MERCURY

Pumps, Compressors and Turbines: Principles, Applications, and Performance



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Introduction:

This course focuses on the importance of rotating machinery such as pumps, compressors and turbines of various designs and applications, which are encountered throughout process industry, petrochemical and oil and gas industries. The training course aims to proceed with an introduction to liquid and gas systems including pressure and head, capacity and flow, friction head losses & operational dynamics. Centrifugal and positive-displacement pumps, compressors and turbines, will all be introduced, together with their main construction and parts. The application of the different types of pumps, compressors and turbines will be discussed along with their suitability for different operational duties.

Targeted Groups:

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

Course Objectives:

At the end of this course the participants will be able to:

- Have an understanding of relevant fluid laws and the different types of pumps and their associated terminology
- Have an understanding of Centrifugal and positive displacement pumps and compressors, and their related components
- Know how to calculate and use pump performance curves and pumping system requirements and have an understanding of different parameters affecting their operation.
- Be able to operate pumps and compressors as close as possible to the design efficiency
- Know the different types and major components of turbines
- Understand the working principles and characteristics of turbines and know the major components
- Have the ability to perform troubleshooting of systems involving pumps, compressors and turbines
- Have learnt about selection, operation and maintenance strategies

Targeted Competencies:

- Solid knowledge of basic principles of fluid flow
- Optimization of the operation and maintenance of different types of pumps, compressors and turbines
- Confidence to troubleshoot problems related to pumps compressors and turbines, thereby

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avoiding repetitive failures
- Allow tighter control of maintenance budgets by the avoidance of unplanned equipment failures in service

Course Content:

Unit 1: Introduction and Fluid Laws

- Introduction to basic types and principles of, Pumps, Compressors and Turbines
- Basic liquid and gas Laws
- Understanding Head
- Types of flow and losses
- Net Positive Suction Head NPSH

Unit 2: Pumping Systems, Pump Performance and Pump Type Construction

- Pump type and Performance Centrifugal and Positive Displacement
- Pump characteristics. Head, Capacity, Power, Efficiency and Net Positive Suction Head NPSH
- Pump Curves and System Curves.
- Positive Displacement Pumps, Reciprocating and Rotary
- Dynamic Pumps Types, Centrifugal, Axial, Mixed, Multistage, etc.
- Sealing Systems. Conventional Packing Glands and Mechanical Seals

Unit 3: Compressor Construction, Types, Characteristics and Performance

- Positive displacement compressors, reciprocating compressors, reciprocating compressors, diaphragm compressors.
- Rotary compressors, rotary screw compressor, lobe type air compressor, sliding vane compressors, liquid ring compressors
- Dynamic compressors, centrifugal compressors, axial compressors
- Principle of operation and performance curves
- Surging and choking problems

Unit 4: Turbine Types, Construction and Performance

- Turbine Types
    - Gas Turbines
    - Steam turbines
- Turbine Operation
- Main components
    - Nozzles
    - Stator and Rotor Blades Vanes Configuration and Flow
    - Aero foil and Twisted Contours
- Working cycle of a gas turbine, representation of the Pressure-Volume diagram indicator card
- Stages

Unit 5: Troubleshooting & Maintenance

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- Potential Failure Analysis
- Troubleshooting
    - Review of common faults
    - Developing a Preventive Maintenance Plan
- Vibration causes, forcing frequency causes, unbalance, misalignment, mechanical looseness, bearing defects, gear defects, oil whirl, blade or vane problems
- Cavitation
- Water Hammer
    - What causes water hammer
    - Solutions for water hammer