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MECHANICAL ENGINEERING TECHNOLOGY

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Infrared Thermal Imaging is an excellent condition monitoring tool to assist in the reduction of maintenance costs on mechanical equipment.

Thermography applications:

1. Motors: Overheating of windings and bearings, blockages in cooling passages, friction, damping, material deformations, brush contact problems, rotors.

2. Ovens, furnaces, kilns, pipes: location and severity of damaged insulation, location of steam leaks in buried steam lines.

3. Drives/conveyors, pillow blocks, couplings, gears, power transmission belts, pulleys, shafts: overheated bearings or rollers, misalignment of shaft, pulley or coupling, lubrication failure uneven pressure.

4. Mechanical drive turbines and small turbine generator units, gas turbine, exhaust ducts: high lube oil temperature, high bearing temperatures, faulty stop/control valve operation, uneven metal temperature, leaking shaft seals, gas turbine firing conditions, including deterioration in firing chambers, cross firing tubes.

5. Pumps/compressors/fans/blowers: overheated bearings, high compressor discharges temperature, high oil temperature, and broken or defective valve.

Improved Troubleshooting

Infrared Thermal Imaging definitely should be one of the tools that are selected for motor and rotating equipment inspection. Thermographic examination can help technicians use the other tools, such as vibration analysis, more effectively. If a thermal anomaly is found, then the other tools can be employed to help isolate the cause of the problem [1].

Vibration analysis is one of the most important and effective methods of detecting the health of machinery. Vibration data can help us identify faults or detect warning signs of potential failures. It can also aid in the detection of misalignment or unbalance of assets such as bearings and rotating pieces of equipment. By looking at vibration data, we can also identify high and damaging levels of vibration.

Vibration monitoring and analysis can be used to provide early indicators of failures in motors, rotary based systems or structures that resonate during normal operation.

Measure vibration is:

Sampling rate required, Vibration amplitude, Sensitivity, Number of axes, Weight, Mounting options, Environmental constraints, Signal conditioning.

The characteristics of vibration are: Peak amplitude, crest factor, phase, velocity, acceleration, kurtosis, standard deviations, resonance.

The benefits of monitoring mechanical vibration are: By tracking assets over time, we can determine what is normal behaviour for a system.

By using analytical methods such as Fast Fourier Transforms or Power Spectral Density – allowing us to get a deeper insight into the vibration trace – we can focus our attention and spend our efforts on a specific area. We can identify mechanical unbalance, looseness or unexpected vibration levels, as well as obtaining early indications of wear and fatigue of a system [2].

Mechanical equipment condition monitoring and fault diagnosis techniques generally contain lubricating oil analysis.

Oil analysis provides a nondestructive testing diagnostic method for predicting possible impending failure and for avoiding catastrophic failures long before they occur and furthermore tends to determine the frequencies of oil changes and the remaining life of oil with the consequence of reducing maintenance costs and downtime.

Oil analysis can be sorted into two categories, namely physical and chemical analysis and WDA analysis [3].

Oil testing

Oil testing or Oil analysis is the process of analyzing the physical, chemical, and performance characteristics of different types of oils, such as crude oil, refined petroleum products, lubricants, and edible oils. Oil analysis is a routine activity for analyzing oil health, oil contamination and machine wear.

The purpose of an oil analysis program is to verify that a lubricated machine is operating according to expectations. When an abnormal condition or parameter is identified through oil analysis, immediate actions can be taken to correct the root cause or to mitigate a developing failure.

There are three main categories of oil analysis: fluid properties, contamination and wear debris.

Fluid Properties

This type of oil analysis focuses on identifying the oil's current physical and chemical state as well as on defining its remaining useful life (RUL).

Contamination

By detecting the presence of destructive contaminants and narrowing down their probable sources (internal or external), oil analysis can help answer questions such as: 1. Is the oil clean? 2. What types of contaminants are in the oil?

Wear Debris

This form of oil analysis is about determining the presence and identification of particles produced as a result of mechanical wear, corrosion or other machine surface degradation.

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