



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



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## Introduction

Pressure equipment, including boilers, pressure vessels, heat exchangers, pressure piping, and related safety equipment, is essential across various industries such as hydrocarbon processing, chemical, power, pharmaceutical, and manufacturing. These critical components are designed to safely contain energy and potentially hazardous fluids, necessitating strict adherence to regulations, codes, and standards.

This ASME boiler, pressure vessel code BPVC, and B31 course includes comprehensive considerations for material selection, stress analysis, fabrication, testing, inspection, operation, failure analysis, and a thorough understanding of pressure vessel codes and standards.

Regulatory bodies mandate which standards apply and reference specific codes and standards. Non-compliance presents significant safety risks and can result in severe penalties, including fines and potentially imprisonment. The International Boiler and Pressure Vessel BPV Code and the B31 Piping Codes provide safety rules governing the design, manufacture, and inspection of boilers, pressure vessels, and piping. These rules are continuously updated with the latest design advancements, material innovations, and insightful experiences gleaned from service use.

## Targeted Groups

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

## Course Objectives

Participants in this ASME boiler, pressure vessel code BPVC, and B31 course will:

- Comprehend ASME codes application, deciphering when and how to use them.
- Gain an in-depth understanding of code requirements, including terminology and interpretation.
- Learn about the applications of codes for various industries and the responsibilities associated with code selection.
- Recognize the role of engineering practices and knowledgeable engineers in following ASME standards for pressure vessels.
- Grasp the importance of Due Diligence in design to ensure responsible engineering decisions.

## Targeted Competencies

The target competencies in this ASME boiler, pressure vessel code BPVC, and B31 course will be able to improve:

- Overview of an in-depth ASME Boiler and Pressure Vessel Code BPVC sections I, II, V, VIII, and IX with a focus on section VIII division 1 for ASME section VIII training.
- Overview of a comprehensive look at ASME B31 Code for pressure piping, including B31.1 for power piping, B31.3 for process piping, B31.4 for pipeline transportation, and B31.8 for gas transmission, with particular emphasis on B31.3 Process Piping for pressure vessel training.
- Learn about Highlights of the Detailed coverage of standards referenced in the codes, including the B16 series, and understand ASME boiler code work updates.

## Course Content

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

- Review of general engineering principles.
- Design conditions and specifications.
- Primary 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, and EN.
- Development of codes and standards - consensus.
- Limitations of codes and standards - they are not design handbooks.
- ASME history and general policies.
- BPV Code.
- B31 Piping Code.
- Referenced standards - B16, API 510, and API 570.
- 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.
- Learn about the maximum allowable material stresses specified by the ASME Code.
- ASME Code and brittle-fracture evaluation.
- Understand 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 is the specification for welding rods, electrodes, and filler metals.
- Part D - properties.
- ASME section V - nondestructive examination - scope and structure.
- Scope.
- Understand the description of the types of NDE specified in the code.
- Where and when is each type to be used?
- Examples.
- Personnel qualification.
- Authorized inspectors.
- Interpretation of results.
- Learn about reporting and corrective action.
- Basic Coverage.
- Development background.
- Review of article I.
- Review of article IV.
- WPS preparation and review.
- PQR preparation and review.
- WPS illustrative example.
- ASME section V - nondestructive examination.
- ASME section IX - welding and brazing qualifications.

## **Unit 3: ASME BPV 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 appendix.
- 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 include supports, external local loads, and 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**

- Learn about piping design methodology, procedures, and guidelines.
- Pressure integrity - internal and external pressure.
- Learn about mechanical integrity - static and dynamic loads.
- Understand specification and selection of piping components - flanges, valves.
- Learn expansion, flexibility, supports, and restraints.
- Piping stress analysis.
- Pipe thickness calculations.
- Simplify flexibility analysis methods.
- Demonstrate computer-assisted piping flexibility analysis.