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VIBRATION MONITORING: A VALUABLE TOOL IN AIR COMPRESSOR MAINTENANCE

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Unexpected breakdowns of industrial air compressors can bring production and processes to an extremely expensive halt. Vibration monitoring can prove to be an essential predictive tool providing information regarding the health of your equipment helping to prevent unplanned downtime, and thus, reducing costs. In this article, we will be discussing the following:

Downtime is the devil. For most manufacturers keeping an operation up and running, efficiently and productively is what keeps them up at night. Considered the fourth utility for its ubiquitous role, keeping compressed air flowing is of vital importance to the health of an overall operation. A step beyond proper maintenance is predictive maintenance. Knowing the health of the compressor throughout its life span – before an issue arises, will result in smooth operations.

There are several steps to achieving predictive maintenance; one of the easiest and most cost-effective steps is vibration analysis. When done regularly, vibration analysis monitors the health of a compressed air system from installation and provides an in-depth view of what is ailing your system – and more importantly, what could ail your system in the (near) future.

What is Vibration Analysis?

Vibration analysis is the testing and tracking of an air compressor's vibration profile to aid in diagnosing any current or future faults. Vibration can come from

electrical or mechanical faults, poor installation or may be caused by normal functioning of the machine. In this way, vibration can be normal or indicate an issue. Every compressor has its own vibration signature and documenting and tracking that unique vibration allows the owner to "see" a number of performance issues. As the compressor runs, bearings in the air end and motor as well as gears and other mechanics emit a vibration frequency. That frequency, when tracked over time tells a story. At certain known/documented frequencies, a skilled analyst can tell (and then predict) when a bearing or gear is failing. The analyst can even discern details like the difference between the rolling element, the inner or outer race, or the cage

in a bearing that has or is beginning to fail. In addition to bearings, the issues that may be diagnosed through vibration analysis include mass unbalance, misalignment, mechanical looseness, gear issues, motor faults (bent shafts, broken motor bars), and more.

In addition to helping prevent catastrophic compressed air machine failure, the benefits to vibration analysis are many – from reduced maintenance costs to lower insurance premiums, less standby equipment, lower energy costs, and enhanced safety.

Capturing the Data

Vibration analysis is ideally started as soon as the air compressor is installed. Collecting a baseline vibration profile will help the analyst see, over time, when the integrity of the various components begins to break down. It can also determine if the compressor was installed correctly and identify any balance issues, etc. And, while vibration analysis can begin after installation and even mid-life (or later) of a compressor, the readings are best if trended from installation startup. Collecting readings from machines in a faulted state doesn't allow the analyst time to alert a customer on possible downtime from what's creating the issue as baseline readings are captured on an already faulted machine.

After the initial baseline analysis, ideally a vibration profile should be collected at quarterly preventive maintenance visits – depending on the usage of the air compressor, but at a minimum annually. The route and data collection usually only takes about 20-30 minutes to complete. To conduct the analysis, typically a small handheld vibration tool with an accelerometer, is placed (via magnet) to various areas of the air end as well as the motor and other select areas of the compressor. The technician will then take readings in up to three directions – vertical, horizontal, and axial along the measuring points – and may even take several readings from one measuring point. Some vibration accelerometer devices read in all three directions – vertical, horizontal, and axial – at the same time, but some analysts prefer using a single direction as it tends to be more accurate. Additionally, the data collected can be more dependable if the measuring points of the routes are marked so that the future routes are taken in the same locations. Once the machine reaches its operating temperature and stabilizes, the compressor will then need to run at rated pressure and full load for the entire time the readings are being taken – with the usual environmental conditions and temperature. The handheld analyzer along with the accelerometer measure the machine's vibration in FFT spectrum or Fast Fourier Transform and converts the data gathered into FFT spectrum by the Fast Fourier Transform algorithm. This FFT data is recorded at each measuring point of the compressor and route and then sent off to an analyst to analyze the readings.

The analyst will view the collected data on spectrum and time wave form plots and render a report. The vibration levels recorded on the graph will indicate what components are performing normally, which are changing (if historical data is available), and what, if anything, is beginning to fail. Every component has its own frequency; from the individual parts of the ball bearings to the gears and rotors. By reviewing the frequency readings and studying the peaks and valleys on the graph, analysts can pinpoint an issue by a shift or abnormal component frequency as vibration peaks will become more pronounced or elevated when there is a problem. The process is extremely accurate. If the analyst for some reason can't determine exactly what is at issue, they can come extremely close to providing at least a strong indication of the issues brewing.

The final vibration report provides an overview of the health of the compressor and includes a detailed summary of where the various parts and components are in their life cycle. Most importantly, the report can inform the user when an issue will become serious, or a failure is likely. This will allow the user to schedule maintenance at a time most convenient to the overall operation. Instead of a bearing failing during a busy or critical production window, plant management can shut down operations at a pre-determined time and coordinate repairs to other areas of the factory at the same time. Scheduling this kind of maintenance also ensures that the parts needed for the repairs are in house. Unplanned shutdowns can stretch into days or even weeks if parts are unavailable.

At the end of the day, vibration analysis is a tool - an important tool - to utilize regularly to keep your air compressor properly maintained and running as efficiently as possible. If vibration analysis is not part of your maintenance plan, it absolutely should be.