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Course Name

Mechanical Vibration Analysis & Diagnostics

Sector Name

Mechanical Engineering

Document Type

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Mechanical Vibration Analysis & Diagnostics

Course Introduction

Vibration is one of the most valuable sources of information about the mechanical behavior of rotating equipment, but a high vibration reading alone does not explain what is wrong. Imbalance, misalignment, looseness, bearing defects, resonance, gear problems, and other mechanical conditions can produce different patterns, while speed, load, and operating changes can alter the signals being observed. Effective diagnosis therefore requires more than measuring vibration; engineers need to understand what the signal is revealing about machine behavior.

Boost Consulting & Training offers this course to develop practical capability in mechanical vibration analysis and equipment diagnostics. Participants progress from vibration fundamentals and measurement practices to waveform and spectrum interpretation, frequency identification, fault-pattern recognition, resonance assessment, and diagnostic reasoning. Practical cases emphasize combining vibration evidence with operating and mechanical information before reaching conclusions about equipment condition.

The **main concept of this course** is to translate vibration signals into mechanical evidence that helps engineers distinguish between possible equipment problems and make better diagnostic decisions.

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Target Audience

- ✓ Mechanical and rotating equipment engineers
- ✓ Vibration and condition monitoring professionals
- ✓ Plant and equipment engineers
- ✓ Technical specialists involved in machinery diagnostics

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Learning Objectives

- ✓ Explain the fundamental principles and characteristics of mechanical vibration.
- ✓ Select appropriate vibration measurement locations, parameters, and techniques.
- ✓ Interpret time waveforms, frequency spectra, amplitude, phase, and frequency information.
- ✓ Relate vibration frequencies to rotating equipment components and operating speed.
- ✓ Recognize vibration patterns associated with common mechanical faults.
- ✓ Distinguish imbalance, misalignment, looseness, bearing, gear, and resonance-related conditions.
- ✓ Combine vibration findings with operating and mechanical evidence.
- ✓ Apply a structured diagnostic process to rotating equipment vibration problems.

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Mechanical Vibration Analysis & Diagnostics

Course Outline

✓ Day 01

Understanding Mechanical Vibration

Reading Machine Motion

- ✓ Understand displacement, velocity, acceleration, frequency, amplitude, and phase.
- ✓ Relate vibration characteristics to different types of machine motion.
- ✓ Distinguish periodic, transient, and complex vibration behavior.

Capturing Meaningful Vibration Data

- ✓ Select appropriate measurement points and directions on rotating equipment.
- ✓ Understand the role of sensors, mounting, measurement settings, and machine operating conditions.
- ✓ Complete a **Vibration Measurement Planning Exercise** for an equipment train.

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Course Outline

✓ Day 02

Turning Signals into Mechanical Information

Interpreting Time and Frequency Data

- ✓ Read time waveforms and understand what changes in signal shape can indicate.
- ✓ Use frequency spectra to separate vibration components within a complex signal.
- ✓ Connect frequency peaks with machine speed and mechanical components.

Recognizing Significant Patterns

- ✓ Distinguish fundamental running speed, harmonics, sidebands, and non-synchronous components.
- ✓ Evaluate changes in amplitude and frequency across operating conditions.
- ✓ Complete a **Vibration Signal Interpretation Challenge** using contrasting machine signatures.

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Course Outline

✓ Day 03

Diagnosing Common Mechanical Faults

Identifying Imbalance and Misalignment

- ✓ Recognize vibration characteristics commonly associated with rotating imbalance.
- ✓ Distinguish angular and parallel misalignment through vibration behavior.
- ✓ Combine axial and radial measurements with mechanical observations.

Detecting Looseness and Structural Problems

- ✓ Identify patterns associated with mechanical looseness and unstable components.
- ✓ Examine soft foot, foundation effects, and structural movement.
- ✓ Conduct a **Mechanical Fault Diagnosis Case** using multiple vibration measurements.

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Mechanical Vibration Analysis & Diagnostics

Course Outline

✓ Day 04

Investigating Complex Vibration Conditions

Detecting Bearing and Gear Problems

- ✓ Recognize vibration behavior associated with rolling-element bearing deterioration.
- ✓ Interpret gear mesh frequencies, sidebands, and changing gear conditions.
- ✓ Distinguish component-related signals from other vibration sources.

Understanding Resonance and Operating Influence

- ✓ Explain natural frequency, resonance, and amplification of machine vibration.
- ✓ Evaluate how speed and load changes can expose or suppress vibration problems.
- ✓ Run a **Resonance Investigation Exercise** using changing operating conditions.

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Course Outline

✓ Day 05

Making Diagnostic Decisions from Vibration Evidence

Combining Multiple Sources of Evidence

- ✓ Compare vibration findings with temperature, sound, lubrication, inspection, and operating data.
- ✓ Separate strong diagnostic evidence from coincidental signal changes.
- ✓ Determine when additional measurements are needed before reaching a conclusion.

Solving the Vibration Case

- ✓ Develop and test competing explanations for abnormal machinery vibration.
- ✓ Determine appropriate engineering responses based on the diagnosed condition and severity.
- ✓ Complete a **Mechanical Vibration Diagnostic Case** from raw measurements and operating information through fault identification and recommended action.

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
Dec. 7, 2026	Dec. 11, 2026	5 days	4250.00 \$	UAE , Dubai

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