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# PRACTICAL BALANCING, ALIGNMENT AND CONDITION MONITORING OF ROTATING EQUIPMENT



## **YOU WILL LEARN HOW TO:**

- Apply practical techniques for troubleshooting rotating machinery
- Eliminate problems through proven precision maintenance methods
- Identify which machines require precision maintenance
- Reduce maintenance costs
- Prevent failures from occurring
- Manage a precision maintenance program

## **WHO SHOULD ATTEND:**

- Plant Operations and Maintenance Personnel
- Consulting Engineers
- Design Engineers
- Process Technicians
- Plant Engineer Managers and Supervisors
- Process Control Engineers and Supervisors
- Mechanical Engineers
- Pump Sales Engineers
- Pump Service Contractors
- Pump Operators

## The Workshop

This is a comprehensive, highly practical and interactive two-day course. You will have an opportunity to discuss precision maintenance for rotating machinery and associated applications, operations, maintenance and management issues. The focus will be on the most up-to-date information and best practice. Towards the end of the workshop, you will have developed the skills and ability to recognise and solve precision maintenance issues in a structured and confident manner, in working and improving the reliability and performance of your rotating machinery.

After an introduction to the application of maintenance and costs of breakdowns, the important issue of vibration and vibration measurement is detailed. The important topic of balancing is then discussed drawing on practical examples. Alignment and other machinery faults are then covered. Other often neglected areas of particle and chemical analysis, temperature monitoring and failure analysis are covered in practical detail. The workshop is concluded with a set of practical rules for a precision maintenance program including issues, such as; which machines to monitor, managing the data usefully and scheduling maintenance.

### Pre-requisites

A basic understanding of mechanical processes is not essential, but would be useful.

## The Program

### INTRODUCTION

- The mission of maintenance
- Maintenance philosophies
- Cost of breakdowns
- The role of precision maintenance

### VIBRATION BASICS

- What is vibration?
- Vibration waves
- Overall vibration
- Vibration spectrum
- Natural and forcing frequencies

### VIBRATION MEASUREMENT

- Vibration sensors
- Which to choose?
- Sensor specifications
- Sensor mounting
- Spectrum analysers
- Other instrumentation

### BALANCING

- Why balance?
- Identifying unbalance
- Practical aspects
- Definitions
- Single-plane balancing
- Four-run method
- Two-plane balancing
- Overhung rotor
- Balancing standards

### ALIGNMENT

- Introduction
- Identifying misalignment
- Measuring misalignment
- Rough methods
- Reverse dial method
- Face-rim method
- Laser alignment
- Alignment tolerances

### OTHER COMMON MACHINERY FAULTS

- Rotating machinery
- Piping, bases and supports
- Natural frequencies and resonance
- Modal and deflection shape analysis
- Troubleshooting unwanted vibration

### RELATED TASKS FOR PRECISION MAINTENANCE

- Tighten, Lubricate, Clean (TLC)
- Chemical and particle analysis
- Ultrasonic inspection
- Temperature monitoring
- Performance monitoring
- Failure analysis

### MANAGING YOUR PRECISION MAINTENANCE PROGRAM

- Baselines and trending
- Which machines to monitor
- Managing the data
- Scheduling maintenance
- Outsourcing
- Selling to management: A new mindset

