

# Refinery Critical Equipment Operation for Compressors, Turbines and Pumps

## INTRODUCTION

- Rotating equipment, such as compressors, turbines, pumps and others, are the most critical for processes in oil refineries and large petrochemical plants. These components with complex controls are subject to wear, deterioration and aging, which results in equipment failures, breakdowns and outages. Each type of equipment has a special role in the overall refinery operation and has a different criticality index associated with a failure's consequence that bring risks related to safety, environment, production loss and maintenance costs.
- This highly interactive and intensive Refinery Critical Equipment Operation for Compressors, Turbines and Pumps training course will consider the operation and maintenance of compressors, turbines and pumps from the aspect of quantitative critical analysis of their faults and defects and rank them according to the seriousness of consequences on safety, environment and production loss. This training course will explain the most efficient maintenance management strategy focused on high-priority maintenance tasks that minimize unplanned breakdowns and repeated failures, with the ultimate goal of maximizing the life of the components and the system.

This training seminar will highlight:

- Technical characteristics of compressors, turbines and pumps for the given application
- Criticality index and criticality list of components
- Practical issues related to trouble-free operation of rotating equipment
- Root cause analysis of problems related to vibration and dynamic balancing
- Guidelines for monitoring, maintenance and troubleshooting

## OBJECTIVES

At the end of this training seminar, you will learn to:

- Deal with technical characteristics of compressors, turbines and pumps
- Apply the guidelines for efficient operation with decreased maintenance costs
- Interpret results of testing and inspection of critical components
- Analyze failure modes of critical components
- Apply diagnostic and monitoring technologies to achieve the best results

## TRAINING METHODOLOGY

- This course will be conducted along the workshop principles with formal lectures, case studies and interactive work examples. Relevant and real-life case studies will be provided to illustrate the application of each tool in an operation and troubleshooting situation. Learning topics will be re-enforced with practical exercises. There will be plenty of opportunities for discussions and sharing experiences during class workshops.

## ORGANISATIONAL IMPACT

- On completion of this training course, the participants will be able to adequately analyze operation and maintenance methodologies employed within their organization. They will be able to initiate potential improvements where required. This training will give the participant the required level of technical knowledge and skill that will prove useful in their professional activities.

## PERSONAL IMPACT

- The knowledge gained in this course will provide a better understanding of compressors, turbines and pumps in complex operating conditions. The participants will be able to develop a proactive maintenance system which will allow better inspection, control and monitoring with the goal of avoiding unplanned equipment failures and maximizing rotating equipment availability and reliability.

## WHO SHOULD ATTEND?

This training course is suitable to a wide range of professionals but will greatly benefit:

- Mechanical and Process Engineers
- Plant Engineers responsible for operations, maintenance and troubleshooting
- Project Leaders
- Maintenance and Instrumentation Professionals
- Technologists and Facility Operators

## Course Outline

### Equipment Criticality Analysis

- Rotating Equipment in Refineries: Criticality Aspect
- Quantitative Analysis of Equipment Faults
- Input Data Preparation
- Tools and Techniques
- Risk Assessment and Determination of Equipment Criticality
- Equipment Criticality Index

## Compressors

- Overview of Positive Displacement Compressors
- Reciprocating Compressor Design Elements: Valves, Pistons, Bearings, Seals
- Effect of Gas Composition and Suction Conditions on Performance
- Wet Gas Compressors in FCC Operations
- Centrifugal Compressors Design and Configuration
- Performance Curves: Choke Conditions, Surge and Anti-Surge Protection
- Flow Control Techniques and Start-Up Procedures: Low- and High-speed Limits
- Auxiliary Systems: Lubrication and Cooling

## Turbines

- Steam Turbine Construction Elements
- Technical Characteristics of Blades and Nozzles
- Control Systems and Safety Devices
- Technical Characteristics of Gas Turbines
- Combustion Monitoring, Ignition and Flaming System, Fuel Control
- Start-Up System, Over-speed Control Protection and Calibration
- Rotor Dynamics and Balancing
- Associated Equipment and Systems: Lubrication, Bearings and Seals

## Pumps

- Centrifugal Pumps Design Overview
- Impellers, Shafts and Bearings
- Importance of Mechanical Seals
- Characteristic Curves
- NPSH and Cavitation Prevention
- Design of Suction Configuration and Flow Control
- Positive Displacement Pumps: Reciprocating and Rotary
- Problems with Pumping Difficult Liquids

## Maintenance and Overhaul Management

- Maintenance and Overhaul of Rotating Equipment
- Preventive Maintenance for Critical Machines
- Predictive Maintenance Based on Inspection and NDT
- FMEA and Root Cause Analysis (RCA)
- On-Line and Off-Line Condition Monitoring
- Reliability-Centered Maintenance
- Computerized Maintenance Management System (CMMS)
- Best Practices Adopted in Maintenance