improve reliability of the equipment.

There have been no temperature spikes as experienced with the previous product.

In addition, there is no root build-up creating a layer that could cause alignment issues with the pinion (as had occurred with the previous lubricant).

Maintenance reports a drastic increase in visibility of the gear face – due to the translucency of the Pyroshield product – allowing easier viewing for alignment issues and pitch lines as well as top land changes.

The plant also reported lower labour costs due to a fourfold decrease in the number of required drum changes, as well as the ability to do inspections while in production. Strobe light presents far clearer than with the previous product. Only during extremely cold temperatures in January and February have heat lamps been needed, unlike the six months they were used with previous lubricant.

Fewer drum changes each year also led to a reduced potential for contamination and equipment damage.

Finally, the reduction in required lubricant as well as the modification in the lubrication system helped lower the amount of waste lubricant to dispose of each year, bringing further cost savings and improving the company's environmental footprint. ■