

# Mechanical Engineering for Static and Rotating Equipment

## INTRODUCTION

- Oil and Gas Production Plants comprise both static and rotating equipment that represent main capital investment. Proper design, operation and maintenance of these equipment would increase their availability and reliability thus, ensure good return on investment. Understanding of the operation parameters effects and implementation of effective condition monitoring methods improve equipment health, extend their life time and mitigate the associated risks.

The delegates will cover:

- Design, inspection, and testing methods of static equipment [e.g., storage tanks, valves, boilers, heat exchangers and piping systems] according to the relevant standards to perform the fitness for service (FFS) analysis. The most up-to-date methods of equipment protection methodologies together with maintenance activities, including necessary repairs as prevention of failures.
- Working principles, operation, and condition monitoring methods of rotating equipment [e.g., motors, pumps, compressors, steam, and gas turbines] with modern maintenance strategies to improve equipment availability and to mitigate failures.
- This Mechanical Engineering for Static and Rotating Equipment training course will include several workshops with real problems from industrial practice which will enable discussions and exchange of experiences.

## OBJECTIVES

At the end of this seminar, you will learn to:

- Follow the requirements of industry inspection standards and practices
- Identify elements of safety of pressure vessels, storage tanks and pipelines
- Apply diagnostics and inspection procedures to pressure equipment
- Analyze results of condition monitoring and corrosion tests of static equipment
- Plan and manage activities related to maintenance and repair
- Apply industry inspection standards and best practices at your organization
- Optimize design and operation methods for your rotating equipment
- Apply diagnostics and inspection procedures to the rotating equipment
- Analyze results of condition monitoring and vibration control of rotating equipment
- Plan and manage activities related to maintenance and repair of rotating equipment

## **TRAINING METHODOLOGY**

- This training course will be conducted along workshop principles with formal lectures and interactive worked examples included in several workshops. Presented also will be several illustrative and instructive videos. The emphasis in this training course will be on the explanation of all technical points and providing answers to problems that are encountered in everyday industrial practice related to operation and maintenance, as well as repair and alterations of static equipment.
- Each learning point will be reinforced with practical examples. There will be ample opportunities for active discussion and sharing professional experiences and exchange that will help solidify the gained knowledge. All training seminar materials will be provided.

## **ORGANISATIONAL IMPACT**

Proper design and construction of new plant with appropriate specification would result in significant measurable improvements in process plant systems including improved plant integrity, reliability and availability with fewer failures that leading to:

- Improved plant integrity
- Improved equipment reliability
- Improved equipment availability
- Better safety record
- Improved plant profitability
- Improved plant integration and operation

## **PERSONAL IMPACT**

- Optimized design for Oil & Gas process plant
- Knowledge of static and rotating equipment construction and design
- Commissioning, inspection & testing of static and rotating equipment
- Knowledge of the requirements and application of relevant standards
- Management of reliability as applied to process plant

## **WHO SHOULD ATTEND?**

This training course is suitable to a wide range of professionals but will greatly benefit:

- Operation, technical service and maintenance professionals
- Technical professionals responsible for maintenance and repair of equipment
- Professionals involved in inspection and maintenance and repair
- Technical professionals dealing with risk assessment and integrity analysis
- Technicians dealing with regulating and metering and other measurements

## Course Outline

### Module I

#### Materials Engineering for Static Equipment

- Engineering Material Properties and Selection
- Materials Testing and Types of Metals
- Materials Failure Mechanisms
- Mechanical Design, Standards and Codes

#### Pressure Vessels, Tanks and Piping Systems

- Pressure Vessels and Steam Boilers
- Above Ground Storage Tanks: Operation & Safety
- Pipelines & Piping Systems: Operation & Safety
- Pressure Relief Valves: Selection & Sizing
- ASME BPV VIII & ASME B31.3 Standards and API Codes
- Storage Tanks: External & Internal Maintenance Techniques
- Cathodic Protection of Pipelines and Storage Tanks

#### Heat Exchanger: Types and Design Criteria

- Fundamentals and Types of Heat Exchangers
- Tube and Shell Heat Exchanger Design Methods
- Plate Heat Exchangers
- Performance Improvement of Heat Exchangers

#### Boilers and Valves: Design and Fundamentals of Operation

- Design and Operation of Boilers
- Operation and Control Methods
- Types of Valves
- Inspection Techniques for Boilers and Valves

#### Inspection, Monitoring & Maintenance Engineering

- Risk Management & Mitigation Technologies: ALARP Criteria
- Risk Based Inspection (RBI API 580) For Stationary Pressure Equipment (NDT)
- Pipeline Internal and External Corrosion Direct Assessment (ICDA & ECFA) Methods
- Repair Modern Technologies
- Review, Summary and Conclusions

## Module II

### Motors: Operation and Technical Characteristics

- Operation Principles of Motors
- Motor Characteristics: Torque Power Curves
- Power Consumption of Motors
- Motors International Standards
- Common Failure Modes
- Condition Monitoring Methods

### Pumps: Design, Operation and Monitoring Methods

- Pump Types, Positive Displacement and Dynamic
- Pump curves and Pump Selection
- Pumping system optimisation
- Energy saving opportunities for pumps

### Compressors: Design, Operation and Monitoring Methods

- Types of Compressors
- Compressor Performance Curves
- Surge and Stonewall on Compressors
- Effects of Speed and Gas Composition

### Steam Turbines: Design, Operation and Monitoring Methods

- Fundamentals of Steam
- Design and Operation of Steam Turbines
- Boiler Types and Characteristics
- Performance of Steam Turbines

### Gas Turbines: Design, Operation and Monitoring Methods

- Design and Operation of Gas Turbines
- Gas Turbine Characteristics
- Performance of Gas Turbines
- Summary and Conclusions