

Grease Sampling and Grease Thief® PocketLab Analysis for Pulp and Paper 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 critical pulp and paper assets. Providing the information to make data driven decisions, 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 allows the optimization of regreasing intervals and asset availability.



Figure 1: Pulp and paper bearing repair shop sampling

MRG has helped pulp and paper asset owners monitor critical equipment and optimize grease life. Over a **10-year** period of testing grease samples from multiple operators, recommendations for greasing replenishment change result in an average of 25% less grease used.



This data was generated from grease samples that were collected from critical pulp and paper equipment bearings for analysis to evaluate the grease condition. Grease sampling was performed per ASTM D7718 and analyzed per ASTM D7918. The grease test slate included ferrous wear analysis via FerroQ Analyzer, Die Extrusion via the Grease Thief Analyzer, moisture analysis, grease optical transmission via the Grease Thief Colorimeter, and FTIR

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

Wear Levels

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 in that it accumulates wear until purged with new grease. The 10-years of samples from pulp and paper bearings showed that most ferrous levels were acceptable. Outlier samples accounted for **8%** of the tested bearings. Knowing which machines comprised that 8% was critical in taking data-based action.

Consistency

The Grease Thief Index (GTI) is a unitless number that can identify in-service samples that have deviated from new grease condition and can confirm if the analyzed grease has hardened or softened while in-service. A GTI of 100 represents the consistency of the new grease. Higher GTI shows grease dry-out or hardening while lower GTI values show softening or separation.

Die Extrusion data over this period showed that most of the in-service grease consistency was acceptable. But a significant **37%** of the samples tested changed notably compared to the referenced baseline while in-service.

Moisture

Moisture levels were evaluated to show impacts on lubricants performance leading to the formation of red oxides. The presence of moisture can also indicate **Liquor** contamination. Moisture data showed that while most bearing samples had acceptable levels of moisture. **29%** of the samples showed significant moisture ingress, a problem for the bearings if not corrected by improving sealing or grease purging.



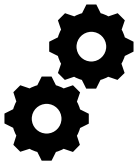
Oxidation

Linear Sweep Voltammetry (RULER) 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



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wasting resources while preventing conditions where the levels are completely depleted and grease quality is impacted. RULER data produced over this period show that most bearing samples had high levels of anti-oxidants remaining, demonstrating significant remaining life and opportunities to reduce labor and grease purchases.



98% of Paper Mill Greases have remaining anti-oxidants

GREASE COLORIMETRY

Grease colorimetry is a quick and easy screening test that is performed on the in-service grease. As grease ages, accumulates wear or becomes contaminated, the color changes, creating a larger ΔE value compared to the referenced baseline. The screening analysis flagged just over **30%** of samples from the tested pulp and paper bearings indicating that these machines should be investigated for accumulated wear, or contamination while in-service.

FTIR

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 degraded or picked up contaminants. FTIR data showed that for the study, FTIR confirmation was acceptable **79%** of the time, indicating possibly mixed greases, heavily contaminated grease, or degraded. This identifies samples to monitor to provide maintenance action recommendations.

How Can Paper Mills improve Grease Use and Protect Machinery?

The Die Extrusion, moisture, colorimetry, and FTIR analysis identified the largest percentage of outlier samples during the testing. In the field samples can be screened using the Grease Thief® PocketLab. The PocketLab includes the FerroQ ferrous wear debris analyzer, GTA-Mini to evaluate consistency and create uniform thin-film coupons for inspection or testing, and Grease Thief Colorimetry to identify color changes. These field or onsite lab instruments can be used to identify outlier samples from critical pulp and paper bearings and when necessary, they can be sent out to a full lab for further grease analysis.

Lab Testing

In-service greases that have high wear identified via FerroQ can be candidates for further analysis in the laboratory to understand the wear composition. An advanced test for grease is analytical ferrography, which involves looking at wear particles under magnification to determine a root cause for wear. Root cause or type of wear can help to determine which assets may need maintenance adjustments. Samples flagged on 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 asset based on its unique case versus a traditional time-based interval.



Figure 2: Grease Thief® PocketLab

In-service grease analysis gives a quick, easy, and effective way to monitor the health of pulp and paper 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 wearing over time and develop best maintenance practices. Grease analysis leads to identification of potential problems to recognize and correct issues before they lead to failure, helping to prevent costly maintenance repairs and maximizing availability and production.

PocketLab Advantages

- Remote site or location – screening can be done on-site with field testing instruments leased by MRG Laboratories.
- Representative in-service grease samples taken per ASTM D7718 are easily introduced to the PocketLab with no additional handling required.
- Only flagged samples need to be sent to an outside lab for further analysis.

