

# VIBRATION ANALYSIS & CONDITION MONITORING



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## **TRAINING TITLE**

VIBRATION ANALYSIS & CONDITION MONITORING

## **VENUE**

Dubai, UAE

## **DURATION**

5 Days

## **DATES**

17 - 21 January 2021

## **PRICE**

US\$4,000 per attendee including training material/handouts, morning/afternoon coffee breaks and Lunch buffet.

## **TRAINING INTRODUCTION**

This course provides a detailed examination of the detection, location and diagnosis of faults in rotating and reciprocating machinery using vibration analysis. The basics and underlying physics of vibration signals are first examined. The acquisition and processing of signals is then reviewed followed by a discussion of machinery fault diagnosis using vibration analysis. The course is concluded by a review of the other techniques of predictive maintenance such as oil and particle analysis, ultrasound and infrared thermography with an introduction to automated machine condition monitoring.

## **TRAINING OBJECTIVES**

**Upon completing this course, participants will be able to:**

- Understand the basics of vibration measurement
- Demonstrate the basics of signal analysis
- Understand measurement and the characteristics of vibration signals
- Understand how to use Data Acquisition Equipment for vibration signals

- Apply vibration analysis for different machinery faults
- Apply specific techniques for pumps, compressors, engines, turbines and motors
- Apply vibration based fault detection and diagnostic techniques
- Diagnose machinery related problems with vibration analysis techniques
- Apply advanced signal processing techniques and tools to Vibration analysis
- Detect, locate and diagnose faults in rotating and reciprocating machinery using vibration analysis techniques
- Identify conditions of resonance and be able to rectify these problems
- Understand the basic advantages of allied predictive techniques such as oil analysis, thermography, ultrasonics and performance evaluation

### **TRAINING AUDIENCE**

Engineers, engineering supervisors and managers responsible for designing or qualifying mechanical components, equipment, piping and structures subjected to dynamic forces; those responsible for auditing, reviewing, or approving shock and vibration analysis tasks. Those with a few years of experience in vibration analysis as well as those who are new to the area will benefit.

### **TRAINING OUTLINE**

#### **Introduction**

- Definition of Machinery Monitoring, Fault Diagnostics and Failure
- Maintenance Strategies and their application (pros and cons)
- Principles of Predictive Maintenance (including specific tasks)
- Periodic Monitoring versus Continuous Monitoring
- Various Techniques of Predictive Maintenance
- Vibration Analysis as a Key Technique

## **Part 1 THEORY: INTRODUCTION TO VIBRATION ANALYSIS**

### **Chapter 1 introduction**

### **Chapter 2 vibration analysis applications**

### **Chapter 3 vibration analysis overview**

Theoretical vibration profiles

Actual vibration profiles

Time domain

Vibration measuring equipment

Transducer

Portable vibration analyzer

### **Chapter 4**

#### **Vibration sources**

Rotating machinery

Rotor imbalance

Flow instability and operating conditions

Mechanical motion and forces

Reciprocating and/or linear-motion machinery

Sources of vibration

### **Chapter 5**

#### **Vibration theory**

Periodic motion

Harmonic motion

Measurable parameters

Frequency

Amplitude

Maximum Vibration Measurement

Displacement

Velocity

Acceleration

## **Measurement Classifications**

Broadband or Overall

Narrowband

## **Component**

Common Elements of Curves

Peak-to- Peak

Zero-to-Peak

Root-Mean-Square

## **VIBRATION DATA TYPES AND FORMATS**

ANALYSIS TECHNIQUES

TRENDING

Broadband

## **Narrowband**

Industrial Reference Data

Vibration monitoring overview

## **MACHINE-TRAIN MONITORING PARAMETERS**

### **TRENDING ANALYSIS**

### **Part 2 Machine vibration**

Machine history

Machine characteristics

### **Data acquisition**

Vibration amplitude versus frequency analysis

Importance of tri-axial reading

The machine sketch

Machinery vibration signature

Supporting information

### **Obtaining amplitude versus frequency data**

Waterfall diagram

### **Amplitude/phase versus machine rpm**

#### **Data interpretation**

Identifying the type of rotor unbalance

Determining machinery condition

#### **Controlling normal vibration**

#### **Controlling radiated noise**

#### **Special techniques for monitoring bearing condition**

#### **Vibration due to plane (journal) bearings**

Oil whirl

Dry whirl

#### **Vibration due to resonance**

#### **Turbomachinery problems**

#### **Friction induced (hysteresis) whirl**

Aerodynamic cross coupling

Surging

Choking (stone-walling)

#### **Vibration problems with specific machinery types**

Centrifugal pumps

Hydraulic forces

Cavitation

Re-circulation

## **Vibration of reciprocating machines**

### **Part 3 Non-Vibration Based Techniques**

- Costs versus Benefits
- Visual Monitoring
- Performance Monitoring
- Oil Quality Analysis
- Wear Particle Analysis
- Acoustic Emission
- Thermography (thermal imaging)

### **TRAINING CERTIFICATE**

**MAESTRO CONSULTANTS** Certificate of Completion for delegates who attend and complete the training course

### **METHODOLOGY**

Our courses are highly interactive, typically taking a case study approach that we have found to be an effective method of fostering discussions and transferring knowledge. Participants will learn by active participation during the program through the use of individual exercises, questionnaires, team exercises, training videos and discussions of “real life” issues in their organizations.

The material has been designed to enable delegates to apply all of the material with immediate effect back in the workplace.