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ASME
Section VIII – Division 3
Example Problem Manual



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**ASME Section VIII
Division 3 Example Problem
Manual**

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FOREWORD

In the 1980's, the Special Working Group on High Pressure Vessels was established for the purpose of creating a Standard dealing with the construction of "high pressure vessels" which are in general above 10,000 psi. This was based on recommendations made by the Operations, Applications, and Components Technical Committee of the ASME Pressure Vessel and Piping Division. "ASME Section VIII, Division 3 Alternative Rules for Construction of High Pressure Vessels" was first published in 1997. The Committee continues to refine and develop the Standard to this day.

Some of the innovative concepts which began with ASME Section VIII, Division 3 include:

- Use of elastic-plastic finite element analysis in design of pressure equipment
- One of the lowest design margins which was originally published at 2.0 and then lowered to 1.8
- Use of high strength materials for the pressure equipment used in manufacture of high pressure equipment
- Stringent requirements on fracture toughness for materials used in construction
- Complete volumetric and surface examination after hydrotest
- The use of fracture mechanics for evaluation of design life assessment in all cases where "Leak-Before-Burst" cannot be shown
- Consideration of beneficial residual stresses in the evaluation of the design life of vessels

ASME contracted with Structural Integrity Associates, Inc. to develop the ASME Section VIII, Division 3 Example Problem Manual. This publication is provided to illustrate some of the design calculations and methodologies used in the ASME B&PV Code, Section VIII, Division 3. It is recognized that many high pressure designs are unique and quite innovative and therefore, this example problem manual cannot cover all design aspects within the scope of Section VIII, Division 3. This is an attempt at covering some of the most common ones.

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PART 1

General Requirements



1 GENERAL REQUIREMENTS

1.1 Introduction

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 manual is based on the 2011 edition of the code.

1.2 Scope

Example problems illustrating the use of the analysis methods in ASME B&PV Code, Section VIII, Division 3 are provided in this document.

1.3 Organization and Use

An introduction to the example problems in this document is described in Part 2 of this document. The remaining Parts of this document contain the example problems. The Parts 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 in this document coincide with the Parts KM, KD-2 Elastic – Plastic analysis, KD-2 Elastic Analysis, KD-3 fatigue analysis, KD-4 fracture mechanics assessment, KD-5 evaluation of autofrettagged vessels, KD-6 evaluation of openings and closures, KD-8 evaluation of residual stresses in dual walled vessels, KT determination of limits on hydrostatic test pressure, Appendix E determination of bottom head dimensions for thick & thin walls and evaluation of thread load distributions in the ASME B&PV Code, Section VIII, Division 3, respectively. All paragraph references are to the ASME B&PV Code, Section VIII, Division 3 2010 edition with the 2011 Addenda [1].

The example problems in this manual follow the calculation procedures in ASME B&PV Code, Section VIII, Division 3. It is recommended that users of this manual obtain a copy of "Criteria of the ASME Boiler and Pressure Vessel Code Section VIII, Division 3" [2] that contains criteria on the use of the Code.

It should be noted that VIII-3 requires the use of API 579-1/ASME FFS-1 [3] for some calculation procedures. When reviewing certain example problems in this manual, it is recommended that a copy be obtained of this standard.