

# Grease Sampling and Analysis for Mining Applications

Grease analysis is a reliable, cost-effective way to determine the health of grease-lubricated equipment. For years grease analysis has been used as an essential tool to monitor the health of greases and optimize grease life for mining applications. This helps to ensure availability of critical equipment and reduce grease consumption and manpower by avoiding unnecessary maintenance actions. MRG Laboratories helps asset owners to optimize grease life. It is often found that grease lubricated assets are lubricated more frequently than necessary, creating waste of resources and manpower. Measuring wear, contamination, consistency, and anti-oxidant levels optimizes regreasing intervals and asset availability.



In this case study, grease samples were collected from the drive end and non-drive end of large crusher bearings at a mining site. To ensure that a representative sample was obtained, grease sampling was performed per ASTM D7718 and analyzed per ASTM D7918. The grease test slate, which includes ferrous wear analysis via FerroQ Analyzer, Die Extrusion via the Grease Thief Analyzer, Linear Sweep Voltammetry via RULER, moisture analysis, elemental analysis via Rotating Disc Electrode (RDE) Spectroscopy for wear and contamination, and FTIR analysis. Data from these tests gives insight into the wear rate, consistency, contamination, and anti-oxidant levels remaining in the in-service greases, and can be used to evaluate the condition of the in-

service greases. Action levels are determined by trending the results from an asset over time or comparing similar assets in a fleet.

## Laboratory Tests

Ferrous content screening is a non-destructive test that can be performed while the grease is still in the sampling device. Grease differs from oil samples in that it accumulates wear until purged with new grease. Ferrous data showed that most crusher bearing samples were acceptable. The analysis identified outlier samples which accounted for 9% of the samples tested.

Die Extrusion was performed on the in-service greases, and the consistency results were compared to the reference baseline. The Grease Thief Index (GTI) is a unitless number that can identify in-service samples that have deviated from the expected response and can confirm if the analyzed grease has hardened or softened while in-service. The closer to a GTI of 100 the less that has changed compared to the referenced baseline consistency. Die Extrusion data showed that most crusher bearing samples consistency was acceptable. The analysis identified outlier samples which accounted for 11% of the samples tested and indicates where the grease has softened compared to the referenced baseline while in-service.

Linear Sweep Voltammetry via RULER was performed and allows for the evaluation of the anti-oxidant additives remaining in a lubricant sample. Over time this can be monitored and used to ensure that grease is not replenished too frequently wasting a resource (grease) and preventing conditions where the levels are completely depleted. RULER data showed that most crusher bearing samples had acceptable anti-oxidant levels remaining. Less than 1% of the samples were flagged for low anti-oxidant levels and indicates that the grease is not running out of anti-oxidant additives during service.



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Moisture analysis was performed and evaluated for the crusher bearing samples. Elevated moisture impacts lubricants performance and can lead to the formation of red oxides. Moisture data showed that most crusher bearing samples had acceptable levels of moisture. The analysis identified outlier samples which accounted for 4% of the samples tested and indicates that moisture ingress is not a problem for the crusher bearings.

Elemental analysis was performed via RDE Spectroscopy and allows for the evaluation of 26 elements to see how the in-service sample has changed over time. RDE data showed that most elemental data for the crusher bearings was acceptable. The analysis identified outlier samples which accounted for 32% of the samples tested. Of these samples 12% was determined to be at elevated levels with maintenance actions recommended.

Lastly, FTIR was performed on the in-service greases, and the spectra were compared to the reference baseline to complete the screening testing. The FTIR confirmation can identify samples that have deviated from the expected response and can confirm contamination in a sample. The closer to 1.0 the less has changed compared to the referenced baseline. FTIR data showed that recent samples from crusher bearings FTIR confirmations was acceptable. Less than 1% of the samples were flagged as possible mixed greases, highly oxidized, or heavily contaminated grease. This confirms the right grease is being used and there are no extreme signs of degradation in the samples collected.

Elemental analysis identified the largest percentage of outlier samples during the testing. Reviewing the outlier data shows that for this customer elemental analysis, FerroQ, and Die Extrusion are the key test parameters to monitor and identify outlier samples.

## Further Testing

In-service greases that have high wear identified via FerroQ or elemental analysis can be candidates for further analysis in the laboratory to understand the wear present better. One valuable advanced test for grease is analytical ferrography, which involves looking at wear particles under magnification to determine a root cause for the wear. Determining the root cause or type of wear can help to determine which assets may need maintenance or an adjustment to the lubrication frequency. Samples flagged on the other tests can indicate greases that have accumulated contamination, become oxidized, or aged. Understanding the origin of the contamination, or the severity of oxidation can help to adjust regreasing intervals to the optimal level for each mining asset based on its unique case versus a traditional time-based interval.

In-service grease analysis gives a cheap, easy, and effective way to monitor the health of mining assets, extend asset life, and prevent costly repairs. Grease screening analysis can also be used to flag samples on-site then send out for further laboratory testing. Periodic scheduled sampling can help to understand how the components are aging over time and develop maintenance best practices. Grease analysis leads to identification of potential problems in order to recognize and correct issues before they lead to failure, helping to prevent costly maintenance repairs and maximizing availability and production.

## Grease Thief® Benefits

- Remote site or location – screening can be done on-site with field testing instruments leased by MRG Laboratories.
- Representative in-service grease samples per ASTM D7718 are easily and quickly screened with Pocket-Lab.
- Outlier samples can be sent to the lab for further analysis

