

Principles, Applications and Performance of Pumps, Compressors and Turbines

INTRODUCTION

- This Principles, Applications and Performance of Pumps, Compressors and Turbines training course will focus 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. This training course will start 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. Operation, troubleshooting and maintenance will also be dealt with.

The key highlights of this training course are:

- Solid knowledge of basic principles of fluid flow
- Optimisation of the operation and maintenance of different types of pumps, compressors and turbines
- Confidence to troubleshoot problems related to pumps compressors and turbines, thereby avoiding repetitive failures
- Allow tighter control of maintenance budgets by the avoidance of unplanned equipment failures in service

PROGRAMME OBJECTIVES

- 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

WHO SHOULD ATTEND?

- 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
- This Principles, Applications and Performance of Pumps, Compressors and Turbines training course will also of benefit anyone who wishes to update themselves on pump, compressor and turbine technology, judge the suitability of different types of pumps, compressors and turbines for their needs, and learn how to operate and maintain them for the benefit of their organisations.

TRAINING METHODOLOGY

- This Principles, Applications and Performance of Pumps, Compressors and Turbines training course will be conducted along workshop principles with formal lectures, computer simulation, relevant videos, case studies and interactive worked examples. Relevant case studies will be provided to illustrate the application of each tool in an operations environment. Each learning point will be re-enforced with practical exercises. There will be ample opportunities for discussion and sharing experiences. Hard and soft copies of the programme manual will be presented to each delegate.

PROGRAMME SUMMARY

- The knowledge gained in this training course will provide better understanding of pumps, compressors and turbines in complex operating conditions. The delegates 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 maximising compressor and turbine availability and reliability.

This training course will give the delegate the required level of technical knowledge and skill to achieve that personal satisfaction.

- Understanding of reciprocating and rotating equipment operating and maintenance techniques
- Ability to put in place measures to quantify equipment condition
- Interface with pump, compressor and turbine equipment providers
- Identify and specify new and replacement pumps, compressors and turbines
- Ability to operate and troubleshoot rotating equipment

PROGRAM OUTLINE

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)

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

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

Turbine Types, Construction and Performance

- Turbine Types
- Gas Turbines
- Steam turbines
- Turbine Operation
- Main components
- Nozzles
- Stator and Rotor Blades (Vaness) Configuration and Flow
- Aerofoil and Twisted Contours
- working cycle of a gas turbine, representation of the Pressure-Volume diagram (indicator card)
- Stages

Troubleshooting & Maintenance

- 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
- Review of the Week & Wrap-Up