APPLICATION NOTE

Tiered maintenance
uses new smart tools and work practices to boost reduced resources

Industrial companies are facing unprecedented pressure to do more with less. Many companies look to proactive maintenance or reliability centered maintenance to help get ahead of their machinery breakdowns, but reliability programs require resources. In such a lean environment, maintenance teams often only have bandwidth to apply best practices to the most critical few machines, which leaves them constantly distracted by reactive maintenance on the rest of the machines.

Today, industrial and commercial maintenance teams are facing more resource constraints than ever:

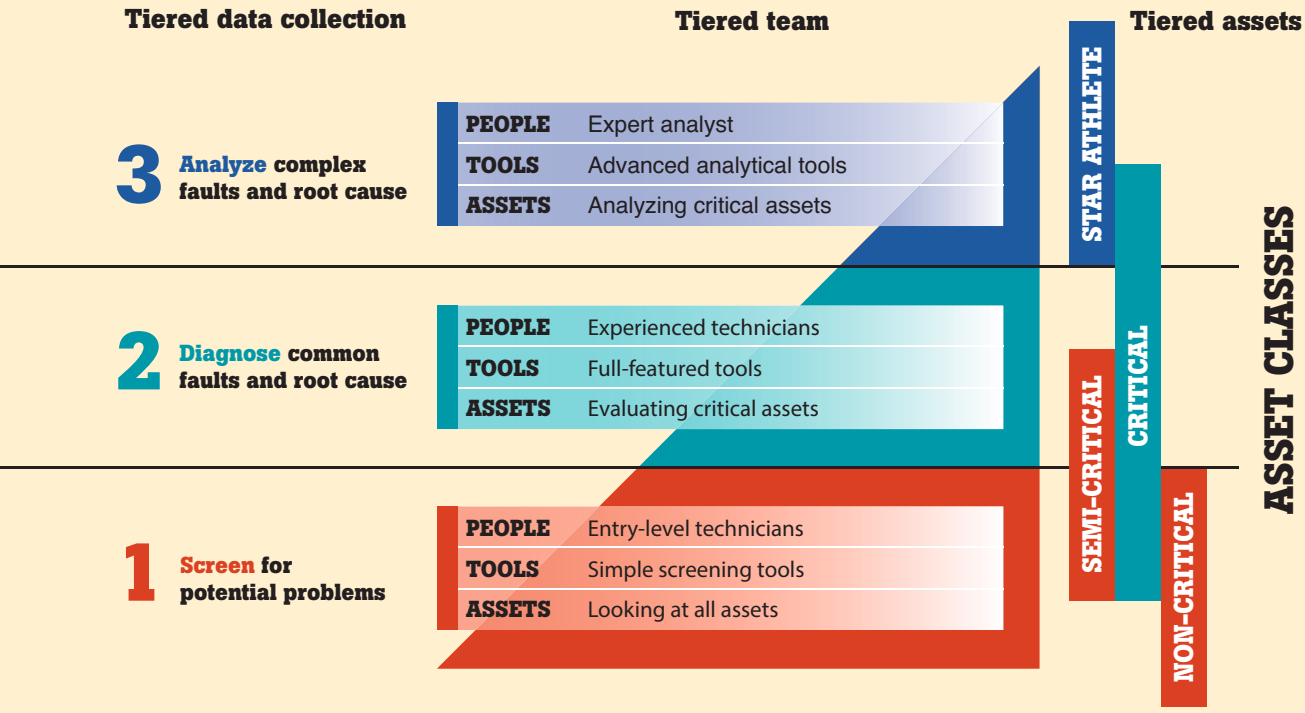
- Competition and performance pressures are increasing in all industries
- Economic downturns force cost-cutting measures that seldom return to normal after recovery
- Teams are shrinking because of demands to minimize fixed operating costs
- Team members are retiring and new hires are not being slotted into backfill positions
- Teams are also evolving from individual specialists more toward generalists and cross-training
- As skilled technicians retire, transferring the decades of on-the-job experience is difficult

So how can maintenance teams cover all their assets in a proactive way, even when they have fewer resources than ever? The answer lies in adoption of a "tiered" maintenance strategy.

Tiered condition-based maintenance

The biggest enemy of a well-run condition-based maintenance program is waste. The highest performing teams don't waste time diagnosing machines that are healthy. You might be asking yourself, "How do you know if a machine is healthy, unless you take a diagnostic measurement?" New smart tools can quickly take the "vital sign" measurements on a machine and "screen" the machine to see if it needs further diagnosis. Just like a sick person going to the hospital, a nurse will check the patient's vital signs before sending them to a general practice doctor and the general practice doctor will do a basic check-up before referring the patient to a specialist.

Looking at it another way, the test and measurement tool market is shifting away from the solo fixer mentality to a more team-oriented condition-based maintenance approach that includes routes as well as more frequent screening checks. The frontline soldiers in the first tier are entry-level technicians or operators who can use simple smart tools to quickly screen machines to see which ones are healthy and which ones need additional attention. The next tier is the more experienced technician who can perform the majority of all diagnoses and determine when a machine will need repairs. The final tier is the expert analyst, either a seasoned expert inside the team, or an outsourced service provider with specialized tools and knowledge.



While larger industries have sported high tech sensored up machinery for years, many of the medium and even smaller manufacturers and facilities are embracing a more condition-based approach.

So, technologies that can automatically save measurements are catching on such as the less complicated Fluke 810 Vibration Tester, the rugged higher resolution Fluke Ti450 Infrared Camera, the Fluke 376 FC True-rms AC/DC Clamp Meter with iFlex® and the Fluke 3000 FC Series Wireless Multimeter.

Even newer are portable condition monitoring systems, such as Fluke 3500 FC Condition Monitoring Sensors, that can be used to sensor up critical but under-monitored equipment that is acting up, or older equipment that is too expensive to retrofit with fixed sensors. Indeed even workflow tracking systems, like Computerized Maintenance Management Systems (CMMS), are adding new capabilities to add data from an array of test tools.

The tiered maintenance strategy

1. Screen machines to find out which ones are good or bad. The Fluke Ti450 Infrared Camera, the Fluke 805 FC Vibration Meter or the Fluke Condition Monitoring System can determine which assets have problems.
2. Diagnose the machine faults with the Fluke 810 Vibration Tester to determine the root cause fault, severity, and repair recommendation.
3. If misalignment is the fault, correct the problem with the Fluke 830 Laser Shaft Alignment Tool.
4. Use the same screening or diagnostic tools to check the machine with smart tools, such as Fluke Professional Series Infrared Cameras and the Fluke 376 FC True-rms AC/DC Clamp Meter with iFlex® to make sure the repair is good and return the machine to service.
5. Create baseline measurements and save to the cloud using Fluke Connect. This is invaluable for future reference so everyone on the team is informed.

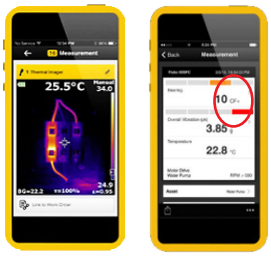
Screen | **Diagnose** | **Correct** | **Verify and report**

Thermal, electrical and mechanical

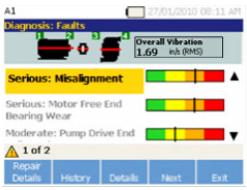
Vibration tester

Laser alignment tool

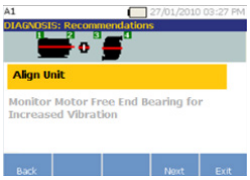
Thermal, electrical and mechanical



Diagnosis



Recommendation



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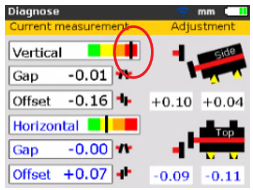

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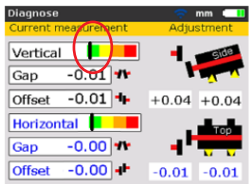

With ubiquitous mobile phones and wirelessly connected tools, more workers who are charged with maintaining equipment can at least partly change their orientation toward periodic predictive tasks to check assets for issues—before problems occur.

Wirelessly connected test and measurement tools that are tied together by the Fluke Connect Condition Monitoring system can help kick-start a condition-based maintenance program without a massive investment in capital, labor or IT infrastructure. Starting with a few wirelessly enabled smart tools, such as the Fluke Ti450 Infrared Camera, Fluke 805 FC Vibration Meter and Fluke 3500 FC Condition Monitoring Sensors, you can create a starter tiered program that can be implemented immediately, that scales over time.

With a thermal imager, malfunctioning components will appear warmer than others while failed components will be cooler or cold by comparison. Periodic inspection can reveal over and under heating conditions with switches, circuit breakers, motors, gear boxes, pumps, panels and other machinery.

For machines with rotating parts, the shaking, shimmying and thumping of loose, misaligned or unbalanced parts, can be detected with a vibration meter. Recent developments in vibration sensors, data acquisition and analysis technologies are making vibration analysis less expensive and more widely available.

With a portable condition monitoring system you can get real-time data on temperature, voltage, current or power, via sensors. And you can trend that data over time to track equipment performance or degradation.

For each of these tools, data is logged by date and equipment and can easily be shared to involve more team members and even manufacturer reps or engineers in the process. And since these technologies can be safely used while equipment is running they can provide an early warning system to issues.

To best execute inspections, establish a route through the plant. Following the same routine each inspection can provide time and data advantages as each piece of equipment is viewed, images and readings captured and anomalies recorded. The associated software provides the mechanism to record, track and recall a specific reading as needed for reference.

Tiered strategy stages

Screen → **Diagnose** → **Correct** → **Verify and report**

Fluke Ti450 Infrared Camera, Fluke 805 FC Vibration Meter, Fluke Condition Monitoring

Fluke 810 Vibration Tester

830 Laser Shaft Alignment Tool

Fluke Professional Series Infrared Cameras, Fluke 376 FC True-rms AC/DC Clamp Meter with iFlex®

Data analysis

The goal is to trend the data, capture regular results over time, and catch irregular results quickly and early. Measuring the same equipment types, operating under the same conditions but showing different temperature levels, can provide benchmark measurements and variants to track. By establishing a baseline reading on equipment that operates at high temperatures, a range can be established that represents a normal state for that particular asset. Any deviation from that range gives a clear indication of change and the potential for component failure. A similar method can be used for vibration readings with the caveat that exact repeatability is limited.

By being able to monitor assets in real time or at regular intervals you can apply the right kind of maintenance at the right level. When there are no signs of equipment deterioration, you keep the equipment running. Thus, in many cases it is the decision not to do maintenance where the cost savings are realized—if you are not doing maintenance then you are not spending money. That is the compelling ROI case for a condition-based maintenance strategy.

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