BASIC PUMP TECHNOLOGY

TRAINIT ACADEMY

MUE238
Mechanical & Utility Engineering

COURSE TITLE

BASIC PUMP TECHNOLOGY

COURSE DATE/VENUE

18 - 22 March, 2019

London, UK

COURSE REFERENCE

MUE238

COURSE DURATION

05 Days

DISCIPLINE

Mechanical & Utility Engineering

COURSE INTRODUCTION

Pumps Troubleshooting means to find the root cause behind the problems or failures of the pump. Troubleshooting is a complete exercise involves number of activities that need to be practiced carefully and accurately for the troubleshooting to be successful. A good monitoring system, enough instrumentations, adequate data recording system, expert edition process of the accumulated data, right technique and analysis, need to be available. Of course troubleshooter must be deeply understand and familiar with the machine he is troubleshooting, the design, operation, oil systems, flushing systems, bearings, balancing systems, type of mechanical seals, and the application.

The course will discuss all aspects concerning pumps, familiar the participant with the details of pumps, different designs, application, operation, maintenance and potential problems and their possible root causes, and methods of eliminating or reducing the failure causes, methods analysis to find out the root causes of failures, and methods of curing such problems. A successful troubleshooting method increase the uptime of

machines, increase the profitability of the plant, and assure more safety for machines and personnel and minimize the cost of maintenance. will discuss different aspects of pipeline pigging and its different applications for the pipelines.

COURSE OBJECTIVE

Upon successful completion of this course, the delegates will be able to:

- Recognize pumps' different designs for different applications
- Recognize the different auxiliary systems for pumps, oil system, mechanical seals, flushing systems, balancing systems and alike
- Explain the performance, limit of operations and common causes of failures of pumps
- Describe methods of failure analysis, like oil analysis, vibration measurements, etc.
- Explain the principles and elements of troubleshooting methodology
- Describe the appropriate strategy of maintenance

COURSE AUDIENCE

The course is designed for plant safety specialists, maintenance engineers and technicians, maintenance planners, system engineers and operators in the power generation, oil, chemical, paper and other processing industries involved in pumps selection, specification, procurement, inspection, troubleshooting or repair. Mechanical and operation engineers and senior technicians who are responsible for specifying, selecting, operating, and troubleshooting and maintaining pumps.

COURSE CONTENT

Day One

1. Pumps: Performance, Control and Operation
   Manufacturer Characteristic Curves

   How to obtain pump performance curves experimentally

How to calculate pump performance curves operated at different speed

How to calculate pump performance curves for different impeller size

How to correct pump characteristics for fluid viscosity

Effect of suction conditions on pump characteristics

Positive displacement pumps Metering Feature

Limits of Operation

ISO and ASME characteristic curves

Preferred range of operation

Allowable range of Operation

Pump cavitation, $NPSH_R$

Pumps minimum flow rate limit

Pumps Controls

Pump and System interaction

Variation of operating conditions

Protective controls

Capacity control

Modification by speed variation

Modification by valve positioning

Day Two

2. Pumps: Selection, Standards, and Specifications
   Pumps Standards:

ANSI, HI, API, ASME, ISO standards

How standards differ

Standards tolerances

Pumps Application

- Boiler Feed Pumps
  - Pump capacity, suction conditions, and discharge pressure
- Condensate Pumps
  - Extremely low $NPSH_A$
- Water works
  - Ground and surface water sources
- Petroleum refinery service pumps (API-610)
  - Production, transportation and refining, high degree of standardization
- Chemical pumps
  - The widest variety of pumping problems, corrosive and corrosive-abrasive liquids
- Paper stock and process pumps
  - Similar to chemical pumps, non-clogging impellers
- Sewage and waste water
  - Submersible pumps
- Food and beverage sanitary pumps
  - Cleanliness and Contamination problems and Dispensing
- Air conditioning and refrigeration pumps
  - Sodium chloride and calcium chloride brines

The piping system to serve

- System Head curve
  - How to calculate friction loss
- Suction system configurations, $NPSH_A$
  - How to calculate $NPSH_A$

Pumps ratings

Head, Capacity and Power

Manufacturer Data

How to read through the manufacturer catalogues

Manufacturer Selector Chart

Specifications and inquiries

Preparing pump inquiries

Inquiries for specific services

Water works services

Chemical services

Petroleum services

Day Three

3. Pumps: Design, Materials and Seals
   Types of Pumps

Positive displacement pumps

Rotary Pumps

Dispensing Pumps

Metering Feature

Centrifugal pumps

Axial flow pumps

Multistage pumps

Special design pumps

Vertical pumps

Seal-less magnetic drive pumps

Submersible wastewater pumps

Multi-phase pumps

Pumps fittings

Standard fitted pump

All bronze, all iron, acid-resisting and salt water pumps

Material Selection, pH value, and galvanic corrosion

Mechanical seal selection

Single seals

Double seals

Cartridge seals

Dry gas seals

Seal flush and circulation plans

Day Four

4. Pumps: Failure Analysis, Troubleshooting and Maintenance
   The six sigma problem solving method 'DMAIC'

   (Development, Measurement, Analysis, Improvement, and Control Phases)

   Pump condition monitoring

   Vibration Analysis

   Vibration severity charts

   The head-Flow Method

   Shut-off Head Method

   Thermodynamic Method

   Balance Flow Measurement

   Reasons for Failures

   Mechanical

   Mechanical seal

Shaft deflection

Lubrication system

Balancing system

Operational

Reduced NPSH

Low flow operation

Cavitation

Parallel flow operation

Maintenance Strategies

Preventive Maintenance

Predictive Maintenance

Proactive Maintenance

Day Five

5. Case Studies
    a. system resistance reduction
    b. system resistance increase
    c. pump internal wear
    d. pump internal leakage
    e. pump foundation deterioration
    f. cavitation effect
    g. erosion and corrosion effect
    h. wearing ring problem

6. Delegates case studies
    Each group supposes to bring with them their own cases in order to analyze them and come up with the root cause behind the failure. The case should be supported with the necessary documents: the pump catalogue, the piping system, the type of service, the description of the problem, and the measurement carried out.

COURSE CERTIFICATE

TRAINIT ACADEMY will award an internationally recognized certificate(s) for each delegate on completion of training.

COURSE FEES

$6,150 per Delegate. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

COURSE METHODOLOGY

The training course will be highly participatory and the course leader will present, guide and facilitate learning, using a range of methods including formal presentation, discussions, sector-specific case studies and exercises. Above all, the course leader will make extensive use of real-life case examples in which he has been personally involved. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Case studies & Practical Exercises
- 10% Role Play
- 10% Videos, Software or Simulators (as applicable) & General Discussions