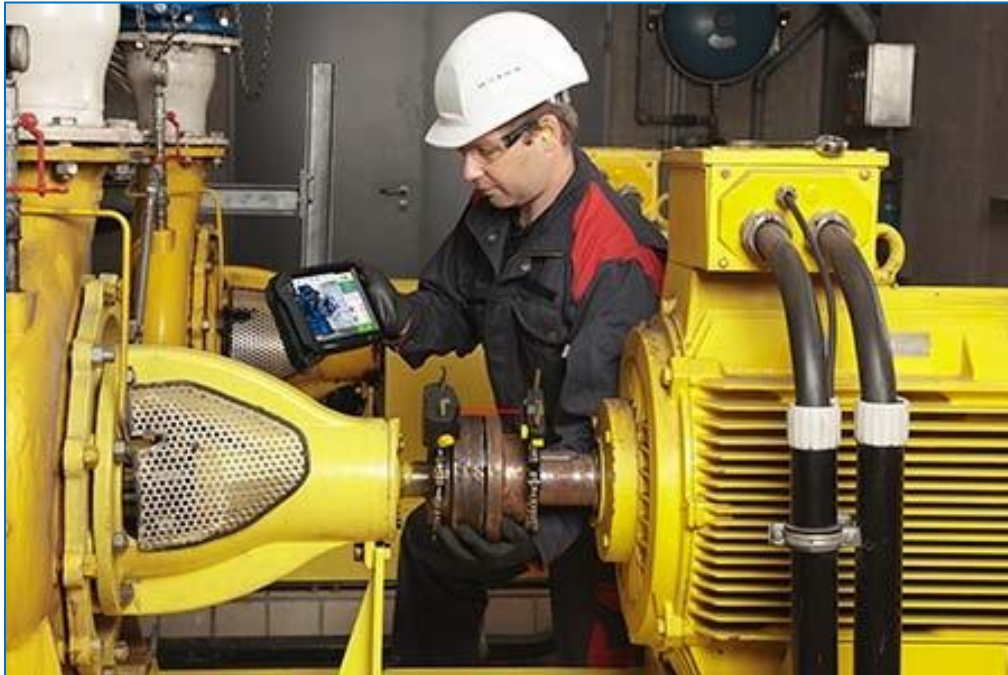




MU164: Mechanical Shaft Alignment & Vibration Analysis

Training Description:

Mechanical Shaft Alignment & Vibration Analysis is a comprehensive, practical training program designed to provide maintenance and reliability professionals with the knowledge and skills required to accurately align rotating machinery and diagnose vibration-related problems. The training course combines the principles of precision shaft alignment with vibration measurement, analysis and corrective maintenance techniques to improve equipment reliability, reduce downtime, minimize energy losses and extend machinery life.

Participants will gain hands-on knowledge of laser alignment systems, dial indicator methods, vibration monitoring instruments, balancing concepts, fault diagnosis and best maintenance practices in accordance with internationally recognized standards and industrial practices.

Training Objectives:

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

- ✓ Understand the fundamentals of rotating equipment reliability
- ✓ Explain the causes and effects of shaft misalignment and excessive vibration
- ✓ Perform precision shaft alignment using dial indicators and laser alignment systems
- ✓ Apply alignment tolerances based on machine operating conditions
- ✓ Understand thermal growth and machinery movement
- ✓ Measure and analyze machinery vibration using modern instruments
- ✓ Interpret vibration spectra and identify common machinery faults
- ✓ Diagnose bearing defects, imbalance, looseness, resonance and gear faults
- ✓ Implement corrective actions based on vibration analysis.
- ✓ Integrate shaft alignment and vibration monitoring into predictive maintenance programs.
- ✓ Improve equipment availability while reducing maintenance costs

Training Designed for:

This course is intended for Mechanical Engineers, Maintenance Engineers, Reliability Engineers, Rotating Equipment Engineers, Plant Engineers, Maintenance Supervisors, Mechanical Technicians, Predictive Maintenance Personnel, Condition Monitoring Specialists, Reliability Specialists, Asset Integrity Engineers, Field Service Engineers, Maintenance Planners and Operations Personnel responsible for rotating machinery.

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:

FUNDAMENTALS OF ROTATING MACHINERY, SHAFT ALIGNMENT & VIBRATION

❖ Introduction to Rotating Equipment

- Pumps
- Compressors
- Motors
- Turbines
- Fans
- Blowers
- Gearboxes
- Couplings

❖ Machinery Reliability Fundamentals

- Reliability-centered maintenance principles
- Equipment failure mechanisms
- Maintenance strategies
 - Reactive
 - Preventive
 - Predictive
 - Reliability-centered maintenance (RCM)

❖ Fundamentals of Shaft Alignment

- What is shaft alignment?
- Why precision alignment matters
- Consequences of misalignment
- Machine operating conditions
- Alignment terminology

❖ Introduction to Machinery Vibration

- What is vibration?
- Types of vibration
- Vibration parameters
 - Displacement
 - Velocity
 - Acceleration
- Frequency
- Amplitude
- Phase

❖ Effects of Excessive Vibration

- Bearing damage
- Seal failures
- Coupling failures
- Energy losses
- Increased maintenance costs
- Equipment downtime

DAY TWO:

PRECISION SHAFT ALIGNMENT TECHNIQUES

❖ Causes of Misalignment

- Offset misalignment
- Angular misalignment

- Combination misalignment
- Soft foot
- Pipe strain
- Base distortion
- Thermal growth
- ❖ **Alignment Measurement Methods**
- ❖ **Straight Edge Method**
- ❖ **Feeler Gauge Method**
- ❖ **Dial Indicator Alignment**
 - Rim and face method
 - Reverse dial method
 - Indicator setup
 - Data collection
 - Error elimination
- ❖ **Laser Shaft Alignment**
 - Laser alignment principles
 - Equipment setup
 - Measurement procedures
 - Live move techniques
 - Vertical machine alignment
 - Horizontal machine alignment
- ❖ **Alignment Corrections**
 - Shim calculations
 - Machine movement
 - Horizontal corrections
 - Vertical corrections
- ❖ **Alignment Tolerances**
 - ANSI recommendations
 - ISO considerations
 - RPM-based tolerances
 - Coupling tolerances
- ❖ **Practical Exercises:**
 - Dial indicator alignment
 - Laser alignment practice
 - Soft foot correction
 - Machine movement practice

DAY THREE:

MACHINERY VIBRATION MEASUREMENT & ANALYSIS

- ❖ **Fundamentals of Vibration Monitoring**
 - Predictive maintenance concepts
 - Condition monitoring programs
 - Data collection routes
- ❖ **Vibration Measuring Instruments**
 - Accelerometers
 - Velocity sensors

- Displacement probes
- Portable vibration analyzers
- Online monitoring systems
- ❖ **Vibration Data Collection**
 - Sensor mounting methods
 - Measurement directions
 - Data quality
 - Repeatability
 - Baseline measurements
- ❖ **Understanding FFT Analysis**
 - Time waveform
 - Frequency spectrum
 - FFT concepts
 - Harmonics
 - Sidebands
- ❖ **Vibration Standards**
 - ISO 10816
 - ISO 20816
 - Alarm limits
 - Acceptance criteria
- ❖ **Practical Session:**
 - Collecting vibration data
 - Using portable analyzers
 - Basic spectrum interpretation

DAY FOUR:

MACHINERY FAULT DIAGNOSIS

- ❖ **Machinery Fault Identification**
- ❖ **Rotor Imbalance**
 - Static imbalance
 - Dynamic imbalance
 - Couple imbalance
- ❖ **Shaft Misalignment**
 - Parallel
 - Angular
 - Combination
- ❖ **Mechanical Looseness**
 - Structural looseness
 - Rotating looseness
- ❖ **Bearing Defects**
 - Inner race defects
 - Outer race defects
 - Rolling element defects
 - Cage defects
- ❖ **Gearbox Faults**
 - Gear mesh frequency

- Broken gear teeth
- Gear wear
- ❖ **Belt Drive Problems**
 - Belt frequency
 - Pulley misalignment
- ❖ **Electrical Faults**
 - Rotor bar defects
 - Electrical unbalance
 - Air gap problems
- ❖ **Resonance**
 - Natural frequency
 - Structural resonance
- ❖ **Advanced Spectrum Analysis**
 - Phase analysis
 - Envelope analysis
 - Trending
 - Fault severity assessment
- ❖ **Corrective Maintenance**
 - Root cause identification
 - Maintenance recommendations
 - Verification testing

DAY FIVE:

INTEGRATED RELIABILITY IMPROVEMENT & PRACTICAL APPLICATIONS

- ❖ **Balancing Fundamentals**
 - Static balancing
 - Dynamic balancing
 - Field balancing overview
- ❖ **Integrated Alignment and Vibration Program**
 - Alignment verification
 - Commissioning checks
 - Acceptance testing
 - Condition-based maintenance
- ❖ **Reliability Improvement**
 - Root Cause Failure Analysis (RCFA)
 - Failure prevention
 - Maintenance optimization
 - Lubrication considerations
- ❖ **Developing Predictive Maintenance Programs**
 - Inspection intervals
 - Vibration routes
 - Critical equipment ranking
 - Reporting techniques
- ❖ **Case Studies**
 - Pump alignment failures
 - Motor vibration problems

- Compressor diagnostics
- Fan balancing
- Turbine alignment issues
- Gearbox fault diagnosis
- ❖ **Practical Workshop**
 - Complete shaft alignment exercise
 - Vibration data acquisition
 - Fault diagnosis using vibration spectra
 - Corrective action planning
 - Verification measurements
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

Training Methodology:

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 Certificate(s):

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

Training Fees:

USD\$ - 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 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 14:00	Last Session

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

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