SmartDiagnostics® Application Note

Why Online Monitoring Matters

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Overview

The SmartDiagnostics® wireless machine health monitoring is a cutting edge solution that uniquely offers near real-time and continuous (online) machine health assessments at a costs that is competitive with infrequent route-based vibration monitoring. Because most machine failures are unexpected, online monitoring is the key to catching problematic operating conditions and rapidly progressing faults.

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More Data Enables Better Diagnostics

Route-based monitoring in part addresses the need for condition monitoring, but it lacks capability to catch many failures for the following reasons: 1) route-monitoring is done under controlled conditions (generally fixed load and running speed) so that the data can accurately be compared to a bench mark taken in a similar operating scenario, 2) it is performed on an infrequent basis due to the cost of manually acquiring data, and 3) hard to reach locations are rarely monitored or not at all.

The vast majority of machine failures, 89% reported in one study, are unexpected and only 11% are related to traditional machine wear out.[1] These unexpected failures occur due to improper installation, maintenance, environmental conditions, or operating loads and speeds. In practice, such conditions can change rapidly and do not follow traditional, Potential Failure -Failure commonly known a P-F curves. Severe damage may be intermittent and go unnoticed for months or years. For example, cavitation in a pumping system is often intermittent and nearly always overlooked by conventional, diagnostic, route-based (periodic inspections) monitoring.

Similarly, machine resonance during spin-up and spin-down is not recognized by conventional diagnostics even though significant damage can occur during these transient operating conditions. Excessive loading and most faults in reciprocating equipment are intermittent and rarely considered by most diagnostic methods.

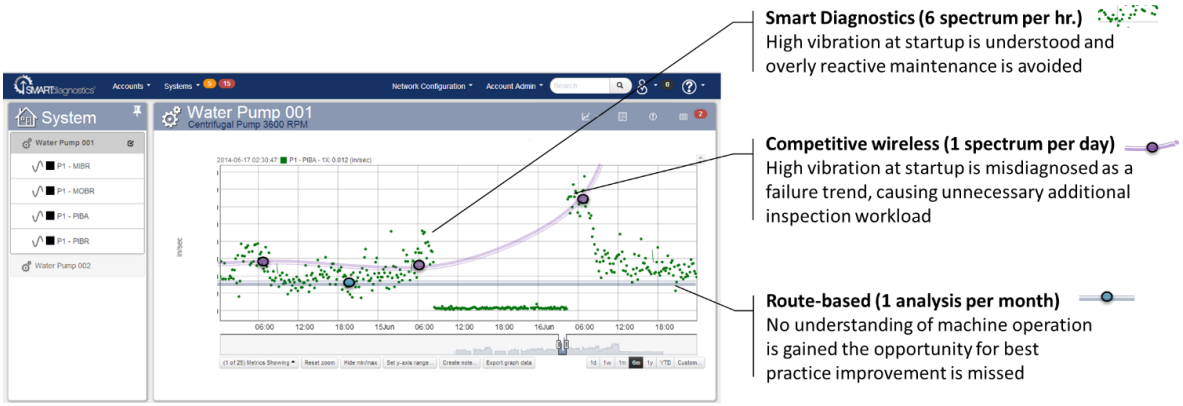
Wireless vibration monitoring solutions are emerging as alternatives to route-based monitoring approaches. Many of these new wireless solutions lack the innovative technology that enables SmartDiagnostics® to offer full spectrum analysis every few minutes while maintaining a multi-year battery life. Rather, these competitive wireless sensors typically deliver RMS or Peak values on an hourly basis and spectrum daily, weekly, or even monthly. This lower amount of data limits their ability to provide the highly valuable diagnostic information associated with continuous monitoring such as critical running speed avoidance and best practices improvements. Many of the competitive wireless solutions also are sold at a higher cost point and offer installation complications such as limited communication range.

SmartDiagnostics® Wireless Online Monitoring

The value in SmartDiagnostics® online monitoring is exemplified by an actual water pump failure captured by SmartDiagnostics® shown in the following figures. Example monitoring points for a route-based system and a competitive solution are superimposed on the failure trend to show their limitation for capturing such a failure before it happens. Even if the route-based inspection occurred during the pump failure period, a point in time where the vibration was below the warning level could have been recorded because there is significant variability in the vibration level due to load and pump speed variation.

SmartDiagnostics® uniquely allows the user to repair the pump prior to the catastrophic failure event, thus preventing secondary damage and a lengthier down time for repair.

As shown in the figure above, route-based methods not only miss occurrences of critical machine expression related to faults, but they also do not provide sufficiently high resolution time series trends, which are essential to mitigate false diagnosis that result from short duration high amplitude operating conditions, such as resonance during spin-up. For example, in the figure below the trended vibration for the same pump at a previous point in time shows a brief period of high amplitude vibration. If infrequent acquisitions are taken by, for example, a competitive wireless solution or a walk-around system, false diagnosis are likely, leading to unnecessary additional inspection work load.



In addition, for early fault detection, SmartDiagnostics' high resolution data acquisition enables evaluation of challenging problems that affect component life such as resonance conditions or cavitation in variable speed drive systems, which have been left unaddressed by route-based monitoring approaches.

SmartDiagnostics® is clearly differentiated from competitive wireless solutions by its ability to deliver full spectrum data acquisition every few minutes while sustaining a multi-year battery life. The lower data rate of competitive wireless offers analogous limitations as route based systems. SmartDiagnostics®' high performance capability is delivered at the lowest in class cost point and with a superior software interface.

1. Nowlan, F. Stanley, and Howard F. Heap. Reliability-Centered Maintenance. Report Number AD-A066579, United States Department of Defense, 1978.