

**Training Title**

**BASIC PUMP TECHNOLOGY**

**Training Duration**

5 days

**Training Venue and Dates**

REF ME042	Basic Pump Technology	5	20 – 24 October, 2019	\$4,250	Dubai, UAE
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In any of the 5 star hotel. The exact venue will be informed once finalized.

**Training Fees**

- 4,250 US\$ per participant for Public Training. Fees Includes Course Materials/ Handouts, Tea/Coffee, refreshments, International Buffet Lunch

**Training Certificate**

Define Management Consultancy & Training Certificate of course completion will be issued to all attendees.

**COURSE DESCRIPTION**

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.

**TRAINING OBJECTIVES:**

- Deep understanding of the pumps' different designs for different applications
- Familiarize the participants with different auxiliary systems for pumps, oil system, mechanical seals, flushing systems, balancing systems and alike

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- Learn the performance, limit of operations and common causes of failures of pumps
- Learn methods of failure analysis, like oil analysis, vibration measurements, etc...
- Learn the principles and elements of troubleshooting methodology
- Learn the appropriate strategy of maintenance

1. Exercise the troubleshooting on real cases

**WHO SHOULD ATTEND**

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.

**TRAINING METHODOLOGY:**

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions, and motivate everybody find the right answers. 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.

Very useful Course Materials will be given.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Group Work & Practical Exercises
- 20% Videos & General Discussions

**COURSE CONTENTS:**

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**OUTLINE :-**

**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

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**Positive displacement pumps Metering Feature**

*Limits of Operation*

ISO and ASME characteristic curves

Preferred range of operation

Allowable range of Operation

Pump cavitation, NPSH<sub>R</sub>

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<sub>A</sub>

Water works

Ground and surface water sources

Petroleum refinery service pumps (API-610)

Production, transportation and refining, high degree of standardization

Chemical pumps [www.definettraining.com](http://www.definettraining.com)

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

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*The piping system to serve*  
System Head curve  
How to calculate friction loss  
Suction system configurations, NPSH<sub>A</sub>  
How to calculate NPSH<sub>A</sub>  
*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*

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## 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

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with the necessary documents: the pump catalogue, the piping system, the type of service, the description of the problem, and the measurement carried out.

NOTE:

Pre & Post Tests will be conducted

Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.

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