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ASME Section VIII – Division 1 Example Problem Manual

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ASME Section VIII - Division 1 Example Problem Manual

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FOREWORD

This document is the Division 1 example problem manual. In this manual, example problems are solved using both the Division 1 and Division 2 rules. When the design rule is the same, the example problem is solved using the Division 2 rules with the Division 1 allowable stress and weld joint efficiency. With this approach, users of Division 1 will become familiar and adept at using Division 2, and this will also provide a significant training benefit to the Division 1 user in that Division 2 has been designed as the home for the common rules initiative being undertaken by the ASME Section VIII Committee.

In 2007, ASME released a new version of the ASME B&PV Code, Section VIII, Division 2. This new version of Division 2 incorporated the latest technologies to enhance competitiveness and is structured in a way to make it more user-friendly for both users and the committees that maintain it. In addition to updating many of the design-by-analysis technologies, the design-by-rule technologies, many adopted from the Division 1 rules, were modernized. ASME has issued *ASME Section VIII – Division 2 Criteria and Commentary, PTB-1-2009* that provides background and insight into design-by-analysis and design-by-rule technologies.

The ASME Section VIII Committee is currently undertaking an effort to review and identify common rules contained in the Section VIII Division 1, Division 2, and Division 3 B&PV Codes. In this context, common rules are defined as those rules in the Section VIII, Division 1, Division 2, and Division 3 Codes that are identical and difficult to maintain because they are computationally or editorially complex, or they require frequent updating because of the introduction of new technologies. Common rules typically occur in the design-by-rule and design-by-analysis parts of the code; but also exist in material, fabrication, and examination requirements. A plan has been developed to coordinate common rules with the following objectives.

- Common rules in the Section VIII Division 1, 2, and 3 codes should be identical and updated at the same time to ensure consistency.
- Common rules will be identified and published in a single document and referenced by other documents to; promote user-friendliness, minimize volunteer time on maintenance activities, and increase volunteer time for incorporation of new technologies to keep the Section VIII codes competitive and to facilitate publication.
- Core rules for basic vessel design such as wall thickness for shells and formed heads, nozzle design, etc. will be maintained in Division 1; although different from Division 2 these rules are time-proven and should remain in Division1 because they provide sufficient design requirements for many vessels.
- ASME Section VIII Committee recognizes that Division 2 is the most technically advanced and best organized for referencing from the other Divisions and recommends that, with the exception of overpressure protection requirements, common rules identified by the committee shall reside in Division 2 and be referenced from Division 1 and Division 3, as applicable.

As a starting point for the common rules initiative, the ASME Section VIII Committee has developed Code Case 2695 to permit the use of some the design-by-rule procedures in Division 2 to be used for Division 1 construction.

As part of the common rules initiative, the ASME Section VIII Committee is working with ASME LLC to create separate example problem manuals for each Division. These manuals will contain problem examples that illustrate the proper use of code rules in design. The *ASME Section VIII - Division 2 Example Problem Manual, PTB-3 2009* has been completed and issued.

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PART 1

GENERAL REQUIREMENTS

1.1 Introduction

ASME B&PV Code, Section VIII, Division 1 contains mandatory requirements, specific prohibitions, and non-mandatory guidance for the design, materials, fabrication, examination, inspection, testing, and certification of pressure vessels and their associated pressure relief devices.

1.2 Scope

Example problems illustrating the use of the design-by-rule methods in ASME B&PV Code, Section VIII, Division 1 are provided in this document. Example problems are provided for most of the calculation procedures in either SI or US Customary units.

1.3 Definitions

The following definitions are used in this manual.

VIII-1 – ASME B&PV Code, Section VIII, Division 1, 2010 Edition, 2011 Addenda

VIII-2 – ASME B&PV Code, Section VIII, Division 2, 2010 Edition, 2011 Addenda

1.4 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. All paragraph references without a code designation, i.e. VIII-1 or VIII-2, see Definitions, are to the ASME B&PV Code, Section VIII, Division 1, 2010 with the 2011 Addenda [1].

The example problems in this manual follow the design by rule methods in ASME B&PV Code, Section VIII, Division 1. Many of the example problems are also solved using ASME B&PV Code, Section VIII, Division 2 design-by-rule procedures contained in Part 4 of this Code using the allowable stress from VIII-1. In addition, where the design rules are the same, the VIII-2 format has been used in this example problem manual because of the user-friendliness of these rules.

1.5 Comparison of VIII-1 and VIII-2 Design Rules

Since many of the design rules in VIII-2 were developed using the principles of VIII-1, it is recommended that users of this manual obtain a copy of ASME PTB-1-2009 [2] that contains the VIII-2 criteria and commentary on the technical background to these rules. A comparison of the design-by-rule procedures in VIII-2 compared with VIII-1 is shown in Table E1.1.

1.6 ASME Code Case 2695

In recognition of the similarities and the use of the latest technology in developing the design-by-rule part of VIII-2, ASME has issued Code Case 2695 that permits the use of VIII-2 design rules with VIII-1 allowable stresses with some limitations. Code Case 2695 is shown in Table E1.2.