WHITE PAPER

Condition Monitoring

Cost-effectively monitor the performance and health of your rotating machinery

In an effort to improve manufacturing safety and performance, many manufacturing organizations have added condition-based (predictive) maintenance approaches to their maintenance strategies. However, the predominate perception about these services is that they come at a premium and are not cost-effective to implement.

Unfortunately, this perception has pervaded because most condition monitoring solutions in the market today are either incomplete or too expensive to deploy on a broad range of equipment. To overcome these challenges, plant managers often settle for workaround solutions. They allocate condition monitoring to high-value equipment—or equipment perceived as mission-critical to operations—leaving the balance of machinery and smaller workhorse motors in the plant unmonitored and open to detrimental ramifications such as unplanned downtime, costly maintenance and repairs, and reduced production.

In this white paper, you'll learn the pros and cons of traditional predictive maintenance offerings as well as the benefits to implementing a condition monitoring program using real-time visibility across an entire asset fleet to reduce maintenance costs and capture performance and health data to drive your maintenance and inspection strategies.

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HID Condition Monitoring enabled by bluvision

Re-think Mission Critical: Manufacturing Plant's Biggest Offenders

Rotating machinery is ubiquitous in the manufacturing equipment ecosystem and needs to be maintained and inspected regularly to achieve operational efficiencies. Plant managers usually categorize motors by 1) Critical/expensive 2) Semi-critical, and 3) Balance of plant (BoP), when planning the overall maintenance and condition monitoring strategy.

The most expensive and critical motors in a plant only account for 5-10% of the total population. Semi-critical equipment makes up approximately 10-15%. Unfortunately, this equipment is often the only group equipped with condition monitoring or a predictive maintenance system, leaving the remaining 85% of a production facility's equipment vulnerable to unexpected downtime and repairs.[1]

In reality, all equipment is critical to operations and is costly to maintain—and if failures occur, production output is dampened. But what's a plant manager to do? Condition monitoring is historically far too expensive or ineffective to use on BoP equipment. Yet run-to-failure protocols hold the potential for catastrophic damage, resulting in safety risks and lengthy (as well as costly) production downtime. Scheduled preventive maintenance is also limited in effectiveness, with potentially excessive costs for inspections and replacement parts.

Deploying a more cost-effective condition monitoring system on the majority of a plant's equipment is commonly overlooked; however, having increased visibility down the production line can thwart possible threats:

- **Unplanned Downtime -** Unexpected failure in operational equipment is incredibly costly. For example, in the automotive industry, every hour of downtime costs $200,000, on average. Petro-chemical plants see every hour down costing an average of $87,000, and even food processing plants experience a similarly hefty average of $30,000 per hour. Many repairs, of course, take much longer than a few hours—they could take days, or even weeks.
- **Increased Labor Costs, Repairs and Equipment Replacement -** Without the continuous visibility, experienced technicians might manually inspect or touch motors to feel if the motor is operating properly. If failure occurs in any of the BoP motors—which can sometimes number in the hundreds or thousands—the direct and ancillary costs are often more extensive and catastrophic — excessive man hours, replacement parts, and even the need for newly installed equipment must be considered.
- **Plant Production Loss -** The cost for failed equipment considerably exceeds the repair to the equipment itself. Smaller rotating motors, bearings and belts are often overlooked, and their failures can shut down operations—shifting production to other lines and creating increasing dependence on other equipment, threatening manufacturing timelines, hindering production service-level agreements (SLAs) and creating back logs.

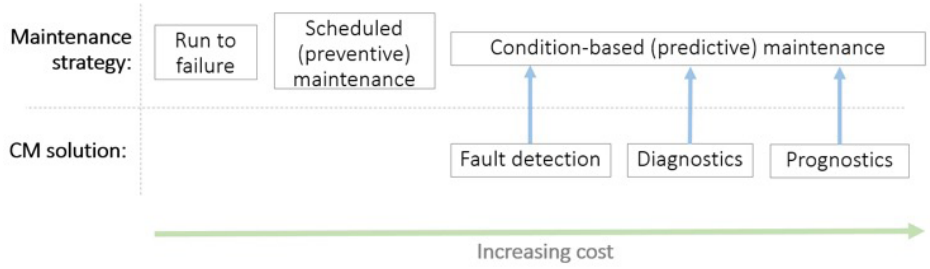
Maintenance Strategy: A Snapshot into Condition Monitoring

Based on the risks and costs involved with failed equipment, the clear best option is to extend condition-based predictive maintenance and monitoring into the full spectrum of the motor and equipment fleet. However, since most traditional solutions do not meet plant expectations or are too expensive to deploy, solution decisions often vary.

When selecting a condition monitoring solution, plant managers choose between three common options: fault detection, diagnostics and prognostics. There are many solution options under these three umbrellas—and pros and cons exist for each based on the manufacturing strategy and condition monitoring needs.

1 United States Department of Energy Best Practices Program (2010)

- **Fault Detection -** Determines that something happened: Lower-cost hardware is installed, and data is collected from the device at selected intervals. This approach typically leverages existing industry knowledge in vibration severity levels to alert when vibration is excessive. This solution is cost-effective, but since in some older systems data traditionally is not collected continuously in an automated way, the probability of missed failures is high..
- **Diagnostics -** Determines what happened: Portable hardware performs root cause analysis and pinpoints what maintenance is required, or which parts need to be replaced. Data is manually collected intermittently at extremely high sampling rates, requiring advanced data processing and offline expert analysis. This option can be effective, yet expensive for mass deployment.
- **Prognostics –** Determines what will happen: Permanently installed, high-fidelity instrumentation hardware collects data continuously. This is an ideal option for more sophisticated, high-end equipment requiring real-time visibility, diagnostics and prognostics. This solution provides accurate predictions of failure and remaining useful life. The only downside is its cost—this premium product is cost-prohibitive for all but the most critical assets, leaving the balance of plant equipment unmonitored.



Game Changer: Real-time, Accurate, Continuous Fault Detection

As a leader in boosting efficiency, enhancing productivity, and connecting things, HID Global answered the challenge to the growing need for a real-time monitoring solution that provides increased visibility into equipment performance using multiple data points to monitor and react quickly to critical events.

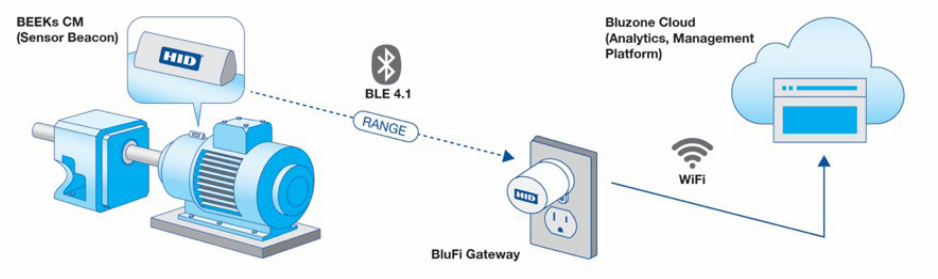
HID Condition Monitoring, enabled by Bluvision, builds upon the benefits of premium condition monitoring features. HID Condition Monitoring integrates low-cost, low-powered sensors into a wireless communication platform with cloud analytics to offer the lowest cost end-to-end condition monitoring solution for the masses. The solution enables plant managers to monitor the health and performance of multiple fleet assets and can continuously collect data on any rotating machinery. With no wired infrastructure, servers or antennas, information is easily collected and interpreted—and can be easily integrated into a plant manager's inspections, maintenance and operations practices.

How It Works

HID's wireless, remote condition monitoring solution provides vibration and temperature data in real-time. Data is collected on the BEEKs™ CM beacon using intelligent edge processing to calculate metrics related to machine health. This calculated metrics data substantially reduces the required throughput because the transmission is made through the BluFi™ gateway, and subsequently sent to the Bluzone™ cloud for further analysis.

Initially, HID's cloud-based artificial intelligence (AI) learns the baseline vibration behavior pre-deployment for each asset on which the beacon is installed.

Once the training period is complete, the data collected is used to generate a model of the machine's normal activity. Any defined deviation from the training period, such as a significant change in vibration behavior, generates an alert to indicate a change in the asset's health state. In addition to identifying emerging problems, data allows management to better establish proactive maintenance, inspection and operation strategies and enable better planning and execution decisions.



BEEKs™ CM sensor beacons send data via Bluetooth to the BluFi™ Bluetooth-to-WiFi gateway, which sends it to Bluzone™, HID's cloud-management console

Pharmaceutical Manufacturing: Early Indication of Equipment Degradation

A recent case study involving a leading pharmaceutical manufacturing facility demonstrates the immediate benefits of HID Condition Monitoring, enabled by Bluvision. The manufacturing environment is critical to the integrity and composition of the finished pharmaceutical products. Failure of a vacuum or cooling pump could ruin the efficacy of active ingredients used in production.

Prior to HID Condition Monitoring, the plant had been using traditional, intermittent condition monitoring practices that required tedious physical and manual inspections. As they searched for a new solution, HID's Condition Monitoring solution met the required features and benefits they were seeking from a new system—reduction in manual workloads, ability to perform analytics on pump health well in advance of failure, remote access, and real-time, continuous data and alert notifications.

HID's CM BEEKs were installed in the plant, and a one-week machine learning period commenced. After the training period, the machine learning algorithm was in place to catch any deviations—and an alert quickly sprang up.

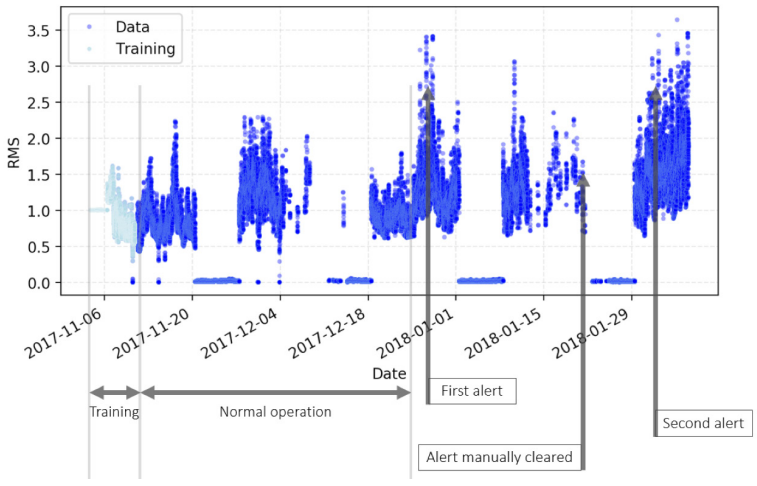
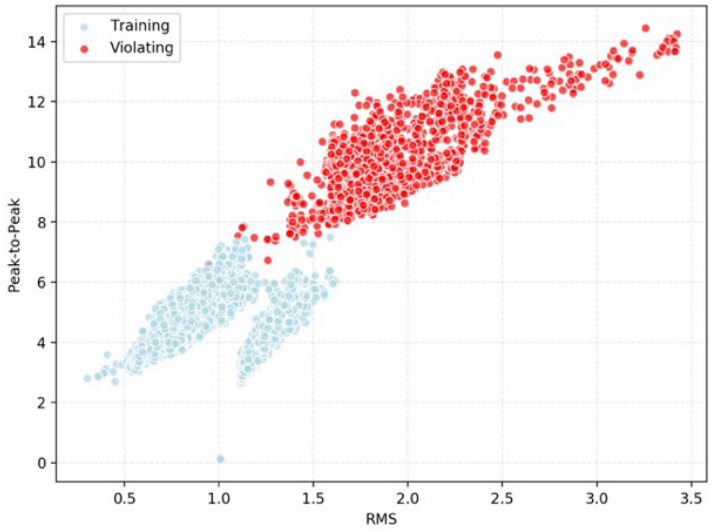


Figure 2. Time history of Z-axis RMS, overlaid with key events in detecting the degraded state of a motor.

Because the maintenance team could not visually see a problem, the alert was removed from the dashboard and placed under observation to see if discrepancies would return. After another week, an alert was sent on the very same asset. Now, maintenance knew that a thorough check was needed. They scoped the motor with high-bandwidth, lab-grade instrumentation, and performed advanced processing on the data—the conclusion was that the motor was indeed in a degraded state. Discovering this information in advance allowed the plant to make needed decisions about the degraded motor, avoiding unplanned, expensive downtime consequences.



Cross section of the empirical model developed by the machine learning algorithm (blue), with the data points in the deployment flagged as abnormal (red)

Achievable, Affordable and Accurate: End-to-End Condition Monitoring

Motors and motorized devices fail—but with proper preparation and planning, your plant's downtime consequences can be minimized with effective preemptive measures and remedial actions. HID Condition Monitoring, enabled by Bluvision, provides valuable input into the manufacturing condition-based maintenance (CBM) strategy, helps reduce unplanned downtime and enables plant managers to use proactive, data driven decision-making in their operational practices.

Benefits include:

- Lowest-cost system to wirelessly monitor continuous performance and health of assets
- Real-time visibility into previously unmonitored critical equipment
- Fast response times when monitored equipment stops operating or exceeds temperature thresholds
- Reduction in facility costs through predictive maintenance – receive alerts and notifications of equipment performance or behavioral changes

In addition to the above-described standard condition monitoring via BluFi Gateways, the following variants are also possible:

- **Cloud-based REST API:** Enables web developers and OEMs to build their own custom Condition Monitoring console and take advantage of

BEEKs Cooler keeps a temperature log for Cold-Chain applications

Bluzone cloud AI and machine learning algorithms and over-the-air beacon management functions.

- **Mobile SDK:** Enables integrators and OEMs to build mobile apps (Android or iOS) to interact with BEEKs beacons, for example, to retrieve telemetry data locally e.g. from BEEKs Cooler.
- **BEEKs Cooler:** BLE sensor beacon configured to store logs of temperature data locally for cold chain applications.
- **Real-Time Location System (RTLS):** Asset movement can be tracked in facilities using the same beacon technology and different SaaS subscription module.

Summary

For more information on HID BEEKs CM and our full portfolio of IoT tools, visit https://www.hidglobal.com/solutions/hid-location-services-and-condition-monitoring or email tagsales@hidglobal.com

hidglobal.com

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