



Process Equipment & Piping Systems:
Application, Design & Operation
Conference



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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 design for the oil and gas conference 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.

This equipment and piping design for the oil and gas conference will add value to the organization and improve plant safety and reliability.

The Significance of Piping and Process Equipment in Oil and Gas Operations:

Oil and gas operations rely heavily on robust and efficient process equipment and piping systems. From exploration to refining and distribution, using specialized equipment and piping design is crucial for ensuring oil and gas products' safe and effective handling.

This equipment and piping design for the oil and gas conference includes equipment specific to the industry, such as separators, heaters, flaring systems, and various containers built to withstand the substances they hold.

This equipment and piping design for the oil and gas conference aims to provide a deep dive into the application, design, and operation of such critical oil and gas production equipment, equipping delegates with the necessary skills to optimize oil and gas equipment systems for functionality and safety.

Targeted Groups:

- Process, Mechanical, and Chemical Engineers.
- Operation and Maintenance Engineers.
- Project Engineers.
- Supervisors and Managers.
- Technical Personnel are involved in the inspection.

Conference Objectives:

At the end of this equipment and piping design for the oil and gas conference, the participants will be able to:

- Increasing awareness and understanding of the mechanical integrity of process equipment and piping systems depend jointly on their proper design, operation, condition assessment, and maintenance, underscoring their vital individual and team roles in managing change.
- Get 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 its 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.
- Enhance the knowledge and skills in hazard identification, analysis, and risk assessment and management.

Targeted Competencies:

Upon the end of this equipment and piping design for the oil and gas conference, the target competencies will be able to:

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

Conference Content:

Unit 1: Key Design Considerations, Guidelines, and Practices:

- Process Equipment - An Overview
- Plant Integrity and Reliability
- Interdependence of engineering, operation, and maintenance
- Management of change
- Fitness for Purpose
- Service conditions, equipment sizing, and functional performance
- Business-Focused-Facilities - Appropriate quality at the lowest life cycle cost
- Safety by Design
- Worst foreseeable credible scenarios, safeguarding, best industry practices
- Codes, Standards, Industry Practices
- Compliance with Regulations and Acts - HS&E requirements and considerations

Unit 2: Design and Operation of Pressure Equipment:

- Pressure Vessels and Reactors
- Materials of construction and standards
- Basic Design Methodology
- ASME Boiler and Pressure Vessel Code Sections
- Storage Tanks
- Types and applications cone roof tanks, floating roof tanks
- Basic design methodology
- Overview of API 650
- Piping Systems
- Materials of construction and standards
- 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
- Worked Examples
- Overpressure Protection
- Types and application of pressure-relieving devices
- Code requirements
- Sizing methodology: API 520 and 521
- Specific operation and maintenance requirements: API 576

Unit 3: Design and Operation of Thermal Equipment:

- Process Heaters
- Types and configuration box type, vertical cylindrical type
- Thermal and mechanical design
- API 560, API 530
- Boilers
- Types and configuration of water tube, firetube, and waste heat recovery boilers
- Fundamentals of design and operation
- Operating efficiency and testing
- ASME B&PVC Section 1 and Section 4, ASME PTC-4
- Heat Exchangers
- Types and applications Shell & Tube Heat Exchangers, Plate Heat Exchangers, Air Cooled Heat Exchangers
- Thermal and mechanical design
- Overview of TEMA standards, API 660, API 661
- Operation, fouling, and effectiveness

Unit 4: 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.
- Compressors:
 - Types and application Centrifugal, Screw, Reciprocating
 - Design considerations and standards.
 - Operation and troubleshooting.
- Electric motors:
 - Types and applications.
 - Operation and troubleshooting.
- Condition Monitoring:
 - Vibration monitoring.
 - Lubricat oil analysis.
- Troubleshooting:
 - Methodology and Guidelines.
 - Reliability improvement.

Unit 5: Degradation and Condition Assessment of Process Equipment:

- Degradation processes
- Corrosion, erosion, fatigue, hydrogen attack

- Overview of API 571
- Industrial Failures and Failure Prevention
- Inspection and Testing
- Inspection strategies, plans, and coverage - The real function of inspection
- 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
- Worked examples
- Maintenance Strategies and Best Practices
- Optimum mix of reactive, preventive, and predictive methods
- Reliability Centered Maintenance RCM

Unit 6: Failure Mechanics:

- Wear & Failure Mechanisms
- Imperfections and Defects
- Corrosion Mechanisms
- Failure Modes
- Fatigue
- Fretting
- Creep & Thermal fatigue
- Stress Corrosion Cracking, Other modes
- Material properties and selection
- Carbon & Alloy steels
- Nickel, Titanium, and Specialty alloys
- Aluminum, aluminum alloys
- Copper, copper alloys
- Plastic piping
- Alternative options-linings, cladding
- Limitations and safeguards
- Material selection - economics cycle costing

Unit 7: Failure Prevention By Design:

- Failure Causes - Design, Operation Maintenance, Other Causes
- Material properties and selection
- Physical properties and limitations of components
- Physical properties of steel and alloy piping and tubing
- Physical properties of fittings
- Basic Design
- Pressure Vessels
- Piping Systems
- Liquid Storage Tanks
- Operation and Maintenance of Process Equipment
- Damage Mechanisms Affecting Process Equipment

Unit 8: Process Equipment Failures:

- Failures in Pressure Vessels, Piping and Boilers
- Strength reduction through material loss
- Case histories



- Piping System Vibration
- Mechanical & Flow-Induced Resonance
- Transient Hydraulic pulsation
- Pipe supports and restraints.
- Wind Loading
- Industry Practices for Failure Prevention

Unit 9: Inspection, Assessment, and Maintenance:

- Inspection Strategies Plans and Procedures - Risk-Based Inspection API 580
- Developing an RBI Plan
- Fitness-For-Service Assessment API 579
- NDT Methods and Techniques
- Probability of Detection
- Damage Characterization
- Selecting the correct techniques
- Pigging of Pipelines
- Smart pigging
- Cleaning
- Operational procedures
- Operation and Maintenance
- Maintenance Programs
- Repair and Alteration of Pressure Equipment and Piping
- Rerating Piping and Pressure Vessels
- Estimation of Consequences of Pressure Vessels and Piping Failures
- Failure Analysis Techniques