CONDITION MONITORING

Common Causes of Abnormal Vibration in Machines

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Origins of Machines Faults?

Some levels (normal) of vibration in machines are expected as various forces influence the dynamic behavior at normal operating conditions. However, this becomes a challenge when the expected vibration amplitude levels (especially at known fault frequencies) deviate significantly from the normal. In most cases, the faults that show up on machines are because of wrong practices carried out during various aspects of operation and usage. Here we look at the practices and the after-effects (faults).

Practices

Some of the common causes of high vibration levels in machines stem from imperfections that are largely due to carrying out the following practices incorrectly:

- Design: Errors in design can lead to higher vibration levels than normal in machines. We have experienced some field cases where poor design layouts of suction and discharge lines caused pipe strain in centrifugal pumps.
- Manufacture: Inherent defects such as metal casting flaws or even machining errors during manufacturing processes can lead to significant deviations from normal vibration levels at the onset of a machine's life.
- Assembly: Improper assembly of machine parts can lead to eccentricity issues with parts out of alignment from the beginning of operations.
- Installation: Installation of mis-fit bearings / bearing housings is a common cause of high vibration since such improper fits can lead to play and out of specification tolerances.
- Operation: Operating machines out of the manufacturer's specified limits can lead to severe increase in vibration amplitude levels. From experience,

operating a pump outside its designated limits can cause cavitation (visible from vibration spectral plots) which significantly reduces the life of the asset.

- Maintenance: Wrong maintenance practices can result in higher-than-normal machinery vibration levels. Practices such as hammering a bearing, use of wrong replacement spares and poor lubrication practices will lead to high vibration and early wear of machine parts.
- Wear: Machine parts will eventually wear and deteriorate due to age, usage and length of service causing high vibration amplitude levels.

Faults

Furthermore, at the machine level, common faults show up as the after-effects of any shortcomings in dealing with above mentioned practices. Listed below are some of the commonplace faults that will cause machine vibration levels to deviate from the normal.

- Unbalance
- Misalignment
- Damaged Belts and Pulleys
- Lubrication breakdown
- Bearing Defects
- Gear problems
- Looseness
- Bent Shaft
- Bearing Housing Distortion
- Load / Process Variation
- Electrical related issues
- Damaged Rotor Bars
- Flow related issues
- Pump Impeller wear
- Cavitation
- Rub
- Oil Whirl and Oil Whip
- Resonance (Amplification of amplitude levels)

Mitigating Issues with Abnormal Machine Vibration Levels

- Good Practices and Proper Maintenance Culture: Following good practices during design manufacture, assembly, installation, operation and maintenance will ensure that issues of abnormal vibration levels are kept to a minimum. An environment that fosters proper maintenance culture should be encouraged. The use of technology and other non-intrusive maintenance techniques (vibration analysis, oil analysis, thermography, etc.) should be utilized where possible.
- Training: Personnel associated with operations and maintenance of machines should be properly trained in best practices techniques to improve how they interact with critical machines.
- Measure and Analyse Vibration data routinely: Measurement and analysis of Vibration Data will help in spotting the onset of a change in the machine's condition. It also helps to specify the likely faults and reasons for any deviations observed. This in turn means that proper measures can be recommended and implemented to prevent any secondary damages or catastrophic in-service failures.

Brain Teasers: Check your Comprehension

Q1: Which one of the following is not classed as a practice that can cause abnormal vibration in machines? (A): Bearing Defect (B): Manufacture (C): Assembly

Q2: Which one of the following is a common fault that can be identified by vibration analysis? (A): Change in Viscosity (B): Broken Rotor Bar (C): Increase in temperature

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