Vibration Analysis

Vibration analysis done right... requires the right testing equipment, the right certifications & critical experience

One of your technicians has just informed you that a machine has some serious vibration or imbalance issues that they don't have the skill or equipment to fix or understand what is causing it. What you need is someone to perform vibration analysis to figure out what's wrong, but before you start tracking down someone to do the job you'd like to know a little more about what vibration analysis is and how it works -- and how it can help you. You've come to the right place.

What Is Vibration Analysis?

The simplest definition you'll find for vibration analysis measuring the movement of a point on a machine. To measure that movement, you would use a vibration sensor whose job is to take mechanical motion and convert to it an electrical signal that can be analyzed. And keep in mind that vibration and imbalance are not the same: imbalance can be a cause of vibration.

How Does Vibration Analysis Work?

During vibration analysis, a piezoelectric sensor (or modern day, MEMS sensor) provides a varying voltage depending on the magnitude of movement. This data is 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 an FFT Spectrum Analysis -- to detect a variety of machine faults.

Time Waveform

When the displacement data is combined with time data, the result is a Time Waveform (or time domain) plot that shows the relationship between amplitude and time. While this information has its uses, it really doesn't reveal the whole picture when it comes to vibration.

Frequency Spectrum

A Fast Fourier Transform (FFT) can be applied to the data used for the Time Waveform. The result is a Frequency Spectrum (or frequency domain) plot that relates frequency and time. This provides great information about what frequencies are having the most impact on the vibration.

Why Vibration Is Bad

Before we go any further, let's talk about why vibration is usually bad. As you may already know first hand, vibration can cause excessive wear on parts like bearings, it can loosen fasteners such as bolts and screws, it can compromise machine performance, it can make a terrible racket, and can cause seals to leak, and it can even lead to broken and fractured components as a result of fatigue failure. So if your machine -- including your electric motor -- is vibrating, you need to track down the cause -- and vibration analysis is the best tool.

Vibration Analysis and Predictive Maintenance

Vibration analysis is an indispensable part of modern predictive maintenance. It can be used by a knowledgeable technician to quickly detect and isolate the source of potential machine faults before they start to cause serious problems, such as …

- System or component imbalance, allowing it to corrected before damage occurs
- Ball/roller bearing defects, which can cause serious damage if they remain undetected
- Misalignment, which can lead to premature bearings or seal failure, as well as numerous other problems
- Loose bolts/broken welds, which can result in catastrophic failure if not discovered
- Resonance conditions, which can also lead to failure that is both catastrophic and dramatic (e.g., Tacoma Narrows Bridge)

- Electric motor rotor/stator faults, which may be almost impossible to detect otherwise

As you can see, vibration analysis is a powerful tool in the hands of someone who knows what they are doing.

Predictive Maintenance and Continuous Monitoring

When vibration analysis is used as part of a predictive maintenance plan, critical rotating machinery will be analyzed on a regular basis (e.g., monthly, bi-monthly, quarterly) to detect and correct any potential problems as well as investigate any new behavior.

With new advances in technology, it is now possible to inexpensively continuously monitor rotating machinery for changes in behavior. This innovation has been made possible by combining traditional vibration sensing technology with wireless data transfer and IoT (Internet of Things). With this type of approach, alarms or warnings can be issued when major changes in vibratory behavior are detected.

Certifications for Vibration Analysis

Let's face it: some people view vibration analysis of rotating machinery as half science and half witchcraft. The truth is that it is a skill developed through training and experience -- and a skill that can be officially certified.

There are a few groups that offer different levels of certification for vibration analysis. There are four categories of Vibration Analysts, each based on an increasing number of hours and training.

The highest level is Category IV which requires a minimum of 5 years of experience and a total of 130 hours of training. Category IV vibration analysts have a solid understanding of vibration analysis theory, including techniques and signal analysis. They are fully qualified to not just perform and analysis data but make recommendations for design modifications and corrective maintenance.

Needless to say, an electric motor repair shop with certified vibration analysts on staff is a good choice.

HECO Knows Vibration Analysis

At HECO, we have over 30 years of experience in vibration analysis. Not only do we have certified vibration analysts on staff, but we have stayed up-to-date on all the latest developments in the field, including IoT and continuous monitoring. If you are having vibration issues with your electric motors or rotating machinery, contact us right away. From issues with small, low-speed machines to more complex tasks such as modal analysis of machine structures, we have the skill, experience, and equipment to help resolve your vibration issues.