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Track or Category:
Condition Monitoring

A New Approach to On-site Oil Analysis for Industry 4.0

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Abstract

Condition monitoring by lubricant analysis is one of the basic tools of predictive maintenance programs; however, to date, industries have struggled managing programs on a global scale, standardizing knowledge world-wide and capturing global program success. Through the use of on-site oil analysis tools, we will explore the benefits of pairing fluid intelligence software with an on-site oil analysis laboratory at a specialty alloys manufacturer and demonstrate the value of new technologies available in the Industry 4.0 Era.

Introduction

The phrase “Industry 4.0” was created after several ground-breaking technologies came to fruition which significantly impacted the manufacturing and energy sectors. Technologies in the Industry 4.0 sector consist of several major innovations in digital technology including advanced robotics, artificial intelligence, sensors, cloud computing, Internet of Things (IoT), data capture and analytics, Software as a Service (SaaS) and platforms that utilize algorithms to solve complex problems. The technologies are all interconnected on a global scale which create a global value chain where companies are connected world-wide. By 2020, 72% of companies in the aerospace and defense; automotive; chemicals; electronics; engineering and construction; forest products, paper, and packaging; industrial manufacturing; metals; and transportation and logistics expect to achieve advanced levels of integrated digitalization into their overall workflow processes [1].

The oil analysis industry is Included in this rigorous integration of digitalization. This $250 million industry, is turning to Industry 4.0 solutions to solve tough industrial challenges like tracking global program success, normalizing workflow and generating value-add data contributing to the overall success and bottom line of the organization. Manufacturing plants and power plants are among some of the early adopters of Industry 4.0 techniques and have found innovative ways to incorporate these new techniques into their workflow, resulting in predictive analytics becoming a vital part of their maintenance programs.

Understanding how to quickly and effectively implement Industry 4.0 techniques becomes increasingly important in an era when many maintenance programs are being downsized or cut because little value is seen in their role within the organization. Advances in software analytics that integrate the expert knowledge of the onsite equipment expert and lubricant analyst are now available to help maintenance professionals justify oil analysis programs within their facilities and maximize equipment life.

Effective oil analysis techniques that provide value to the facility require the incorporation of two main concepts: knowledge of the component behavior and an understanding of the lubricant data generated by the component. By pairing these two concepts, proper diagnostics and recommendations can be made that are practical and easily implemented by the maintenance staff. Unfortunately, many facilities struggle with the analysis portion due to lack of experience or high turnover rates within the maintenance department. This challenge is overcome by fluid intelligence software that incorporates the diagnostics and recommendations into the software. This Adaptive Rules Engine feature, allows the user the the ability to change the limits and diagnostics as needed in order to properly trend and diagnose equipment issues and make specific recommendations for the maintenance staff [2].

Case Study: On-site oil analysis at specialty alloys manufacturer

The concept of incorporating fluid intelligence software into the maintenance workflow process was introduced to a specialty alloys manufacturing plant in 2018 with the intention of bringing oil analysis capabilities in-house. Equipped with a Rotating Disc Electrode (RDE) spectrometer, IR spectrometer, viscometer and particle imaging device, the in-house oil analysis program improves sample turnaround time, normalizes workflow and better utilizes the valuable in-house resources available at the plant.

Asset Management

As with any large software initiative some planning was required in order to prepare for the changeover. Perhaps the most important planning step to this process was the proper migration and set-up of the assets. During this critical planning step, the asset tree is developed along with designing and setting the goals for the program. The asset tree is imperative to global program success as it effectively maps out the asset structure, location and sampling points which allows the user to effectively create and schedule samples. By properly setting up the asset tree from the beginning, the user was able to easily track sample progress by creating routes and individual samples when necessary.

Adaptive Rules Engine

The flexible features of the adaptive rules engine were utilized by the on-site engineer. In a raw metals manufacturing facility there are a multitude of ignition sources from molten metal, large abrasive saws and batch furnaces. One of the fluids used to minimize fire risks in these applications is Polyol-ester (POE) based hydraulic fluid. The factory component library did not come pre-loaded with a polyol ester rules set, but using the adaptive rules engine feature, the onsite engineer created a new set of rules by using and editing the existing Phosphate Ester rules and diagnostic sets. Total Acid Number, moisture and ISO particle count alarm limits were easily changed by the onsite engineer to fit the profile of the POE fluid.

Future Plans

The specialty alloys manufacturer plans on increasing the testing of their newly delivered fluids to ensure quality and also add additional sites to their overall oil analysis program. The east coast lab is expected to serve as the central lab for their sister locations. As this plan develops, they will be able to

utilize advanced features in the software, which will allow them to make individual rules sets (as needed) based on the site locations and standardize reporting features world-wide.

Conclusion

The fluid analysis software available to support on-site oil analysis programs is designed to incorporate critical knowledge from the on-site equipment expert with lubricant analysis algorithms to standardize on-site lubricant analysis programs on a global scale. Industry 4.0 solutions are currently being used in a variety of on-site oil analysis laboratories in the industrial and manufacturing sectors. By incorporating Industry 4.0 solutions into condition monitoring programs these companies are able to effectively track global program success, normalize workflow and generate value-add data that contributes to the overall success and bottom line of the organization.

References

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