Training Title

RECIPROCATING ROTARY PUMPS & COMPRESSORS

Training Duration

5 days

Training Venue and Dates

REF ME045	Reciprocating Rotary Pumps & Compressors	5	01-05 November 2020	$4,500	Dubai, UAE

Training will be held at any 5 Star Hotels. Exact venue will be informed later.

Training Fees

- **4,500 US$ per participant for Public Training including 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.

TRAINING OVERVIEW

TRAINING DESCRIPTION

Pumps and compressors are essential components in almost all industries in that they are required to meet system demands and operate reliably. Failure to meet these requirements can have significant production (and hence cost) impacts.

Keeping these machines running with least troubles and shutdown decreases the downtime of the whole system. Right machine selection appropriate to the right application, right machine operation, effective maintenance programs, reliable monitoring system, and skilled personnel capable of doing the right trouble shooting are essential requirements for prolong machine life. All the above can be achieved via deeper understanding of the machines construction and tolerances, the limits and constrains on their operation, and the more effective controlling methods.

TRAINING OBJECTIVES

By attending this course you will gain an understanding of the characteristics of various types of Reciprocating Rotary pumps and compressors and their components. The course will provide engineers and technicians with information for the optimal selection, operation and maintenance of positive displacement pumps as well as positive displacement and dynamic compressors.

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WHO SHOULD ATTEND?

Supervisors, Engineers & Facility/Utility engineers, Technicians, Operating Personnel or anyone require a working level knowledge of pumps & compressors.

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**

DAILY OUTLINE

A- POSITIVE DISPLACEMENT PUMPS

1. Positive displacement pumps

- **1.1 External gear pumps**
- **1.2 Internal gear pumps**
- **1.3 Archimedes screw pumps**
- **1.4 Twin-rotor screw pumps**
- **1.5 Triple-rotor and 5-rotor screw pumps**
- **1.6 Twin-rotor geared-screw pumps**
- **1.7 Progressive cavity pumps**
- **1.8 Lobe pumps (including circumferential piston pumps)**
- **1.9 Vane pumps**
- **1.10 Peristaltic pumps(including rotary peristaltic pumps)**
- **1 .11 Rotary eccentric piston pumps**
- **1 .12 Axial and radial piston pumps**
- **1 .13 Inline piston pumps**
- **1 .14 Descaling pumps**
- **1 .15 Plunger pumps(includes horizontal and vertical)**
- **1 .16 Syringe pumps**
- **1 5.17 Diaphragm pumps (includes mechanical and hydraulic actuation)**
- **1.18 Air-operated double-diaphragm pumps**
- **1.19 Metering pumps (flow within + 0.1% to + 3% with substantial dp changes)**

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1.20 Direct-acting reciprocating pumps (includes pneumatic, hydraulic and steam actuation)
1.21 Non-metallic positive displacement pumps
1.22 Sealless positive displacement pumps
1.23 Hydraulic motors

2. Pump theory
2.1 Positive displacement pumps
2.1.1 Rotary positive displacement pump theory
2.1.2 Reciprocating positive displacement pump theory
2.1.3 Positive displacement pump curves
2.1.4 Classification of positive displacement pumps by application
2.1.5 Classification of other pump types by application

3. Pumps and piping systems
3.1 Pump hydraulic data
3.1.1 Hydraulic tolerances
3.1.1.1 General
3.1.1.2 Rotodynamic pumps
5.4.1.3 Positive displacement pumps
3.1.2 Pump H and Q at maximum efficiency qmax
3.1.3 Minimum pump flow
3.1.3.1 Devices for obtaining a minimum flow
3.2 Water hammer
3.2 .1 Hydraulic gradient
3.2 .2 Causes of water hammer
3.2.3 Pump behaviour after power loss
3.3 Pressure pulsations
3.3.1 Rotodynamic pumps
3.3 .2 Positive displacement pumps

4. Materials for pumps
4.1 Introduction
4.2 Typical materials
4.4 Corrosion and erosion
4.5 Abrasion resistant materials
4.6 Materials resistant to cavitation damage
4.7 Material selection

5. Process seals and sealing
5.1 Reciprocating rods
5.1.1 Lip seals
5.1.2 Soft packing
5.2 Process liquid seals for reciprocating rods

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B- Compressor content

1. Introduction

- **1.1. What is a Compressor?**
- **1.2. How Compressors work?**
- **1.3. Compressor Classification and Type Selection**

2. Different Types of Compressors

- **2.1. Dynamic Compressor Training**
  - **2.1.1. Ejector**
  - **2.1.2. Radial / Centrifugal**
  - **2.1.3. Axial**
- **2.2. Positive Displacement Compressor Training**
  - **2.2.1. Rotary Compressor**
    - **2.2.1.1. Sliding Vane**
    - **2.2.1.2. Liquid Ring**
    - **2.2.1.3. Screw**
    - **2.2.1.4. Lobe (Roots)**
  - **2.2.2. Reciprocating Compressor**
    - **2.2.2.1. Trunk type**
    - **2.2.2.2. Crosshead Type**

3. Detailed Description of Popular, Industrial Compressors

- **3.1. Operation Principle of Utility Air Compressors**
  - **3.1.1. Screw Compressor – Skid Mounted**
    - **3.1.1.1. Principle of operation**
    - **3.1.1.2. Control System and Lube oil circuit**
  - **3.1.2. V–Type, Trunk and Crosshead Compressor – Skid Mounted**
    - **3.1.2.1. Multi Stage, Trunk and Crosshead, principle of operation**
    - **3.1.2.2. Air and Cooling Circuit**
  - **3.1.3. Horizontal, Balanced, Opposed, Multi Stage Compressor**

- **3.2. Operation Principle and Maintenance concepts of Process Gas Compressors**
  - **3.2.1. Double Acting, Single and Multi Stage Reciprocating Compressor**
    - **3.2.1.1. Principle of Operation**
    - **3.2.1.2. Lubrication**
    - **3.2.1.2.1. Crankcase Main Bearing / Con-rod Big End Bearing**
    - **3.2.1.2.2. Cylinder and Packing Lubrication**
    - **3.2.1.3. Crankcase / Crank Shaft / Connecting Rod / Crosshead**
    - **3.2.1.4. Valves**
    - **3.2.1.5. Compressor Piston, Piston Elements, Piston Rod Reversal, Piston Runout and Piston End Clearances**
    - **3.2.1.6. Stuffing Box and Rod Packing elements**

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3.2.1.7. Compressor Cylinder Cooling System / Inter Cooling / After Cooling
3.2.1.8. Control System
3.2.1.8.1. Compressor Capacity Controls
3.2.1.8.2. Intake Unloader Valve
3.2.1.8.3. Clearance Pocket Unloading
3.2.2. Centrifugal Compressors
3.2.2.1. Centrifugal Compressor Working Principle
3.2.2.1.1. Capacity
3.2.2.1.2. Head
3.2.2.1.3. Compressor Surge / Compressor Surging and Compressor Anti Surge
3.2.2.1.4. Thrust Balancing
3.2.2.2. Lube Oil System
3.2.2.3. Seal Oil System
3.2.2.4. Component Arrangement
3.2.2.5. Sealing Arrangement
3.2.2.6. Dry Gas Seal
3.2.2.7. Bearing Arrangement

4. Troubleshooting & Maintenance
4.1 Principles of troubleshooting
4.1.1 Principles
4.1.2 Failure modes
4.1.3 Reasons of Failure
4.1.3.1 Mechanical seals
4.1.3.2 Bearings
4.1.3.3 Shaft deflection
4.1.3.4 Cavitation in pumps
4.1.3.5 Surge in compressors
1. Causes of compressor surge
2. Surge and compressor performance
3. Anti-surge methods
4.1.3.6 Statistics of more frequent troubles
5 Maintenanceof Pumps and Compressors.
5.1 Maintenance strategies
5.2 Measuring methods
5.3.. Monitoring and Data collection
5.3.1 Condition monitoring
5.3.2 Vibration.
5.3.3Thermography

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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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