MERCURY

Process Equipment & Piping Resilience: Failures, Prevention, and Efficient Repairs

03 - 14 Feb 2025
Madrid (Spain)

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Process Equipment & Piping Resilience: Failures, Prevention, and Efficient Repairs

Ref.: 6039_249954 **Date:** 03 - 14 Feb 2025 **Location:** Madrid (Spain) **Fees:** 9500 **Euro**

Introduction

The mechanical integrity and reliability of process equipment and piping systems can only be achieved if they are designed by competent engineers and operated and maintained effectively within the design envelope, namely, the integrity operating window IOW.

This process equipment and piping resilience to repairs and prevention course provides the appropriate mix of fundamentals, methodologies, best industry practices, and practical tools to enhance the competencies and improve the performance of design, operation, and maintenance technical professionals individually and collectively to add value to the organization and improve plant safety and reliability.

Critical Insights into Oil and Gas Equipment and Piping

In the domain of oil and gas production, the design, operation, and maintenance of equipment piping and process piping are critical factors that affect the industry's effectiveness and safety. This process equipment and piping resilience to repairs and prevention course covers essential aspects of engineering equipment and tools, with a strong focus on preventing equipment failure and promoting efficient repairs and maintenance.

Participants in the process equipment and piping resilience to repairs and prevention course will delve into several factors, including plumbing pipe repair, resilience measurement tools, aviation maintenance training, maintenance training, process piping engineering, and piping in mechanical engineering. Special attention will be given to the prevention of piping failure, with the aim of cultivating a comprehensive understanding of the challenges and solutions associated with mechanical engineering piping in the oil and gas sector.

Targeted Groups

- Engineers.
- Technical Professionals.
- Operations and Maintenance Personnel.
- Maintenance of Oil and Gas Plants.
- Oil Refineries, Petrochemical Plants, and Power Plants.

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Course Objectives

At the end of this process equipment and piping resilience to repairs and prevention course, the participants will be able to:

- Increase awareness and understanding that the mechanical integrity of process equipment and piping systems depends jointly on the proper design, operation, condition assessment, and maintenance of the equipment, underscoring their vital individual and team roles in managing change.
- Explore practical and sound methods and tools to enable them to carry out basic design calculations for pressure equipment following applicable industrial codes, standards, and best practices.
- Understand the degradation mechanisms that process equipment could be subjected to over their operating life, how to identify them, predict and determine their impact, and what appropriate measures can be taken to prevent and control the resultant damage.
- Gain the knowledge and failure analysis skills they need to conduct damage and failure analysis to prevent similar failures from happening.
- Gain knowledge and skills in hazard identification and analysis and in risk assessment and management.

Targeted Competencies

By the end of this process equipment and piping resilience to repairs and prevention course, the target competencies will be able to:

- Working knowledge in mechanical design of pressure equipment and piping systems in compliance with applicable codes, standards, and regulations - ASME B&PVC Section VIII, B31.3.
- Understand the interdependence of design, operation, and maintenance for achieving mechanical integrity of pressure equipment and piping systems.
- Understand, predict, Identify, and assess active degradation mechanisms and the failures they may cause.
- Learn about failure investigation techniques and root cause analysis.
- Apply risk-based methodologies in inspection and maintenance - API 580.
- NDT methods and their practical application - ASMEB&PVC Section V.
- Perform Level 1 fitness-for-service assessments - API 579.
- Understand engineering materials properties and selection criteria for specific applications.
- Hazard identification and risk analysis and management.

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Course Content

Unit 1: Key Design Considerations, Guidelines, and Practices

- Process equipment - an overview.
- Plant integrity and reliability.
- Learn about the interdependence of engineering, operation, and maintenance.
- Management of change.
- Fitness for purpose.
- Understand service conditions, equipment sizing, and functional performance.
- Business-focused facilities - appropriate quality at the lowest life cycle cost.
- Safety by Design.
- Learn about the worst foreseeable credible scenarios, safeguarding, and best industry practices.
- Learn about codes, standards, and industry practices.
- Understand compliance with regulations and Acts - HS&E requirements and considerations.

Unit 2: Design and Operation of Pressure Equipment

- Understand pressure vessels and reactors.
- Materials of construction and standards.
- Basic design methodology.
- ASME boiler and pressure vessel code sections 2, 5, 8, and 9.
- Work examples.
- Storage Tanks.
- Types and applications include cone roof tanks and floating roof tanks.
- Basic design methodology.
- Overview of API 650.

Unit 3: Piping Systems

- Materials of construction and standards.
- Learn about basic design methodology - hydraulic design, pressure integrity, mechanical integrity.
- ASME B31.1 and B31.3.
- Piping flexibility and support.
- Piping system components - valves and fittings classes, ratings.
- Work Examples.

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Unit 4: Overpressure Protection

- Understand the types and applications of pressure-relieving devices.
- Code requirements.
- Sizing methodology: API 520 and 521.
- Learn about specific operation and maintenance requirements: API 576.

Unit 5: Design and Operation of Thermal Equipment

- Process heaters.
- Types and configurations: box type and vertical cylindrical type.
- Thermal and mechanical design.
- API 560, API 530.

Unit 6: Boilers

- Understand types and configurations: water tube, fire tube, and waste heat recovery boilers.
- Fundamentals of design and operation.
- Operate efficiency and testing.
- ASME B&PVC Section 1 and Section 4, ASME PTC-4.

Unit 7: Heat Exchangers

- Learn about types and applications: shell and tube heat exchangers, plate heat exchangers, and air-cooled heat exchangers.
- Thermal and mechanical design.
- Overview of TEMA standards, API 660, API 661.
- Operate, fouling, and effectiveness.

Unit 8: Design and Operation of Fluid Handling Equipment

- Pumps.
- Learn about the types and applications of centrifugal and positive displacement.
- Performance characteristics.
- Select and design considerations and standards ANSI, API 610.
- Work examples.

Unit 9: Compressors

- Types and applications centrifugal, screw, reciprocating.
- Design considerations and standards.
- Operation and troubleshooting.

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Unit 10: Electric Motors

- Types and applications.
- Operation and troubleshooting.
- Condition monitoring.
- Vibration monitoring.
- Lubricat oil analysis.
- Troubleshooting.
- Methodology and guidelines.
- Reliability improvement.

Unit 11: Degradation and Condition Assessment of Process Equipment

- Degradation processes.
- Overview of corrosion, erosion, fatigue, and hydrogen attack.
- Overview of API 571.
- Learn about industrial failures and failure prevention.
- Inspection and testing.
- Understand inspection strategies, plans, and coverage - a natural function of inspection.
- Understand Nondestructive Testing NDT methods and their characteristics and applicability.
- Risk-Based Inspection RBI.
- Overview of API 580 and API 581.
- Fitness-for-service assessment.
- Overview of API 579.
- Work examples.
- Maintenance Strategies and Best Practices.
- Understand the optimum mix of reactive, preventive, and predictive methods.
- Reliability Centered Maintenance RCM.

Unit 12: Failure Mechanics

- Wear and failure mechanisms.
- Imperfections and Defects.
- Corrosion mechanisms.
- Failure modes.
- Fatigue.
- Fret.
- Learn about creep and thermal fatigue.
- Stress corrosion cracking, other modes.
- Material properties and selection.
- Carbon and alloy steels.
- Nickel, titanium, and specialty alloys.
- Aluminum and aluminum alloys.
- Copper and copper alloys.
- Plastic piping.
- Understand alternative options and cladding.
- Limitations and safeguards.
- Understand material selection - economics cycle costing.

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Unit 13: Failure Prevention By Design

- Failure causes - design, operation maintenance, other causes.
- Material properties and selection.
- Understand the physical properties and limitations of components.
- Understand the physical properties of steel and alloy piping and tubing.
- Physical properties of fittings.
- Basic design.
- Pressure vessels.
- Piping systems.
- Liquid storage tanks.
- Operate and maintenance of process equipment.
- Damage mechanisms affecting process equipment.

Unit 14: Process Equipment Failures

- Learn about failures in pressure vessels, piping, and boilers.
- Strength reduction through material loss.
- Case histories.
- Piping system vibration.
- Mechanical and flow-induced resonance.
- Transient hydraulic pulsation.
- Pipe supports and restraints.
- Wind loading.
- Industry practices for failure prevention.

Unit 15: Inspection, Assessment, and Maintenance

- Inspection strategies plan and procedures - risk-based inspection API 580.
- Develop an RBI plan.
- Understand fitness-for-service assessment API 579.
- NDT methods and techniques.
- Probability of detection.
- Damage characterization.
- Select the correct techniques.
- Pigging of pipelines.
- Smart pigging.
- Cleaning.
- Operational procedures.

Unit 16: Operation and Maintenance

- Maintenance programs.
- Repair and alteration of pressure equipment and piping.
- Rerat piping and pressure vessels.
- Estimate of consequences of pressure vessels and piping failures.
- Failure analysis techniques.

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Registration form on the :
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