

Course Content

Title: ASME B31.3 Piping and Piping Component Design

Potential PDH: 40

Code: BTT010

Description:

The aim of this course is to provide the participants with a complete and up-to-date overview of the area of piping technology with an emphasis on process piping. The course covers design, fabrication, examination and testing requirements of ASME B31.3. It covers Code requirements from design through start-up of new piping systems, as well as requirements for inspection and repair of piping systems that have been in service, as provided in API 570, Piping Inspection Code. This course provides a foundation of knowledge necessary for those responsible for assuring the mechanical integrity of existing piping systems, as well as those responsible for designing and constructing new piping systems

Outline:

A course that will review the basic requirements of the ASME B31 Code for Pressure Piping with emphasis on B31.3, Process Piping. General topics in the course include Code organization and intent, pressure design, design for sustained loads including support design, flexibility analysis, equipment loads, flanges, expansion joints, supports and restraints, materials, fabrication, examination, testing, and, for existing piping systems, mechanical integrity. Applications of these concepts, including simple hand analysis methods and computer-based analysis methods, will be demonstrated. Included will be comparisons between ASME B31.3 and ASME B31.1, Power Piping. Inspection and maintenance (mechanical integrity) of existing piping systems will be covered, as provided in API 570, Piping Inspection Code.

Each session will be conducted in a lecture/discussion/problem solving format designed to provide intensive instruction and guidance on understanding Code requirements. The instructors will be available following each day's session to provide participants with further opportunity for discussion and consideration of specific problems.

1. Introduction
 - General Definitions
 - Piping Development Process
 - Piping System Standards
 - B31 Committee Organization
 - B31.3 Scope
 - Fluid Service Definitions
2. Metallic Pipe & Fitting Selection
 - Piping System Failure
 - Bases for Selection
 - Listed versus Unlisted Piping Components
 - Fluid Service Requirements
 - Piping Components
3. Materials
 - Strength of Materials
 - Bases for Design Stresses
 - B31.3 Material Requirements

Course Content

Page 2 of 4

- Deterioration in Service
- 4. Pressure Design (metallic)
 - Design Pressure & Temperature
 - Quality & Weld Joint Strength Factors
 - Pressure Design of Components
 - Piping Material Specifications
- 5. Valve Selection
 - Code Requirements
 - Selection by Valve Type
- 6. Introduction to Flexibility Analysis
 - What are we trying to achieve?
 - Sustained loads
 - Displacement Loads
 - Reaction Design Criteria
 - Stress Intensification
 - Flexibility Analysis
 - Input sample problem with instructor and examine output
- 7. Layout and Support
 - General Considerations
 - Support Spacing
 - Support Locations
 - Support Elements
 - The Sustained Load Analysis Fixing Problems
 - Sustained Load Analysis Workshop
- 8. Flexibility
 - General Considerations
 - Friction
 - Elbow Flexibility
 - Thermal Expansion
 - Spring Hangers
 - The Displacement Load Analysis
 - Elastic follow-up
 - Fixing Problems
 - Friction Workshop
 - Spring Hanger Workshop
 - Guided Cantilever Workshop
 - Numbered Problems 1 thru 5
- 9. Reactions
 - General Considerations
 - Fabricated Equipment
 - Rotating Equipment
 - Supports
 - Flanged Joints
 - Cold Spring
 - Numbered Problem 6
- 10. Flexibility Analysis
 - When to Perform a Detailed Analysis
 - Considerations
 - Solving Problems

Course Content

Page 3 of 4

- Chuck's Problem
- 11. Designing with Expansion Joints
 - Types of Expansion Joints
 - Pressure Thrust
 - Installation of Expansion Joints
 - Metal Bellows Expansion Joints
 - Other considerations
 - Argon Gas Piping (simplified)
- 12. Fabrication and Installation
 - Welder/Brazer Qualification
 - Welding Processes
 - Weld Preparation
 - Typical Welds
 - Preheating & Heat Treatment
 - Bending & Forming
 - Typical Owner Added Requirements
 - Installation
 - Flange Joints
- 13. Inspection, Examination and Testing
 - Inspection
 - Examination
 - Leak Testing
- 14. Systems
 - Instrument Piping
 - Pressure Relieving Systems
- 19. In-service Piping - Inspection, Repair, Alteration and Rerating
 - API 570 Piping Inspection Code
 - What to Inspect
 - Types of Inspection
 - Inspection Practices
 - Frequency and Extent of Inspection
 - Remaining Life Calculation
 - Repairs and Alterations
 - Rerating
- 20. What's Different in B31.1
 - Scope
 - Organization of the Code
 - Bases for Allowable Stresses
 - Piping Component Standards
 - Fluid Service Requirements
 - Material Requirements
 - Pressure Design and Flexibility Analysis
 - Fabrication and Installation
 - Inspection, Examination and Testing
- 23. Final Exam
 - Discussion Questions

Instructor:

Don Frikken is an internationally recognized authority in piping design. Now employed by Becht Engineering, Don had been with Solutia, Inc. and Monsanto Company for 34 years; working on a wide range of activities including piping and mechanical design, project engineering, and engineering standards. Don's principal specialty is piping design, including design of complex piping systems, piping flexibility analysis, selection of piping components including valves, development of piping standards and specifications, and developing and teaching numerous piping seminars and workshops. He is an ASME Fellow and is active on various ASME standards committees. He is a member and past Chair of the ASME B31.3 Process Piping Code committee, a member and past Chair of the B31 Standards Committee, which oversees all B31 Piping Code committees, a member of the B16 Standards Committee, a past member of the ASME Board of Governors, and a past member of the Council on Standards and Certification, which oversees ASME's codes and standards development.

Don has received many awards, including the ASME Melvin R. Green Codes and Standards Medal, which recognizes outstanding contributions to the development of documents used in ASME programs of technical codification, standardization and certification; the ASME B31 Forever Medal for Excellence in Piping; and the ASME B16 Hall of Fame Medal. Don graduated with a bachelor's degree in mechanical engineering from Kansas State University and has a master's degree in civil engineering from the University of Missouri-Rolla.

Ranjan Nadarajah Ph.D, PE, career has spanned over 22 years of worldwide involvement in petrochemical industries for ExxonMobil Research and Engineering and Becht Engineering. Prior to joining Becht Engineering, he worked as a fixed equipment specialist at ExxonMobil Research and Engineering and he has worked in more than a dozen countries worldwide to solve complex mechanical plant problems as well as mechanical support for large scale projects. He has extensive knowledge in pressure vessels, piping, and storage tanks, design and maintenance codes. At ExxonMobil, he was the lead fitness for service specialist and he is very well versed with the fitness for service codes as well as linear and non-linear finite element methods, piping flexibility analysis to solve complicated plant problems. Ranjan was also the Mechanical Delayed Coker and Storage Tank subject matter expert at ExxonMobil Research and Engineering. He was a former member of API-650 Welded Steel Tank for Oil Storage and presently he is a member of the ASME Working Group on Section VIII, Division II, Design by Analysis and Working Group on Section VIII, Division II, High temperature design. He has more than twenty publications and one patents. Dr. Nadarajah received his PhD and Bachelors in Mechanical Engineering from the University of Strathclyde, Glasgow, United Kingdom.