
Rotating Equipment Vibration Diagnostics Training Course

5 – 9 July 2027
Istanbul





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Programme Summary

Rotating equipment vibration diagnostics is a five-day training course for machinery and reliability leaders at advanced level, culminating in a diagnostic and corrective action report for a problem machine from their own plant. Pumps, compressors, turbines, fans and motors often run for months with a known vibration problem because the evidence is ambiguous and the fault is never confirmed. The approach moves from vibration behaviour and measurement to fault signatures, failure mechanisms and repair decisions. Mars Training Centre UK delivers this programme in rotating equipment vibration diagnostics for oil, gas, petrochemical and power plants.

The Business Case

A misread spectrum leads to the wrong repair: a machine is rebalanced when the cause is resonance, or bearings are replaced while misalignment destroys the next set. Leaders who can test a diagnosis against several kinds of evidence approve the right intervention first time.

- Repeat Failures: Fall as the underlying cause is confirmed before parts are changed.
- Machine Availability: Rises as severity is judged correctly and interventions are planned rather than forced.
- Repair and Spares Cost: Reduces as unnecessary overhauls and misdirected repairs are avoided.

Principles and Evidence Base

- ISO 20816: Its evaluation zones set the severity judgements applied from Session 1 onwards.
- ISO 13373: Its vibration diagnostic techniques structure the signature analysis in Sessions 2 and 3.
- ISO 15243: Its classification of rolling bearing damage guides the component failure analysis in Session 4.
- ISO 21940 and API 670: Balance quality grades and machinery protection practice frame the corrective decisions in Session 5.

Intended Participants

- Leaders who decide whether a vibrating machine keeps running, is repaired or is shut down.
- Managers who review vibration reports from in-house analysts and service contractors.
- Engineering heads who approve balancing, alignment, foundation or design changes.
- Reliability leads who investigate repeat failures on critical machinery.

The programme serves upstream oil and gas, refining, petrochemicals and power generation.



Learning Outcomes

1. Participants will be able to evaluate machine vibration severity against recognised evaluation zones.
2. Participants will be able to diagnose unbalance, misalignment and looseness from spectrum, waveform and phase evidence.
3. Participants will be able to diagnose bearing, gear, resonance and rotor instability faults on rotating equipment.
4. Participants will be able to construct a failure analysis linking a damaged component to its failure mechanism.
5. Participants will be able to justify a corrective action such as balancing, alignment or redesign.
6. Participants will be able to prioritise problem machines for intervention by risk and evidence strength.

Programme Structure

Day 1: Rotating Equipment Vibration Fundamentals

What does vibration reveal about a machine, and how severe is it?

- Displacement, Velocity and Acceleration Measures
- Sensors, Mounting and Proximity Probe Practice
- FFT Spectrum, Time Waveform and Resolution Choices
- ISO 20816 Evaluation Zones for Machine Classes
- Machine Train Data Sheets and Forcing Frequencies

Day 2: Diagnosing Common Mechanical Faults

How are unbalance, misalignment and looseness told apart?

- Unbalance Signatures and Phase Behaviour
- Angular and Parallel Misalignment Patterns
- Structural and Rotating Looseness Indicators
- Phase Analysis Across Bearings and Planes
- Bent Shafts, Eccentricity and Soft Foot

Day 3: Bearings, Gears, Resonance and Instability

Which signatures point to component defects or dynamic problems?

- Rolling Bearing Defect Frequencies and Envelope Analysis
- Gear Mesh Frequencies and Sideband Interpretation
- Natural Frequencies, Bump Tests and Operating Deflection Shapes
- Orbit, Shaft Centreline, Bode and Nyquist Plots
- Oil Whirl, Rubs and Rotor Instability in Turbomachinery



Day 4: Machinery Failure Mechanisms and Analysis

Why did the component fail, and what does the damage show?

- ISO 15243 Rolling Bearing Damage Modes
- Fatigue, Wear, Corrosion and Overload Mechanisms
- Seal, Coupling and Shaft Failure Patterns
- Electrical Faults in Motors and Their Vibration Effects
- Evidence Preservation and Failure Analysis Reports

Day 5: Applying Vibration Diagnostics to Repair Decisions

Which corrective action removes the cause, and how urgent is it?

- Combining Day 2 and Day 3 Evidence into a Confirmed Diagnosis
- Balancing Decisions and ISO 21940 Balance Quality Grades
- Alignment, Foundation and Redesign Options from Day 4 Findings
- API 670 Protection Settings and Run-or-Stop Judgement
- Diagnostic and Corrective Action Report Completion

Methodology

The programme is built around a data workshop using recorded spectra, waveforms, orbits and failed component images from pumps, compressors, steam and gas turbines and fans in oil, gas and power plants. Each session moves from a short briefing to group diagnosis of case data, followed by a challenge in which teams defend their conclusion.

- Suggested activity: Separating unbalance from resonance on a cooling tower fan.
- Suggested activity: Diagnosing a bearing defect on a crude transfer pump from envelope data.
- Suggested activity: Interpreting orbit and Bode plots from a compressor coast-down.

Capstone Output

Each participant completes a diagnostic and corrective action report for a problem machine from their own plant or a case set. It records the evidence, severity assessment, confirmed fault, likely failure mechanism, recommended action and urgency.

Frequently Asked Questions

Is rotating equipment vibration diagnostics suitable for engineering managers rather than analysts?

Yes. It is set at advanced level for leaders who review vibration findings and approve repairs. It assumes machinery experience; analysis methods are explained before they are applied.



Which standards does rotating equipment vibration diagnostics rest on?

It rests on ISO 20816 for severity evaluation, ISO 13373 for diagnostic techniques, ISO 15243 for bearing damage, ISO 21940 for balancing and API 670 for machinery protection.

How is the rotating equipment vibration diagnostic report used at work?

You can use it to decide whether a machine runs, is repaired or is redesigned, and to brief contractors on the work required.

How does rotating equipment vibration diagnostics differ from condition monitoring programme training?

It concentrates on confirming specific machine faults and choosing repairs, rather than designing and governing a monitoring programme across an asset base.