Advanced Practical Pumping Technology

Introduction:

This comprehensive course is designed to provide an in-depth perspective of pump technology in terms of selection, operation, maintenance and repair. Topics covered include pump types and terminology, centrifugal and positive-displacement pumps, packing, mechanical seals and sealing systems, bearings, couplings and other vital components. In addition, various pump types will be examined as to how they perform in their respective operating systems and advantages and disadvantages of various pump types will be discussed. Pump operation, trouble-shooting and maintenance will be dealt with in depth.

This course provides a comprehensive understanding of the various types of reciprocating, rotary, and centrifugal pumps. This includes piston pumps, plunger pumps, rotary pumps, screw pumps, two- and three-lobe pumps, cam pumps, vane pumps, bellows-type metering pumps, diaphragm pumps, canned motor pumps, and centrifugal pumps. The characteristics, selection criteria, sizing calculations, sealing arrangements, common problems, repair techniques, as well as the preventive and predictive maintenance of these pumps are covered in detail.

This course will provide the candidates with a complete and up-to-date knowledge of pumps and their systems. Further, participants will learn more about selection, operation and maintenance strategies which will assist in increasing pump

availability and reliability. Upon the completion of this program, the candidates will be able to troubleshoot all types of pump problems.

The course will introduce the candidates to the different types of pumps and their associated terminology. Centrifugal and positive displacement pumps, packing, mechanical seals and sealing systems, bearings and couplings will all be discussed. The application of the different types of pumps will be discussed along with their suitability for different operational duties. Pump operation, troubleshooting and maintenance will be dealt with in depth. This course is a MUST for those who use this equipment. It covers how pumps operate and provides the guidelines and rules that must be followed for their successful application.

This course provides the following for all types of pumps and bearings:

- Basic Design
- Specification
- Selection Criteria
- Sizing Calculations
- Sealing Arrangements
- Common Operational Problems
- All Diagnostics, Troubleshooting and Maintenance
- Main Artificial Lift Systems
- General Case Studies

Who Should Attend?

Engineers of all disciplines, Supervisors, Team Leaders and Professionals in Maintenance, Engineering and Production Managers, Technicians, Maintenance personnel, Heads of Maintenance and Operation, Mechanical and Chemical Engineers, Equipment Specialists, Technical Engineers, Operation Engineers, Planning Engineers, Process Engineers, Reliability Specialists, Engineers involved with control and safety valves and pumps of different types, anyone who wishes to update themselves on pump technology, judge the suitability of different types of pumps for their needs, and learn how to operate and maintain them for the benefit of their organizations

Course Objectives:

By the end of this course delegates will be able to:

- Have an understanding of the different types of pumps be able to operate pumps as close as possible to the design efficiency
- Monitor pump efficiency, availability and reliability
- Have learnt about selection, operation and maintenance strategies
- Be able to troubleshoot pump problems
- Be able to critically analyze the methodologies employed within the organization and instigate improvements where required
- Optimize the operation and maintenance of different types of pumps
- Carry out failure analyses on pumps thereby avoiding repetitive failures
- Have an understanding of centrifugal and positive displacement pumps, packing, mechanical seals and sealing systems, bearings and couplings
- Have an understanding of different parameters affecting the operation of valves
- Have the ability to select the right valve for the particular application and to perform the necessary calculation for valve sizing
- Have the ability to perform troubleshooting of systems involving valves
- Have the ability to decide on the right maintenance plan concerning different types of valves
- Maximize the efficiency, reliability, and longevity of all types of pumps
- Size and select out of the various types of dynamic and positive displacement pumps using the performance characteristics and the selection criteria that you learn in this program
- Carry out diagnostic testing and inspection of critical components with the knowledge of common failure modes of pumps by applying advanced fault detection techniques
- Select bearings and lubrication, pump sealing arrangements, meet commissioning requirements, troubleshoot, provide predictive and preventive maintenance, enhance reliability and reduce cost
- Determine the maintenance required to minimize pump downtime and operating cost and maximize its efficiency, reliability and useful life

- Gain a thorough understanding of pump characteristics
- Understand all the causes of failures in pumps
- Determine all the design features that improve the efficiency and reliability of all pumps
- Design different types of pumping systems
- Gain a thorough understanding of the various types of sealing arrangements used in compressors
- Studying main artificial lift systems used in crude oil production with overall troubleshooting.

Course Outline:

Introduction: Pumping Systems

- Introduction
- Pump types and terminology
- Pump performance (centrifugal and positive displacement)
- Understanding head
- Types of head: friction, pressure, static & velocity
- Friction in valves, piping & fittings
- Calculating actual head in a system
- Cavitation in pumps and valves
- Net positive suction head (NPSH) for positive and negative suction cases
- Vapor and gas cavitation
- Flashing versus cavitation
- Pump types: positive displacement pumps
- Reciprocating pumps
- Reciprocating pump valves
- Rotary pumps scroll and gear types
- Special application pumps metering pumps, diaphragm pumps
- Failure mechanisms identification and monitoring

Pump Types: Centrifugal Pumps

- Centrifugal pump theory
- Matching pumps with drivers
- Pump wear rings and balance lines
- Multi stage pumps
- Performance analysis (flow rate versus head, motor loading and deduced efficiency).
- Failure mechanisms – identification and monitoring
- Failure mechanisms identification and monitoring
- Seals and bearings
- Conventional packing glands
- Mechanical seals
- Seal failure mechanisms
- Maintenance and repair of mechanical seals
- Bearings failure modes and how to extend life

Achieving Pump Reliability

- Sealing systems
- Conventional packing glands, mechanical seals & flush plans
- Seal failure mechanisms
- Maintenance and repair of mechanical seals
- Bearings – failure modes and how to extend life
- Lubrication
- Plain bearings
- Anti-friction bearings
- Couplings & alignment
- Couplings
- Alignment & balancing
- Foundations & bedplates
- Positive displacement pumps, troubleshooting, maintenance, and selection of pumps
- Reciprocating pumps, piston pumps, plunger pumps, rotary pumps, screw pumps, two-and three-lobe pumps
- Cam pumps, vane pumps, bellows-type metering pumps

- Diaphragm pumps
- Canned motor pumps, seal-less pump motors
- Pump maintenance, inspection, overhaul, diagnoses of pump troubles
- Troubleshooting of centrifugal pumps
- Troubleshooting of rotary pumps
- Troubleshooting of reciprocating pumps
- Water hammer
- Smart instrumentation
- Pump selection
- Pumping system calculations (including main and minor pressure losses and changes in elevations)
- Vibration analysis and predictive maintenance
- Diagnostics of pumping systems
- Pump drivers (types of drivers and calculations of fuel consumption rates)

Valves Troubleshooting & Maintenance

- High pressure drop
- Pressure recovery characteristics
- Flow choking
- High velocities
- Water hammer
- What are causes water hammer?
- Solutions for water hammer
- Troubleshooting the control & isolation valves
- Review of common faults
- Developing a preventive maintenance plan

Valves Technology

Types of valves (globe, gate, ball, plug, check)

COURSE LOCATIONS