

Centrifugal Pumps: Design, Selection, Operation and Maintenance

Scope

Pumps like all rotating equipment, are the most sensitive equipment in a plant. It is therefore very important for all plant employees to be familiar with the design, operation and maintenance of both centrifugal and positive displacement pumps.

Course Objectives

Upon completion of the course, participants will be able to:

- Identify main parameters in pump selection;
- Describe the behavior and the operation of pumps;
- Participate actively in troubleshooting analysis and diagnosis of pump failures;
- Prepare maintenance procedures for all types of pumps with emphasis to centrifugal pumps.

Training Methodology

The duration of the seminar is five days. In the first four days, the theory will be covered with lectures, instructor led discussions exercises and videos. There will be also demonstrations of actual pump parts, such as impellers, bearings mechanical seals and shafts. During the last day of the course participants will have

the opportunity to dismantle and assemble pumps, inspect mechanical seals, install bearings, carry out actual shop measurements. And collect vibration readings.

Who Should Attend:

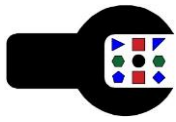
This course is primarily designed for Maintenance and Operations Personnel, Engineers, Apprentice Engineers, Project Engineers, Supervisors, Technicians and Operators involved in the Selection, Operation and Maintenance of Pumps.

Duration: Five days

Course instructor: Mr. George Loizou

George is a Mechanical Engineer with more than 35 years of experience mainly in the Oil and Gas Industry. George holds an MSc Degree from The Pennsylvania State University. He is a member of SMRP, a Certified Maintenance and Reliability Professional (CMRP), member of the Cyprus Scientific and Technical Chamber and of the Institution of Mechanical Engineers of UK.

George worked as Head of Mechanical Maintenance at the Cyprus Petroleum Refinery Ltd, Engineering Manager and Terminal Manager at Cyprus Petroleum Storage Company Ltd.



Course Outline

➤ Day 1

- Course Overview
- Quiz
- Introduction
 - Historical Perspective
 - Pump Types
 - Pump Categorization
 - Pump Classification to API 610
 - Pump Standards and Selection
 - Pump Applications
- Basic Fluid Mechanics
 - Basic Terms
 - Kinematics of Fluid Flow
 - Pressure Drop Calculations
 - System Curves
 - Exercises
- Centrifugal Pumps
 - Introduction
 - Flow within the Impeller
 - Flow
 - Head Net Positive Suction Head
 - Pump Characteristic Curve
 - Pump Efficiency
 - Hydraulic Power
 - Specific Speed
 - Suction Specific Speed
 - Cavitation
 - Recirculation and Air Entrainment
 - Axial and Radial Thrust
 - Control of Centrifugal Pumps
 - Minimum Flow Rate
 - Pumps Operating in Series
 - Pumps Operating in Parallel
 - Exercises
- Quiz

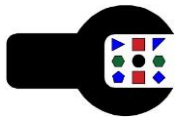
➤ Day 2

- Components of Centrifugal Pumps
 - Casing
 - Stuffing Box

- Bearing Bracket
- Impeller
- Wear Rings
- Shaft
- Couplings
- Auxiliary Components
- Bearings
 - Bearing Types
 - Rolling Element Bearing Classification
 - Bearing Fits
 - Mounting of Bearings
 - Axial Location of Bearings
 - Plain Bearings
 - Magnetic Bearings
 - Bearing Lubrication
 - Bearing Life
 - Bearing Failures
- Shaft Sealing
 - Introduction
 - Packed Stuffing Box
 - Mechanical Seals
 - How Mechanical Seals Work
 - Balanced/Unbalance Mechanical Seals
 - Double Seals
 - Non-Contact Seals
 - Mechanical Seal Lapping
 - Mechanical Seal Selection
 - API 682 Seal Arrangements
- Quiz

➤ Day 3

- Pump Installation
 - Pump Foundations
 - Pump Setting and Levelling
 - Shaft Alignment
- Pump Overhaul
 - Tools Required
 - Disassembly
 - Shop Measurements
 - Reassembly
 - Impeller Adjustment
 - Inspection of Seal Faces



- Inspection of Bearings
- Pump Operation and Monitoring
 - Start Up Procedure
 - Pump Piping
 - Shut Down
 - Operating Checks
 - Pump and System Monitoring
 - Performance Check
 - Vibration Analysis
- Materials Selection
- Quiz
- **Day 4**
 - Rotary pumps
 - Rotary VS Centrifugal Pumps
 - Comparing 4 Types of Rotary Pumps
 - Gear Pumps
 - Lobe Pumps
 - Vane Pumps
 - Positive Displacement Pump Characteristics
 - Pump Selection Guide
 - Operating procedures of rotary pumps
 - Rotary pump troubleshooting
 - Reciprocating pumps
 - Air operated diaphragm pumps
 - Piston Pumps.
 - Plunger pumps
 - Diaphragm Pumps
 - The Metering Pump
 - Liquid End Designs
 - Characteristics of Pulse Flow
 - Reciprocating pump troubleshooting
 - Other types of Rotodynamic pumps
 - Axial Flow Pumps
 - Mixed Flow Pumps
 - Sump pumps
 - Pump Drives
 - Motors
 - Diesel Engines
- Gearboxes
- Quiz
- **Day 5**
 - Practical Training
 - Disassembly and assembly of Centrifugal Pump
 - Use of Dial Gauges
 - Shop Measurements
 - Mechanical Seals inspection
 - Bearing Installation
 - Quiz
 - Course Evaluation
 - Presentation of certificates