# ROTATING EQUIPMENT: START-UP, OPERATION, MAINTENANCE & TROUBLESHOOTING



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# TRAINING TITLE

# ROTATING EQUIPMENT: START-UP, OPERATION, MAINTENANCE & TROUBLESHOOTING

Dubai, UAE

#### **DURATION**

5 Days

## **DATES**

23-27 February 2020

## **PRICE**

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

## TRAINING INTRODUCTION

From a component-by-component perspective, the programme investigates the root causes of failure, and relates these to operating conditions and process parameters. Design, installation, lubrication and wear related failure mechanisms are identified and a detailed understanding of the troubleshooting and diagnostic methods needed to detect and identify these is developed.

Course focus on rotating equipment with particular emphasis on Centrifugal Pump and Compressor Drive Trains; Positive Displacement Pumpsets, Valves, Pulsation Dampers, Electric Motors, associated equipment and systems.

The program provides participants with the knowledge needed to be effective in the inspection, monitoring and diagnostics of pumps and compressors, with emphasis placed upon the importance of a combined condition monitoring and inspection approach to maintenance

Basic Approaches to Machinery Troubleshooting:

Examples from Recent Failure Incidents Attributed to Design Defects, Processing and Manufacturing Deficiencies, Assembly Errors, Off-Design or Unintended Service Conditions, Maintenance Deficiencies Predictive vs. Preventive Maintenance Techniques: Determination of Which Method to Use.

# TRAINING OBJECTIVES

- Learn about the theory of rotating equipment, application and the interaction of plant and equipment
- Improve your ability to prepare and understand specifications and performance criteria for the effective procurement and operation of rotating equipment and associated plant
- Understand basic maintenance principles of specific types of rotating equipment and recognise key factors affecting reliability and availability
- Detailed fault finding including examination of equipment deterioration and the development of cost effective corrective measures
- Technology and Maintenance of the Machine components. OLubrication.
  - $\circ$  Bearings.
  - •Coupling and Alignment.
  - $\circ \mbox{Sealing Devices for Pumps and Compressors.}$
  - $\odot \mbox{Rotors}$  and Shafts.

#### TRAINING AUDIENCE

Field engineers, senior & junior maintenance technicians, planning engineers and workshop professionals.

This application and component course is intended to be of direct use by persons in staff (Senior Technicians, Operators, Supervisors, Superintendents) and corporate engineering

#### TRAINING OUTLINE

# Following topics will be covered in 5 days

Module 1 Pumps

- 1. Types of pumps
- 2. Centrifugal pumps

- 3. Reciprocating pumps
- 4. Capacity and applications for pumps
  - Head and pressure
  - Flow rates
  - Displacement
  - Efficiency
  - Horsepower
  - Frication
  - Pump curves

Module 2 compressor

- 1. Types of gas compressor
- 2. Centrifugal compressor
- 3. Reciprocating compressor
- 4. Axial compressor
- 5. Compressor trouble

Module 3 Auxiliary system

- 1. lubrication system
- 2. Bearings
- 3. Cooling system
- 4. Capacity control
- 5. Instrumentation and control
- 6. gears
- 7. balancing
- 8. alignment

Module 4 – identify the equipment Failure

Building a system for equipment condition indicating

- a) Equipment data
- b) Failure data

- c) Maintenance data
- d) Data format

Failure and maintenance notations

Failure descriptors

Failure causes

Method of detection

Maintenance activity

Data requirements for various applications

BS ISO 17359:

Module 5 - Condition Monitoring Technologies

Technique methods

- Vibration Analysis
- IR Thermography
- Ultrasonic Leak Detection
- Oil and Wear Particle Analysis
- Oil Analysis
- Motor Circuit
- Ultrasonic Thickness (Auto/Manual)
- Eddy Current
- Radiography
- Fluoroscopy

Endscope (Borescope) inspection

#### Module 6 VIBRATION ANALYSIS

Introduction

Data acquisition

Obtaining amplitude versus frequency data

Amplitude/phase versus machine rpm

Data interpretation

Controlling normal vibration Controlling radiated noise Special techniques for monitoring bearing condition Vibration due to plane (journal) bearings Machinery problems

- Aerodynamic cross coupling
- Surging
- Choking (stone-walling)
- Centrifugal pumps
  - Hydraulic forces
  - Cavitation

**Re-circulation** 

#### 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.