

# Pumps, Compressors & Turbines

## INTRODUCTION

- This Pumps, Compressors & Turbines training course will feature the importance of proper operation and maintenance of rotating machineries such as pumps, compressors, and turbines of various designs and applications, which are encountered throughout chemical and process industries, including oil refineries, gas production facilities, power generation and other fields of engineering. It helps familiarize the engineers, technicians, and operators with the guidelines and best practices employed in using this equipment, including installation, operation, maintenance, and repair. The emphasis will be on the physical understanding of the problems in operation and the best way of troubleshooting them.
- This training course will cover the design, installation, operation, and maintenance of these machines by highlighting characteristics features, efficiencies, reliability, and maintenance implications and introduce to the participants the different types of pumps, compressors, and turbines and their associated terminology. Centrifugal and positive-displacement pumps, compressors, and gas turbines packing, mechanical seals and sealing systems, bearings, and couplings will all be discussed.

This training course will highlight:

- Principles of selection of right pump, compressor, and turbine for the given application
- Practical issues related to trouble-free functioning of pumps, compressors, and turbines
- Explanation of complex flow situations in pumps, compressors, and turbines
- Guidelines for installation, operation, maintenance, and troubleshooting
- Maintenance and repair economic issues: cost and benefit analysis

## OBJECTIVES

By the end of this training seminar, participants will be able to:

- Understand technical features of pumps, compressors and turbines
- Select optimal type and size of equipment for a given industrial application
- Use methods of estimating the degree of deterioration and inefficiency of equipment
- Apply best practices and techniques of pinpointing the root cause of problems
- Choose the most efficient remedies and troubleshooting techniques in operation

## TRAINING METHODOLOGY

- This Pumps, Compressors & Turbines training seminar will be conducted along workshop principles with formal lectures and interactive worked examples included in several workshops. Presented also will be several illustrative and instructive videos. The emphasis in this training seminar will be on the explanation of all technical points and providing answers to problems that are encountered in everyday industrial practice related to installation, operation and maintenance, as well as repair and alterations of pipeline systems.
- Each learning point will be reinforced with practical examples. There will be ample opportunities for active discussion and sharing professional experiences and exchange that will help solidify the gained knowledge. All training seminar materials will be provided.

## ORGANISATIONAL IMPACT

Impact on the organisation from the participants in attending this Pumps, Compressors & Turbines training course includes the following benefits:

- Maximize your organizational effectiveness
- Sustain a competitive advantage
- Talent needs to drive your business performance
- Knowledge about the most critical rotating equipment will be raised to the highest level required in the industrial field
- Improve their skills for troubleshooting and apply failure analysis
- The profit will increase as the rotating equipment failures will be decreased or eliminated by the new skills of the participants learn from the course
- Help the employees grow in skill, experience and opportunity not only builds your organization's depth but also creates employee loyalty

## PERSONAL IMPACT

This training course will personally benefit the participants to gain or enhance their understanding and knowledge by the following:

- Job competencies especially operation and maintenance rotating equipment's
- High skills technical ability to work in any field contains the pumps, compressor, and turbine
- High technological knowledge person
- Knowledgeable to the newest technology
- Increase skills, experience and opportunity for higher position
- Increase the professional self-confident

## WHO SHOULD ATTEND?

- Chemical, Process and Mechanical Engineers
- Product Engineers and Technologists
- Operation, Technical Service and Maintenance Professionals
- Engineers, Consultants and Sales Professionals
- Technical Professionals responsible for interdisciplinary energy projects

## Course Outline

### Pumps

#### Centrifugal Pumps

- Theory of Operation
- Types of Pumps Types and Classifications
- API Standard Pumps Design
- Selection and Sizing of Centrifugal Pump
- Main Elements and its functions of Centrifugal Pump
- Centrifugal Pump Installation Requirements
- Pump Performance Curve & Head Loss
- Pump Cavitation, NPSH and Water Hammering
- Multistage Pumps and Operation Arrangement Requirement
- Pump Failure Analysis

#### Positive Displacement Pumps

- Positive Displacement Pumps PDP: Reciprocating and Rotary
- Reciprocating Pump Components Function
- PDP Pumps Application Requirements
- Rotary Pumps Types and Applications
- Guidelines for Pump Installation and Operation
- Pump Inspection, Control, and Performance Testing
- PDP Troubleshooting

#### Centrifugal Compressors

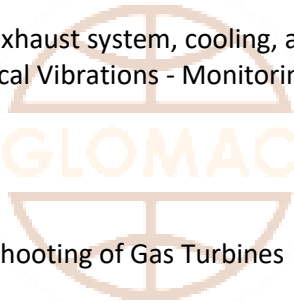
- Gas Laws and Theory of Operation
- Characteristics of Centrifugal and Axial Flow Compressor
- Overview of the Main Features of Various Types of Compressors
- Main Components and its Function
- Analysis and performance characteristics of Centrifugal Compressor Efficiency
- Surging, choking, bleed valves, variable stator vanes, inlet guide vanes
- Troubleshooting and Failure Modes
- Guidelines for Trouble-free Centrifugal Compressor Operation

## Positive Displacement Compressors

- Positive Displacement Compressors: Reciprocating and Rotary
- Piston and Diaphragm Compressors
- Rotary compressors, rotary screw compressor, lobe type air compressor, sliding vane compressors, liquid ring compressors
- Essential Criteria for Selecting the Compressor
- Compressor Capacity: Loadings and Speeds
- Compressor Safety Control Noise Control and Protection
- Guidelines for Compressor Installation and Operation
- Compressor inspection, maintenance, control, performance testing, and troubleshooting

## Industrial Gas Turbines

- Gas Turbine Sections and Components
- Types and Classification of Gas Turbines: (Radial and Axial-flow- impulse / reaction)
- Combustor Performance
- Types of Fuels
- Combustion
- Pollution Control
- Gas Turbines: starting system, exhaust system, cooling, and control system
- Condition Monitoring: Mechanical Vibrations - Monitoring, Measurements, Diagnostics, and Analysis
- Turbine Inspection
- Combustion Inspection
- Hot Gas Path inspection
- Borescope Inspections Troubleshooting of Gas Turbines



## Rotating Equipment Auxiliary System

- Lubrication System
- Rotating Equipment Bearings
- Rotating Equipment Different type of Seals
- Different Design for Cooling System
- Control and Protection System
- Hydraulic Balancing Devices, Balancing Drums and Balancing Disks
- Filtration System
- Variable Speed Drive

## Maintenance

- Coupling and Alignment
- Balancing
- Vibration Analysis
- Condition Monitoring