GENERAL

asme b31 1 to b31 3 comparision ppt psig

Published: September 19, 2026 | Index ID: #-

Understanding the ASME B31.1 to B31.3 Comparison: A Deep Dive into Piping Codes and Their Presentation in PowerPoint (PPT) with PSIG Units

When engineers, designers, and project managers work on industrial piping systems, they often encounter the ASME B31 series of codes. Among them, ASME B31.1 (Power Piping) and ASME B31.3 (Process Piping) are the most widely referenced. Though both codes aim to ensure safe, reliable, and efficient piping, they differ in scope, design pressures, materials, testing, and inspection requirements. For those preparing training or compliance presentations, understanding these differences—and how to convey them clearly in a PowerPoint (PPT) deck—is essential.

In this article we will explore the core distinctions between ASME B31.1 and B31.3, highlight the similarities that unify them, and provide practical guidance on creating an effective PPT that compares the two codes using PSIG (pounds per square inch gauge) as the pressure unit. By the end, you will have a comprehensive reference that balances technical depth with engaging presentation design.

1. Overview of ASME B31.1 – Power Piping

1.1 Scope and Purpose

ASME B31.1 is the standard for the design, fabrication, examination, and testing of power piping systems used in power plants, industrial facilities, and other high pressure applications. It covers a broad range of components, from boilers and turbines to high pressure pumps and piping that transports steam, water, and other power media.

1.2 Key Design Parameters

- Design Pressure: Typically ranges from 0 to 1,500 psig, depending on the system.
- Temperature Limits: Up to 1,500°F (815°C) for certain high temperature components.
- Material Selection: Focuses on alloys that can withstand high temperatures and pressures, such as stainless steels, nickel alloys, and carbon steels.
- Stress Analysis: Uses detailed stress calculations, including dynamic and thermal stresses.

1.3 Testing and Inspection

ASME B31.1 mandates rigorous testing, including:

- Hydrostatic pressure tests at 1.5× the maximum operating pressure.
- Non destructive testing (NDT) such as ultrasonic, magnetic particle, and radiographic inspections.
- Periodic visual inspections and leak detection.

1.4 Typical Applications

Power piping systems are found in:

- Electric power plants (thermal, nuclear, and hydro).
- Industrial steam and process plants.
- Oil and gas refineries.
- Petrochemical facilities.

2. Overview of ASME B31.3 – Process Piping

2.1 Scope and Purpose

ASME B31.3 governs the design, fabrication, inspection, and testing of piping systems that transport process fluids—liquids, gases, slurries, and vapors—within chemical, pharmaceutical, and petrochemical plants. The emphasis is on ensuring product purity, preventing contamination, and maintaining safety in potentially hazardous environments.

2.2 Key Design Parameters

- Design Pressure: Usually up to 1,200 psig, though many applications operate below 400 psig.
- Temperature Limits: Often lower than B31.1, typically below 1,200°F (650°C).
- Material Selection: Focuses on corrosion resistance, cleanliness, and compatibility with process chemicals; common materials include stainless steel, carbon steel, and special alloy steels.
- Stress Analysis: Considers thermal expansion, chemical corrosion, and dynamic loads.

2.3 Testing and Inspection

Process piping testing requirements include:

- Hydrostatic tests at 1.2× the design pressure.
- Leak testing with pressure decay or helium mass spectrometry.
- NDT methods like ultrasonic testing and radiographic inspections for critical joints.
- Routine visual inspections and cleaning to maintain product quality.

2.4 Typical Applications

Process piping is essential in:

- Chemical manufacturing plants.
- Pharmaceutical and biotech facilities.
- Food and beverage processing plants.
- Water treatment and desalination plants.

3. Core Differences Between ASME B31.1 and ASME B31.3

3.1 Design Pressure and Temperature Ranges

While both codes cover similar pressure ranges, B31.1 allows for higher maximum pressures and temperatures due to its power plant focus. B31.3's design pressures are generally lower, reflecting the typical operating conditions of process plants.

3.2 Material Requirements

ASME B31.1 emphasizes materials that can handle high temperatures and thermal stresses, such as nickel based alloys. B31.3 prioritizes corrosion resistance and cleanliness to protect product purity, leading to a broader selection of stainless steels and specialized alloys.

3.3 Stress Analysis and Calculations

B31.1 requires detailed calculations for dynamic and thermal stresses, including considerations for seismic and vibration loads. B31.3 focuses on thermal expansion and chemical corrosion, with less emphasis on dynamic loads unless explicitly stated.

3.4 Testing and Inspection Protocols

Both codes mandate hydrostatic testing, but B31.1 uses a higher test pressure (1.5× design pressure) compared to

B31.3 (1.2×). Additionally, B31.1 often requires more extensive NDT due to the higher risk of failure in power systems.

3.5 Inspection Frequency and Maintenance

Power piping systems (B31.1) typically undergo more frequent inspections and maintenance schedules due to the critical nature of power generation. Process piping (B31.3) focuses on maintaining product quality, leading to inspections that emphasize cleanliness and leak detection.

3.6 Documentation and Records

B31.1 requires comprehensive documentation of stress calculations, material certifications, and test reports. B31.3 places greater emphasis on traceability of materials and cleanliness records to ensure product purity.

4. Similarities That Bind B31.1 and B31.3

- Both codes are part of the ASME Boiler and Pressure Vessel Code (BPVC) and share a common foundation in safety and reliability.
- They both mandate hydrostatic pressure testing, NDT, and visual inspections.
- Material specifications, welding procedures, and inspection methods are often cross referenced.
- Both require compliance with applicable local regulations and industry standards.

5. Designing for PSIG: Why Pressure Units Matter

5.1 Understanding PSIG

PSIG (pounds per square inch gauge) is a pressure unit that measures pressure relative to atmospheric pressure. It is commonly used in industrial piping to specify operating pressures because it aligns with the gauge readings on pressure transducers and pressure vessels.

5.2 Converting PSI to PSIG

When preparing a comparison PPT, it's important to convert absolute pressures (psi) to gauge pressures (psig) for consistency. The conversion is simple: **psig = psi - atmospheric pressure ("H14.7 psi at sea level).**

5.3 Incorporating PSIG in Design Calculations

Both B31.1 and B31.3 use PSIG in their design formulas for stress analysis, material selection, and testing. When creating a PPT, include sample calculations that show how PSIG values influence pipe wall thickness, allowable stress, and safety factors.

6. Crafting an Effective ASME B31.1 to B31.3 Comparison PPT

6.1 Define Your Audience and Objectives

1. Identify whether the audience is engineers, project managers, or compliance officers.
2. Clarify the goal: training, certification, or project brief.
3. Set a clear timeline for the presentation.

6.2 Structure of the PPT

- Title Slide: Title, subtitle, presenter, date.
- Agenda Slide: Outline the sections.
- Introduction: Briefly explain ASME B31.1 and B31.3.
- Key Differences: Use a table or side by side comparison.
- Similarities: Highlight shared requirements.

- PSIG Calculations: Show sample calculations.
- Case Studies: Real world examples of B31.1 and B31.3 applications.
- Conclusion: Summarize key takeaways.
- Q&A: Allow time for questions.
- References: Cite ASME BPVC, ASTM, and other standards.

6.3 Visual Design Tips

- Use contrasting colors for headings and text to improve readability.
- Incorporate diagrams of piping systems, cross sections, and flowcharts.
- Utilize icons for pressure, temperature, and material symbols.
- Keep text concise; use bullet points for key facts.
- Include a slide that shows a sample PSIG conversion table.

6.4 Content for Key Comparison Slides

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