Bases and Application of Design Requirements for High Pressure Vessels in Section VIII Division 3 of the ASME Boiler and Pressure Vessel Code *(MC127)*

A Practical, Case Study-based Training Program
Led by:

Daniel T. Peters, PE

15 Hours • 1.5 CEUs • 15 PDHs

About this MasterClass

ASME B&PV Code Section VIII Division 3 contains mandatory requirements, specific prohibitions, and non-mandatory guidance for the design, materials, fabrication, examination, inspection, testing, and certification of high pressure vessels and their associated pressure relief devices. This two-day MasterClass provides an in-depth review of the rules and parameters of the Code that can have a significant impact on the design of high pressure vessels. This includes an overview of the analysis methods used, including the application of FEA in meeting the requirements of the Code. Practical examples are discussed to demonstrate the philosophy of the Code criteria.

For more information and to register, visit
go.asme.org/mc127

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ASME MasterClass Series

The ASME MasterClass Series focuses on applications and case studies of a particular topic. Each MasterClass is led by an ASME Master, an expert in his professional discipline, who brings a wealth of knowledge and practical examples to the forum. Participants are expected to have prior knowledge of the topic area to gain the most from this interactive environment.

Sessions are focused on real world examples and case studies, with active class discussion and analysis.

About this MasterClass

This two-day MasterClass provides an overview of the design methodology and philosophy of ASME Section VIII Division 3, Alternative Rules for High Pressure Vessels, which incorporates an overview of the analysis methods used, including the application of FEA, to meet the requirements of the Code.

Examples of practical applications for many of the techniques are discussed to demonstrate the philosophy of the Code criteria. This includes an overview of the problems presented in ASME PTB-5-2013 and the ASME Section VIII Division 3 Example Problem Manual. Detailed scenarios are examined to illustrate how the analytical techniques are applied, and their respective limitations. An overview of key elements of the materials, fabrication sections, along with a review of special construction techniques and an overview of fatigue calculations and life assessment are also included in the discussion.

Upon completion, attendees will be able to

- Apply the rules of ASME Section VIII Division 3 to pressure equipment design
- Evaluate the life of a component using ASME Section VIII Division 3 philosophy
- Define the limitations of the ASME Section VIII Division 3 in reference to pressure equipment design

Who Should Attend

This course is intended for pressure vessel engineers working for owner-users, manufacturing, or engineering and design firms in the high pressure industry. This may include refining, petrochemical, upstream petroleum, waterjet, powdered metal (CIP, HIP), or food processing industries, who either directly use or refer to ASME Section VIII Division 3.

About this ASME Master

Daniel T. Peters, PE, is an internationally recognized expert in the design and analysis of pressure equipment and pressure vessels, specializing in high-pressure equipment. He is currently an Associate with Structural Integrity Associates, Inc. and works in the area of pressure vessel and piping design, analysis, fitness for service, and asset management. He has applied engineering principles to the in-service inspection of equipment and long term asset management. This includes remaining life assessment utilizing fracture mechanics and fatigue, flaw evaluation and practical application of NDE techniques.

Mr. Peters has collaborated extensively with ASME BPV Code Sections II and VIII Divisions 1, 2, and 3 and ASME Post Construction Committees. He has been a member of the Subgroup on High Pressure Vessels (primarily responsible for Section VIII Division 3) for 15 years and Chairman for the past six years. He is a past Chair of the ASME Pressure Vessel and Piping Division's High Pressure Technology Committee and the Pressure Vessels and Piping Division. He has authored or coauthored several papers in this area with subject matter including cycle life of pressure vessels and high pressure components and stress concentration factors at cross-bores of cylinders.

Mr. Peters earned his Bachelor degree from Penn State University and his Master's degree from Gannon University. He is a registered Professional Engineer in eleven states including Ohio, Pennsylvania and Texas. He is an ASME Fellow and has received numerous awards for his contributions to both ASME Codes and Standards and with the Pressure Vessels and Piping Division.

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AGENDA

The contents are presented in 9 sessions, tentatively organized as shown. The two-day schedule allows for ample discussion and interaction with attendees. The instructors reserve the right to modify the content to address the audience's needs and preferences.

DAY ONE

8:00am – 10:00am

1. Background and Development of ASME BPV Code VIII-3
    a. Overview of VIII-3
    b. Discussion of VIII-3 Criteria
    c. User's Design Specification Overview
    d. Key References
    e. ASME PTB-5 VIII-3 Example Problem Manual

2. Materials
    a. Overview of Materials Used
    b. Mechanical Property Testing and Locations
    c. Toughness Requirements

10:30am to Noon

1. Basic Concepts in VIII-3, Design by Analysis
    a. Key Definitions – Liners, Layers, Leak before Burst, Design Pressure, Design Temperature, etc.
    b. Common Failure Modes
    c. Loadings

2. Linear Elastic Stress Analysis Method
    a. Overview
    b. Stress Categories and their Stress Limits
    c. Ratcheting – Bree Diagram
    d. Local Failure
    e. Elastic Stress Analysis Method – Example

1:00pm to 3:00pm

1. Nonlinear Stress Analysis Method
    a. Design By Analysis – Global, Local and Hydrotest
    b. Stress Definitions
    c. Stress Equations – Design Pressure / Principal Stresses
    d. Design with Non-Linear Material Models – KD-230

3:15pm to 5:00pm

2. Fundamentals of Nonlinear Ratcheting
    a. Ratcheting Overview
    b. Definitions
    c. Elastic-Plastic Modeling of Ratcheting Using FEA
    d. Cyclic Plasticity
    e. Summary
    f. Ratcheting – References

(End of Day One)

DAY TWO

8:00am – 10:00am

1. Design for the Protection of Fatigue
    a. Definition
    b. VIII-3 Fatigue Analysis – Overview
    c. Fatigue Assessment Methods
        i. Fatigue Curves
        ii. Fracture Mechanics
        iii. Structural Stress

10:15am - Noon

    d. Fatigue Assessment Methods – Comparison
    e. Fatigue Assessment Methods – Example
    f. Fatigue Assessment Methods – Commentary
    g. Fatigue Assessment Methods – References

1:00pm – 3:00pm

2. Special Design Topics ASME VIII-3
    a. Autofrettage
    b. Closures, Heads, Fasteners and Seals
    c. Layered Construction
    d. Wire Wound Vessels
    e. Environmental Considerations including Hydrogen
    f. Welded Construction
    g. Experimental Design Verification
    h. Overview of Additional CRPV Requirements

3:15pm – 5:00pm

3. VIII-3 Examination and Testing Requirements
    a. Examination overview and use of NDE
    b. Rules for Autofrettage and Hydrostatic testing

(End of Day Two)