Grease Sampling and Grease Thief® Pocket Lab Analysis for Industrial Robot Applications

Grease analysis is a reliable, cost-effective way to determine the health of any 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 robots. This helps to ensure availability of critical equipment maintaining operations and reducing grease consumption and manpower. It is often found that grease lubricated robots are maintained more frequently than necessary, creating a waste of resources and manpower. Measuring wear, contamination, consistency, and anti-oxidant levels optimizes regreasing intervals and asset availability.

The 100 robots used for this case study are sampled biannually and with an investment of ~$10,000 USD for sampling kits and analysis the facility sees a savings of $100,000 USD on grease costs and manpower time saved.

In this case study, the grease samples were collected from large 6-axis robots being used in a manufacturing facility for screening analysis to evaluate the grease condition. To ensure that a representative sample was obtained, grease sampling was performed per ASTM D7718 and samples were analyzed per ASTM D7918. The custom screening test slate, which includes Ferrous Wear Analysis via the FerroQ Analyzer, grease optical transmission via the Grease Thief Colorimeter, and Die Extrusion via the Grease Thief Analyzer. This custom slate was created based on the data collected from the pilot program using the full basic grease analysis test slate to identify key parameters

to monitor. Data from these tests gives insight into wear rate, any contamination, and consistency of the in-service greases. Action levels are determined by trending results from an asset over time or comparing similar assets in a fleet.

Screenings 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. Fig. 1 shows the most recent sample sets from robots with most ferrous levels being acceptable. The screening analysis identified one outlier sample for further analysis from this data set, and one other sample was noted as nearing elevated levels for the application, representing less than 1% of the robot joints tested.
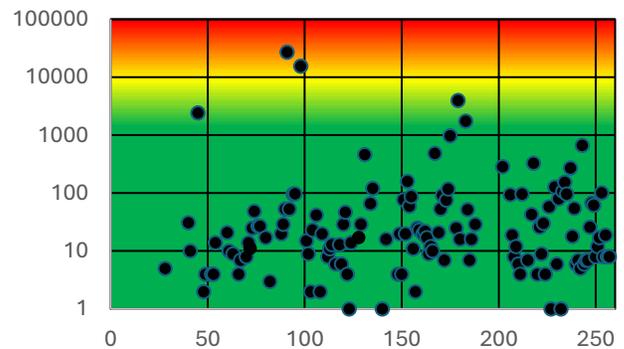

Figure 1. Shows Ferrous data (ppm) for in-service robot grease samples.

Optical transmission is second quick and easy screening test that is performed on the in-service grease. Fig. 2 shows recent sample sets from robots shows that most of colorimetry responses are acceptable. As grease ages and accumulates wear and/or contamination the color darkens creating a larger ΔE compared to the referenced baseline. The screening analysis identified some outlier samples (red and orange area) indicating that some of the in-service greases sampled could be aged or have picked up contamination since we know few samples were flagged for high ferrous wear in the set, representing about 5% of the tested robots. There

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were also sample noted as nearing elevated levels (yellow area).

Figure 2. Shows Colorimetry data (ΔE) for in-service robot grease samples.

Lastly Die Extrusion was performed on the in-service greases, and the consistency results were compared to the reference baseline to complete the custom screening testing. 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. Fig. 3 shows recent sample sets from robots shows most of the consistency responses are acceptable. About 10% of the samples were flagged for consistency and indicate where the grease has softened or hardened compared to the referenced baseline while in-service.

Figure 3. Shows Grease Thief Index (GTI) data for in-service robot grease samples.

Further 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 present better. Determining the root cause or type of wear can help to determine which robots may need maintenance or an adjustment to the lubrication frequency. This is often the case for most industrial robots as one joint will be worked harder than the others due to the loading of joints. Samples flagged for Optical Transmission can indicate greases that have aged, accumulated wear and/or contamination, or oxidation. Further analysis can be performed to understand the origin of the wear, contamination, or severity of oxidation. Flagged samples on Die Extrusion can indicate that the grease could perform differently than expected. Understanding and leveraging this data can help to adjust regreasing intervals to the optimal level for each robot based on its unique operating conditions and environment versus a traditional time-based interval.

In-service grease screening analysis gives a cheap, easy, and effective way to monitor the health of robots, extend asset life, and prevent costly repairs. Grease screening analysis can test all of the robots of a site quickly and inexpensively. Periodic scheduled sampling can help to understand how the assets are aging over time and develop maintenance best practices. Screening analysis leads to identification of potential problems, and further lab analysis can be performed on these identified outlier samples in order to recognize and correct issues before they lead to a failure, helping to prevent costly maintenance repairs and maximizing availability and robot productivity.

Grease Thief® Benefits

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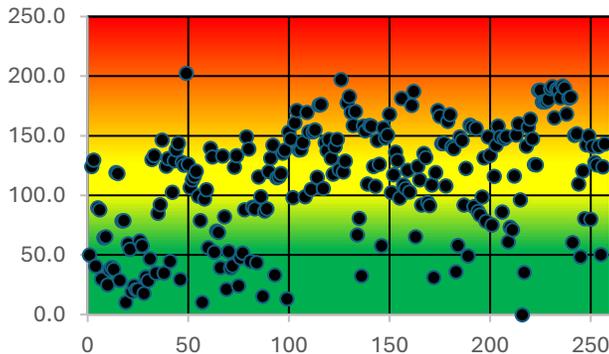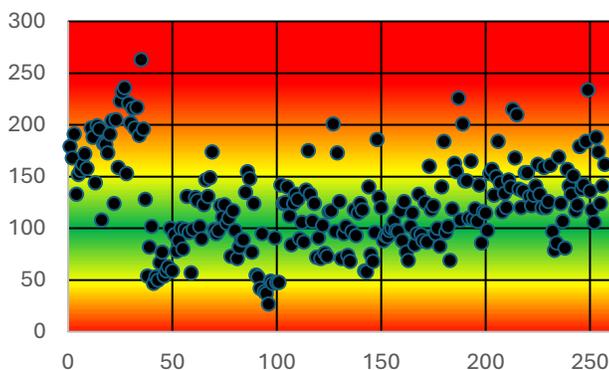- Outlier samples can be sent to the lab for further analysis