

Condition-Based Maintenance

Condition-based maintenance provides best outcomes when it comes to down-time.

It's your job to keep the equipment running smoothly and predictably, and we know that the job is not always as easy as it may sound. You've heard phrases like "condition-based maintenance" and "predictive maintenance" thrown around as possible solutions to the reliability of the equipment you're responsible for ... are they real solutions or just jargon? Read on to find out more!

Three Basic Maintenance Philosophies

There are three **basic maintenance philosophies** that apply to equipment:

- *Breakdown Maintenance*, where you run a machine to failure and then address maintenance; tends to be costly and inefficient and leads to frequent machine downtime
- *Preventive Maintenance*, where a machine is maintained based on a strict schedule of maintenance activities (Time-Based Maintenance); more efficient, but not all machines will follow the schedule
- *Predictive Maintenance*, or Condition-Based Maintenance, where maintenance is performed based on the condition of the machine

(This HECO YouTube presentation discusses three different maintenance philosophies: breakdown maintenance, preventive maintenance, and predictive maintenance.)

Breakdown maintenance and preventive maintenance are older approaches, but although predictive maintenance is considered a newcomer it has a history that goes back to the 1970s. It has risen in popularity because of the results that it gets and because of new technology that makes it even easier to track the condition of machines.

Benefits of Condition-Based Maintenance

Of these three basic maintenance philosophies, condition-based maintenance provides the most optimum response to maintenance needs. Maintenance decisions are based on the health of the equipment so that the machines are neither over maintained nor neglected. The scheduled downtime is kept at a minimum and so is the overtime needed for repairs and maintenance. In addition, unlike preventive and breakdown maintenance, there is no need to keep a large inventory of spare parts on hand.

Surveys for Condition-Based Maintenance

In order to determine the condition of a machine for maintenance, regular equipment surveys need to be performed and a performance baseline needs to be established for each machine. The first decision that must be made is what pieces of equipment are to be included in the survey and how often they are to be surveyed. The equipment that is most important to your facility's overall process should be the highest priority.

As far as how often surveys are to be conducted, you will need to consider the repair and maintenance history of the machine in question. Other considerations involving the frequency of surveys include machine operation (continuous, intermittent, can be rotated out with a spare), available manpower, and costs. For machines that are especially critical or prone to failure, you might want to consider continuous monitoring.

Condition-based Maintenance Survey Data and Tools

There are several different survey tools used to establish the condition of an electric motor, and one of the main methods is vibration analysis.

(The presentation shows time waveform and spectrum analysis basics and how they work.)

During vibration analysis, a piezoelectric sensor generates a varying voltage depending on the magnitude of the machine movement. This data is then compiled by a data acquisition system and processed by a computer to generate useful information about the vibration taking place. A vibration analyst can use this information -- usually in the form of a **Time Waveform and a FFT Spectrum Analysis** -- to detect a wide variety of machine faults and assess the condition of an electric motor.

However, vibration data isn't the only **type of data used in equipment surveys**. Thermal data (including temperatures and temperature gradients), ultrasonic testing, oil testing, visual data, and electrical data are also key to establishing a motor's baseline and future performance.

The **equipment needed to conduct these surveys**, including continuous monitoring equipment, is much more affordable than it was in the past. This change is in part thanks to advances in Bluetooth technology and in part due to the rise of the **Industrial Internet of Things, or IIoT**. The investment in condition monitoring equipment for your critical machines now costs much less than the downtime and repair costs for those machines.

By **comparing a piece of equipment's current performance to its baseline performance**, a knowledgeable technician will be able to quickly tell if something is going wrong with the pump, fan, or motor, etc.. A more skilled vibrations analyst will be able to take time waveform and spectrum data and narrow down the possible causes of the drop in performance. Those causes can be addressed before there is a catastrophic failure of a critical asset. In addition, the machine can be scheduled for downtime and maintenance at a far more convenient time than is possible if you wait until it fails.

Condition-based Maintenance and Reliability

The **reliability of your** rotating equipment is of the utmost importance and the best tool for increasing that reliability is condition-based maintenance and predictive maintenance. **Preventing failure** is almost always cheaper and more convenient than having to fix it after a failure!

Vibration route analysis, which is part of any good condition survey program, is an excellent way to predict and prevent the impending failure of your machines. The data recorded as part of your condition-based maintenance

program can also help you make informed decisions about **when to replace a machine**.

Something you might not be aware of, however, is that condition-based maintenance and predictive maintenance services can actually **extend the life of your existing** equipment.

HECO Provides Condition-based Maintenance

At HECO, we fully recognize the importance of reliability and we provide customized maintenance plans to support the needs and goals of your facility. We will work with you to determine what machines are the most critical to your operation, what type of condition monitoring equipment you need, and find a setup that matches your budget. We provide a benchmark assessment of your equipment, install and setup the condition monitoring equipment, and monitor that data for you. Our reliability team here at HECO includes certified vibration analysts, tribologists, ultrasound technicians, and thermographers. Let us help you initiate a condition-based maintenance approach that will reduce your overall M&O costs while increasing reliability.