CONCEPT

Vibration Analysis and Condition Monitoring: FFT Spectra, Fault Diagnosis and ISO 20816

5 – 9 July 2027
London - Central London four-star



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Introduction:

Bearing, coupling and gearbox failures on rotating machinery often give weeks of warning in their vibration signature, yet many plants collect readings that are never analysed or acted on. Vibration analysis turns those readings into a diagnosis and a repair decision before a breakdown. This Core Concept course trains maintenance and reliability staff to take sound measurements, read FFT spectra and time waveforms, identify common machine faults, judge severity against ISO 20816 and run a route-based condition monitoring programme. Participants produce a Condition Monitoring Route Plan and Vibration Fault Report Pack for machines from their own site.

Course Objectives:

- Collect repeatable vibration data by selecting the right transducer, mounting method, measurement point and unit for each machine
- Configure FFT settings and read spectra, time waveforms and phase to separate machine frequencies from background vibration
- Diagnose unbalance, misalignment, looseness, rolling bearing defects, gear faults and resonance from their characteristic vibration patterns
- Evaluate overall vibration severity against ISO 20816-1 and ISO 20816-3 and set baseline, alert and alarm levels for trending
- Confirm vibration findings with envelope analysis, oil analysis and infrared thermography before recommending repair
- Design a route-based condition monitoring programme and write fault reports that give planners a clear severity and action

Target Audience:

- Maintenance engineers responsible for the availability and repair of motors, fans, pumps, gearboxes and other rotating machines
- Reliability engineers who define monitoring tasks and follow up repeat failures on critical equipment
- Condition monitoring technicians who collect route data and carry out first-line analysis
- Mechanical and electrical technicians who act on vibration findings through alignment, balancing and bearing replacement
- Maintenance planners and supervisors who schedule work from condition reports

Course Outline:

Day 1: Vibration Fundamentals and Measurement Practice

- Amplitude, Frequency and Phase in Displacement, Velocity and Acceleration Terms
- Peak, Peak-to-Peak and RMS Values with a Unit Conversion Worksheet
- Accelerometers, Velocity Sensors and Proximity Probes Selected by Frequency Range
- Sensor Mounting by Stud, Adhesive Pad and Magnet and Its Effect on Usable Bandwidth
- Measurement Point Naming, Axis Convention and Machine Sketch Template

Day 2: Signal Processing, FFT Spectrum and Severity Standards

- FFT Set-Up: Maximum Frequency, Lines of Resolution, Windowing and Averaging
- Time Waveform Reading for Impacts, Beats, Truncation and Rubs
- Phase Measurement with Tachometer Reference and Cross-Channel Comparison
- ISO 20816-1 General Guidelines for Measuring and Evaluating Machine Vibration
- ISO 20816-3 Severity Evaluation for Industrial Machinery and Its Replacement of ISO 10816-3

Day 3: Diagnosing Common Rotating Machinery Faults

- Unbalance Signature: Running Speed Radial Peak and Phase Relationship
- Misalignment Signature: Angular and Parallel Offset Patterns in Axial and Radial Spectra
- Mechanical Looseness Types: Structural, Rotating and Bearing Fit Harmonic Patterns
- Rolling Bearing Defect Frequencies: BPFO, BPFI, BSF and FTF Calculation
- Gear Mesh Frequency, Sidebands and Hunting Tooth Pattern Diagnosis

Day 4: Envelope Analysis, Resonance and Complementary Techniques

- Envelope Demodulation for Early-Stage Bearing Defect Detection
- Resonance Identification with Bump Test and Run-Up or Coast-Down Plot
- Oil Analysis Results on Wear Debris, Viscosity and Contamination as Confirmation
- Infrared Thermography of Bearings, Couplings and Motors Under ISO 18434-1
- Diagnostic Pitfalls: Electrical Versus Mechanical Sources, Variable Speed and Belt Frequencies

Day 5: Monitoring Programme Case Work and Fault Reporting

- Route Plan Drafting with ISO 17359 Steps: Criticality, Points and Intervals for an Own Machine Set
- Baseline, Alert and Alarm Limit Setting from Sample Trend Data
- Spectrum Case Work on Motor, Fan and Gearbox Data Sets from Several Sectors
- Fault Report Writing: Severity Rating, Evidence and Recommended Action
- Condition Monitoring Route Plan and Fault Report Pack Assembly and Peer Review

Skills You Will Gain:

- Vibration Data Acquisition
- FFT Spectrum Interpretation
- Time Waveform Analysis
- Machinery Fault Diagnosis
- Bearing Envelope Analysis
- Vibration Severity Assessment
- Condition Monitoring Route Design
- Technical Fault Reporting

Why Attend This Course:

- Return with a Condition Monitoring Route Plan and Vibration Fault Report Pack prepared for machines from your own site
- Move from collecting overall readings to naming the fault, its severity and the repair needed
- Give planners reports they can schedule from, cutting emergency repairs and needless machine opening
- Compare spectra and monitoring practice with peers from oil and gas, power, water, mining and manufacturing

Conclusion:

Vibration analysis pays off when sound measurements, correct interpretation and a disciplined reporting routine work together. The course moves from vibration units, transducers and mounting, through FFT set-up, time waveforms, phase and ISO 20816 severity evaluation, to the signatures of unbalance, misalignment, looseness, bearing and gear faults, and then to envelope analysis, resonance testing, oil analysis and thermography. The final day applies these methods to case data and produces a Condition Monitoring Route Plan and Vibration Fault Report Pack ready for site use.