Design by Analysis Requirements
ASME Boiler and Pressure Vessel Code
Section VIII, Division 2 – Alternative Rules

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

David Thornton

15 Hours • 1.5 CEUs • 15 PDHs

About this Master Class

This two-day Master Class provides the engineer an in-depth examination of the techniques used in Design by Analysis (DBA) of pressure vessel design. This course includes discussions on general requirements for numerical simulation using Finite Element Analysis (FEA); material modeling requirements for use with FEA; design load combinations for pressure vessel design; design for protection against plastic collapse using elastic stress analysis, limit load, and elastic-plastic stress analysis; background and requirements for the new strain limit criterion; buckling analysis types and differences in design margins; fatigue analysis using smooth bar and welded joint technology in the new structural stress approach; ratcheting assessment using both elastic and elastic-plastic analysis; and a special emphasis on the evaluation of thermal stresses.

For more information and to register, visit
http://go.asme.org/mc121

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ASME MasterClass Series

The ASME Master Class Series focuses on applications and case studies of a particular topic. Each Master Class 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 Master Class

The focus of the two-day Master Class is to provide an understanding of the analytical methods found in Part 5 of Section VIII, Division 2 as well as to convey practical information on how to meet the requirements using FEA. Discussion on the background of the analysis methods and their application will be presented through the ASME Pressure Technology Bulletins, *PTB-1-2013 Section VIII - Division 2 Criteria and Commentary* and *PTB-3-2013 Section VIII - Division 2 Example Problem Manual*. The attendees will gain an appreciation and understanding of how these analytical techniques can be applied to practical design situations. The class will include detailed example problems that demonstrate how the analytical techniques are to be applied, and their limitations. Detailed FEA models will be presented to help illustrate the various analytical techniques.

Upon completion, attendees will be able to:

- Define the basis and application of the design by analysis techniques to ensure proper vessel design.
- Apply the design by analysis techniques to the evaluation of in–service components through the Life-Cycle Management Process and the relationship to API 579-1/ASME FFS-1 Level 3 Assessments.
- Evaluate the basis of design by analysis techniques and how they compare with other International Pressure Vessel Codes, EN 13445 and PD 5500.

Who Should Attend

This course is intended for pressure vessels engineers working for Owner-Users, manufactures or engineering and design construction firms in the refining, petrochemical, and other comparable industries, that desire a practical understanding of one of the major areas of the new Division 2.

About this ASME Master

David Thornton, P.E., Principal Engineer and Technical Advisor, Equity Engineering Group, has over 35 years of experience in the refining and petrochemical industries, as a specialist in pressure vessel, piping, and tank design/analysis. He has worked both as an owner-user, and a consultant, providing his expertise to refineries and chemical plants worldwide. Currently with the Equity Engineering Group, his work has included mechanical engineering quality control for a $500 million clean fuels expansion of a Middle East refinery, FFS evaluations, Fracture mechanics evaluations, High Temperature Creep Analysis and Life Assessment, Fatigue, Structural Reliability, and Risk Assessment, etc. He is also responsible for training engineers and inspectors in API Fitness-For-Service API 579-1/ASME FFS-1, Pressure Vessel Design, and Piping Design and Analysis.

Mr. Thornton serves as a member of the joint API/ASME technical committee responsible for the development of FFS assessment techniques. He earned his Bachelor's degree in Civil Engineering at Drexel University, Philadelphia, PA in 1975, and his Master's degree in Theoretical and Applied Mechanics at Cornell University, Ithaca, NY in 1980. Mr. Thornton is a licensed professional engineer in a number of states.

MasterClass Requirements

Attendees will be sent material via email, which they must review prior to the course. Attendees are encouraged to discuss actual scenarios encountered as part of a class discussion.

This Master Class is structured on the assumption that participants have a basic understanding of ASME B&PV Code Section VIII, Division 2.

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AGENDA

The contents are presented in 7 sessions, tentatively organized as shown. Lunch and coffee breaks will be provided. 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: 8:00 am to 5:00 pm

Background and Development of VIII-2 — 8:00 AM – 10:00 AM

- Overview of VIII-2
- Comparison - Current VIII-2 vs Old VIII-2 (2006)
- ASME PTB-1
- ASME PTB-3
- Key References

Basic Concepts in VIII-2, Part 5 Design by Analysis — 10:15 AM – 12:00 N

- Design By Analysis
- Stress Definitions
- Primary Stress Basis
- Primary Stress Limits
- VIII-2 Allowable Stress Basis
- Secondary Stress Limits
- Peak Stress Limits
- Stress Categories – The Hopper Diagram
- Stress Categories – Nozzles
- Stress Calculations for Code Compliance

Special Topics in VIII-2, Part 5 Design by Analysis — 1:00 PM – 3:00 PM

- Applicability
- Numerical Analysis
- Material Properties
- Load Cases and Multipliers
- Brittle Fracture Assessment Using Facture Mechanics

Design for the Protection against Plastic Collapse — 3:15 PM – 5:00 PM

- Overview
- Elastic Stress Analysis Method
- Elastic Stress Analysis Method – Example
- Limit Load Analysis Method
- Limit Load Analysis Method – Example
- Elastic-Plastic (EP) Analysis Method
- Elastic-Plastic (EP) Analysis Method – Example
- Protection Against Plastic Collapse – Summary

End of Day One

Day Two: 8:00 am - 5:00 pm

Design for the Protection of Buckling 8:00 AM – 10:00 AM

- What is Buckling
- Buckling Analysis
- Buckling Analysis – Type 1
- Buckling Analysis – Type 2
- Buckling Analysis – Types 1 & 2
- Buckling Analysis – Type 3
- Buckling Analysis – Load Cases
- Buckling Analysis – Example
- Buckling Analysis – References

Design for the Protection of Fatigue 10:15 AM – 12:00 N

- Definition
- VIII-2 Fatigue Analysis – Overview
- Fatigue Screening
- Fatigue Assessment Methods
- Fatigue Assessment Methods – Comparison
- Fatigue Assessment Methods – Example
- Fatigue Assessment Methods – Commentary
- Fatigue Assessment Methods – References

Design for the Protection of Fatigue - continued 1:00 PM – 3:00 PM

Fundamentals of Ratcheting for Design by Analysis 3:15 PM – 5:00 PM

- Ratcheting Overview
- Definitions
- Bree Diagram
- Upcoming Code Modification
- Elastic-Plastic Modeling of Ratcheting Using FEA
- Cyclic Plasticity
- Summary
- Ratcheting – References

End of Class