



ME159: Vibration Analysis CAT II

Training Description:

The **Level II Vibration Analysis Certification** course is designed for maintenance and reliability professionals who have successfully completed Level I Vibration Analysis or possess equivalent practical experience. This intensive training course develops the knowledge and practical skills required to perform advanced vibration measurements, diagnose machinery faults, evaluate machine condition, recommend corrective actions and optimize predictive maintenance (PdM) programs.

The training course follows the competency requirements of **ISO 18436-2 (Condition Monitoring and Diagnostics of Machines – Requirements for Qualification and Assessment of Personnel)** and prepares participants for internationally recognized Level II certification examinations offered by accredited certification bodies which our training instructor will guide the attendee's step by step.

Participants will learn how to analyze vibration spectra, identify multiple machine faults, interpret phase and time waveform data, establish alarm limits, conduct field balancing fundamentals and produce professional condition monitoring reports.

Training Objectives:

By the end of the training, participants will be able to learn:

- ✓ Understand the principles of machine dynamics and vibration behavior
- ✓ Perform accurate vibration measurements using modern analyzers
- ✓ Interpret FFT spectra, time waveforms, phase, and orbit plots
- ✓ Diagnose common and complex rotating machinery faults
- ✓ Distinguish between multiple simultaneous machinery defects
- ✓ Identify resonance and structural vibration problems
- ✓ Evaluate bearing, gear, motor, and pump conditions
- ✓ Establish vibration severity criteria and alarm settings
- ✓ Apply advanced diagnostic techniques
- ✓ Recommend corrective maintenance actions
- ✓ Improve predictive maintenance strategies
- ✓ Prepare professional vibration analysis reports
- ✓ Prepare for ISO 18436-2 Level II certification examination

Training Designed for:

This course is intended for Vibration Analysts (Level I certified), Condition Monitoring Engineers, Reliability Engineers, Mechanical Engineers, Rotating Equipment Engineers, Maintenance Engineers, Predictive Maintenance Specialists, Plant Engineers, Asset Integrity Engineers, Inspection Engineers, Reliability Supervisors, Maintenance Supervisors and Technical Consultants.

Prerequisites

- Level I Vibration Analysis Certification (recommended)
- Practical machinery vibration measurement experience
- Basic understanding of rotating equipment

Training Requirement:

“Hand’s on practical sessions, equipment and software will be applied during the course if required and as per the client’s request.”

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

ADVANCED VIBRATION FUNDAMENTALS & DATA COLLECTION

- ❖ **Module 1: Review of Vibration Principles**
 - Review of vibration terminology
 - Simple harmonic motion
 - Frequency relationships
 - Amplitude units
 - Velocity, acceleration, displacement
 - Peak, RMS, Peak-to-Peak
 - Crest factor
 - Phase concepts
- ❖ **Module 2: Machine Dynamics**
 - Natural frequency
 - Resonance
 - Critical speed
 - Damping
 - Stiffness
 - Structural flexibility
 - Dynamic amplification
- ❖ **Module 3: Data Collection Techniques**
 - Sensor selection
 - Accelerometers
 - Velocity sensors
 - Proximity probes
 - Mounting methods
 - Measurement locations
 - Repeatability
 - Route data collection
 - Data quality assurance
- ❖ **Module 4: FFT Analysis**
 - Fourier Transform review
 - Spectral resolution
 - Frequency range selection
 - Windowing

- Averaging
- Aliasing
- Leakage
- Dynamic range
- ❖ **Practical Exercises:**
 - Instrument setup
 - Data collection practice
 - FFT configuration
 - Measurement troubleshooting

DAY TWO:

MACHINERY FAULT DIAGNOSIS

- ❖ **Module 5: Rotor Unbalance**
 - Static unbalance
 - Couple unbalance
 - Dynamic unbalance
 - Frequency characteristics
 - Diagnostic indicators
 - Corrective actions
- ❖ **Module 6: Misalignment**
 - Parallel misalignment
 - Angular misalignment
 - Combination misalignment
 - Coupling effects
 - Axial vibration analysis
- ❖ **Module 7: Mechanical Looseness**
 - Structural looseness
 - Rotating looseness
 - Foundation looseness
 - Soft foot
 - Hold-down bolt issues
- ❖ **Module 8: Mechanical Defects**
 - Bent shaft
 - Eccentric rotor
 - Rotor rub
 - Cracked shaft
 - Broken rotor bars
 - Cavitation
 - Hydraulic instability
- ❖ **Practical Exercises:**
 - Fault recognition
 - Spectrum interpretation
 - Multiple fault diagnosis

DAY THREE:

BEARINGS, GEARS & ELECTRICAL FAULTS

❖ **Module 9: Rolling Element Bearings**

- Bearing geometry
- Bearing frequencies
- BPFO
- BPFH
- BSF
- FTF
- Envelope analysis
- High-frequency detection
- Lubrication effects

❖ **Module 10: Gear Analysis**

- Gear mesh frequency
- Sidebands
- Tooth wear
- Tooth cracking
- Gear eccentricity
- Backlash
- Lubrication faults

❖ **Module 11: Belt and Pulley Systems**

- Belt defects
- Pulley eccentricity
- Belt resonance
- Sheave misalignment

❖ **Module 12: Electric Motor Diagnostics**

- Rotor faults
- Stator faults
- Air gap eccentricity
- Electrical frequencies
- Variable frequency drives

❖ **Practical Exercises:**

- Bearing fault diagnosis
- Gearbox analysis
- Motor fault case studies

DAY FOUR:

ADVANCED DIAGNOSTIC TECHNIQUES

❖ **Module 13: Time Waveform Analysis**

- Waveform interpretation
- Impact detection
- Modulation
- Pulse analysis
- Transient events

- ❖ **Module 14: Phase Analysis**
 - Phase measurement
 - Cross-channel analysis
 - Relative phase
 - Misalignment diagnosis
 - Resonance identification
- ❖ **Module 15: Resonance Testing**
 - Bump testing
 - Operating deflection shapes
 - Natural frequency identification
 - Structural resonance
- ❖ **Module 16: Field Balancing Fundamentals**
 - Single-plane balancing
 - Two-plane balancing concepts
 - Trial weights
 - Correction calculations
 - Balance quality grades
- ❖ **Practical Exercises:**
 - Phase analysis
 - Waveform interpretation
 - Balancing calculations
 - Resonance case studies

DAY FIVE:

CONDITION MONITORING PROGRAM & CERTIFICATION PREPARATION

- ❖ **Module 17: Vibration Standards**
 - ISO 20816
 - ISO 10816 overview
 - ISO 7919 overview
 - Alarm limits
 - Acceptance criteria
- ❖ **Module 18: Predictive Maintenance Strategy**
 - Route development
 - Criticality assessment
 - Inspection intervals
 - Trending
 - KPI development
- ❖ **Module 19: Diagnostic Reporting**
 - Report structure
 - Severity assessment
 - Maintenance recommendations
 - Root cause considerations
 - Communication with maintenance teams
- ❖ **Module 20: Certification Examination Preparation**

- Examination structure
- Sample questions
- Problem-solving strategies
- Practical interpretation exercises
- Mock examination
- Review of common mistakes
- ❖ **Final Practical Assessment**
 - Complete machine diagnosis
 - Vibration spectrum interpretation
 - Fault identification
 - Corrective action recommendations
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Methodology:

The course includes:

- Practical vibration analysis workshops
- Case studies
- Machine fault simulations
- Spectrum interpretation exercises
- Real industrial vibration datasets
- Hands-on software demonstrations
- Daily quizzes
- Mock certification examination

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Fees:

TBA as per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

- 07:45 - 08:00 Morning Coffee / Tea
- 08:00 - 10:00 First Session
- 10:00 - 10:20 Recess (Coffee/Tea/Snacks)
- 10:20 - 12:20 Second Session

12:20 - 13:00 Recess (Prayer Break & Lunch)
13:00 - 14:00 Last Session

For training registrations or in-house enquiries, please contact:

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