

# OPERATION, MAINTENANCE AND INSPECTION OF ROTATING MACHINERY

## OBJECTIVES

The course outlines the general technology of machines and their auxiliaries. It covers how machines work on process, the mechanical aspects, wear and tear, lubrication, and troubleshooting by vibration analysis and other techniques, thus providing participants with the necessary knowledge for inspecting machinery and making a diagnosis.

On completion of the session, the participants have in mind:

- how the machines and their components work
- the mechanical effects of a change in operating conditions
- the failure modes of each component
- how to prevent unexpected breakdowns and perform machinery diagnosis
- how to manage the machinery reliability.

## COURSE CONTENT

<b>TECHNOLOGY AND OPERATION OF ROTATING MACHINES</b>	<b>5 days</b>
<b>General aspects of machine technology</b>	<b>2 days</b>
Main parts of the machines: casing, rotor, bearing, coupling. Auxiliaries: flushing, heating and cooling, lubrication systems. Maintenance: assembly and dismantling procedures, inspection, clearance, adjustment, roughness.	
<b>Operation and performance</b>	<b>3 days</b>
<b>Process aspect</b>	
Running parameters; head, flow, rpm, efficiency. Characteristic curves. Regulation. Start-up, routine survey. Effect of internal wear.	
<b>Mechanical aspect</b>	
Stresses in machines. Influence on lifetime, on damage. Failure prevention; monitoring, repair quality.	
<b>Typical troubles</b>	
Internal leakages. Unbalancing. Wear and ruptures.	
<b>Practical exercises (time included in above items)</b>	
<i>Reporting and plotting pressure or head versus flow applied to a centrifugal pump.</i>	
<b>TECHNOLOGY AND MAINTENANCE OF THE MACHINE COMPONENTS</b>	<b>5 days</b>
<b>Lubrication</b>	<b>0.5 day</b>
Purpose, different types of oil and grease. Practical aspect.	
<b>Bearings</b>	<b>1.25 days</b>
Antifriction bearings: types, lifetime, mounting, applications, related problems. Plain and pad bearings, thrust bearings: operation, maintenance, incidents.	
<b>Coupling and alignment</b>	<b>1.25 days</b>
Different types of couplings, related problems. Different methods of alignment using comparators, tolerances, practical aspects.	
<b>Sealing devices for pumps and compressors</b>	<b>1.25 days</b>
Mechanical pump seals, types, operation, related problems. Installation, geometrical checks. Other seals for positive displacement pumps and reciprocating compressors.	
<b>Rotors and shafts</b>	<b>0.75 day</b>
Balancing: excentricity, tolerances. Assembling on shaft: effect on balancing. Geometrical shaft controls.	
<b>Practical exercises (time included in above items)</b>	
<i>Bearing mounting and overhaul. Geometrical shaft control. Shaft alignment. Mechanical seal mounting.</i>	
<b>Plant visit:</b> antifriction bearing manufacturer (tooling, finishing, quality inspection).	
<b>FORECASTING BREAKDOWNS</b>	<b>5 days</b>
<b>Study of ruptures and wear and other failures</b>	<b>2.75 days</b>
Typical damage to machines: onset of problems and causes of failures, influences of metallurgy and surface treatments. Fatigue, wear and tear. Rupture face analysis. <b>Case studies:</b> <i>rupture and wear examinations of typical machine parts, analysis of some process centrifugal pump complex breakdowns.</i>	
<b>Use of vibration surveys in forecasting</b>	<b>1.75 days</b>
Different types of measurements and sensors. Monitoring of turbomachines rotor behaviour. Spectrum analysis applied to pumps, fans. Examples of diagnosis.	
<b>Management of machinery reliability</b>	<b>0.5 day</b>
Reliability centered maintenance. Detection of <b>Bad Actors</b> . Improving reliability through failure analysis and diagnosis. Monitoring of the maintenance activity performance.	
<b>Practical exercises (time included in above items)</b>	
<i>Measurement and analysis of vibrations. Machinery component failures, analysis on examples.</i>	

▲ Who should attend?

**Junior graduate engineers supervisory and technical staff** involved in rotating machinery maintenance and inspection.

▲ Duration

**15 days**

▲ Dates & Location

**August 18 to September 5, 2008**  
Solaize (Lyon)

▲ Tuition Fees

**€ 5,250**

▲ Course Coordinator

**Christian Castelnau**

Ref. **MTM / OMIRM**