

€ TRAINING

Understanding the Codes: ASME Boiler &
Pressure Vessel Code, and B31 Pressure
Piping Codes





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Introduction:

Pressure equipment such as boilers, pressure vessels, heat exchangers, pressure piping, and associated safety equipment are widely used in many industries e.g., hydrocarbon processing, chemical, power, pharmaceutical, and manufacturing. Pressure vessels and piping store energy and potentially hazardous fluids and thus have inherent safety risks. Pressure equipment designs are performed in compliance with applicable Regulations, Codes, and Standards and follow sound engineering practices to ensure structural integrity and safeguard public safety. The design covers material selection, stress analysis, fabrication, testing, inspection, operation and failure analysis, codes, standards, and regulations.

Regulations dictate the standards to be applied and refer to specific codes and standards. Failure to comply not only jeopardizes the safety and the environment but also carries penalties such as fines and possibly imprisonment. The International Boiler and Pressure Vessel BPV Code and the B31 Piping Codes establish rules of safety governing the design, fabrication, and inspection of boilers, pressure vessels, and piping during construction. The objective of the rules is to provide a margin for deterioration in service. Advancements in design and material and the evidence of experience are constantly being added

Course Objectives:

At the end of this course the participants will be able to:

- Understand what, where, when, and how to use various ASME codes.
- Provide a clear understanding of the intent and requirements of the codes, including terminology and interpretations.
- Show how and where the codes are to be applied.
- Explain the code applications for different industries and who is responsible for selecting the appropriate code.
- Ensure the understanding that Codes developed by standards committees, such as the ASME, rely on the use of sound engineering practices by knowledgeable engineers.
- Provide an understanding of Due Diligence in design i.e. "to be seen to be doing the right thing".

Targeted Audience:

- Refinery, Petrochemical and Process Plant Mechanical and Process Engineers
- Technical Professionals
- Inspectors, Maintenance Personnel
- Project and Consulting Engineers
- Engineering and Technical Personnel involved in plant mechanical integrity and reliability

Course Outlines:

Unit 1: Overview of Pressure Equipment and Piping and Related Codes and Standards:

- Review of General Engineering Principles
- Design conditions and specifications
- Basic stress and strain calculations
- Hoop and radial stresses in vessels and piping
- Welding processes
- Importance of codes and standards
- Codes and standards organizations - ASME, ASTM, ISO, API, ANSI, EN
- Development of codes and standards - consensus
- Limitations of codes and standards - they are not designed handbooks
- ASME history and general policies
- BPV Code
- B31 Piping Code
- Referenced Standards - B16, API 510, API 570, etc.
- Background
- PCC-1 - 2010 Guidelines for Pressure Boundary Bolted Flange Joint Assembly
- PCC-2 - 2008 Repair of Pressure Equipment and Piping
- PCC-3 - 2007 Inspection Planning Using Risk-Based Methods
- Primary factors that influence material selection for pressure vessels
- Maximum allowable material stresses specified by the ASME Code
- ASME Code and Brittle-Fracture Evaluation
- Introduction to the ASME Codes and Standards
- ASME Post Construction Standards
- Materials of Construction

Unit 2: ASME Boiler and Pressure Vessel Code - Service Sections:

- ASME BPV Code Service Sections - II, V, and IX
- ASME Section II - Materials
- Part A - Ferrous Material Specifications
- Part B - Nonferrous Material Specifications
- Part C - Specification For Welding Rods, Electrodes, And Filler Metals
- Part D - Properties
- ASME Section V - Nondestructive Examination - Scope and Structure
- Scope
- Description of the types of NDE specified in the code
- Where and when each type is to be used
- Examples
- Personnel Qualification
- Authorized inspectors
- Interpretation of results
- Reporting and corrective action
- Basic Coverage
- WPS Preparation and Review
- PQR Preparation and Review
- WPS Illustrative Example
- ASME Section V - Nondestructive Examination
- ASME Section IX - Welding and Brazing Qualifications
- ASME Section IX - Welding and Brazing Qualifications

Unit 3: ASME Boiler and Pressure Vessel Code- Design and Fabrication per Section VIII Div 1:

- ASME Section VIII Division 1
- Scope
- Structure of Section 8 Division 1 - Subsections A, B, and C; mandatory and nonmandatory appendices
- Design
- Design Conditions and Loadings
- Weld Joint Efficiency and Corrosion Allowance
- Design for Internal Pressure
- Design for external pressure and compressive stresses
- Design of nozzles, flanges, and reinforcement of openings
- Other design considerations - supports, external local loads, vessel internals
- Pressure Vessel Materials
- Acceptable welding details
- Post-weld heat treatment requirements
- Fabrication
- Inspection and testing requirements

Unit 4: ASME B31 Code for Pressure Piping - Part 1:

- Overview of ASME B31 Code for Pressure Piping
- Background
- Scope
- Overview of B31.1
- Overview of B31.3
- Overview of B31.4
- Overview of B31.8
- Selecting applicable piping code - Responsibility
- Overpressure protection

Unit 5: ASME B31 Code for Pressure Piping - Piping Design per B31.3:

- Piping Design Methodology, Procedures, and Guidelines
- Pressure integrity - internal and external pressure
- Mechanical integrity - static and dynamic loads
- Specification and Selection of Piping Components - Flanges, Valves
- Expansion, Flexibility, Supports, and Restraints
- Piping Stress Analysis
- Pipe thickness calculations
- Simplified flexibility analysis methods
- Demonstration of computer-assisted piping flexibility analysis