PRESSURE POINTS

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ASME CODE NEWS

By Tom Pastor, Director, Engineering Technology Division

Questions and Answers

In the last issue of *Pressure Points (Volume 2 No. 2)*, we stated that for a vessel constructed in accordance with Section VIIII, Division 1, code-required radiography may be performed before or after the PWHT. We'd like to clarify that with the following revised question and answer.

Q For a vessel constructed of carbon and alloy steel in accordance with Section VIII, Division 1, must all radiography be performed after any mandatory PWHT?

A No. For this material, Code-required radiography may be performed before or after the PWHT. However, when constructing with high-alloy material, any welds made with straight chromium electrodes must be radiographed after any PWHT. [UHA-33(b)]

Final Word

REMINDER: 1998 B&PV Edition and '98 Addenda Contains Revisions

It was reported in an earlier edition of *Pressure Points* that the 1998 Edition of the ASME B&PV Code contains revisions (paragraphs with a 98 in the margin) that become mandatory January 1, 1999. In a break from tradition, ASME has chosen to publish one Addenda's worth of revisions within the edition to reduce publication and distribution costs.

A sample of some of the significant A98 changes include:

- PG-109.4 of Section I has been added, addressing the installation and certification of mechanically assembled piping.
- UG-35 of Section VIII-1 has been revised extensively. The definition of a quick-acting closure has been refined, including a clarification on the design of the locking elements.
- Appendix 1-7(b) of Section VIII-1 has been revised to correct the applicability and excessive conservatism that existed in the prior rules.
- QW-423.2 of Section IX is a new paragraph permitting base materials conforming to national and international standards or specifications to be used for welder qualification, in addition to ASME base materials.

A Comparative Analysis of Appendix 2 and Appendix Y Flange Design

By John Swezy Jr., Engineering Technology Division

Flanges used in pressure vessels constructed to the rules of the ASME Code, Section VIII, Division 1 must have appropriate design justification for their selection.

The most common approach is to use a referenced flange standard, such as ASME B16.5 (Small Diameter, NPS 1/2 through 24) or B16.47 (Large Diameter, NPS 26 through 60). The flanges are grouped by Class, with their allowable pressure and temperature ratings determined from a table. This approach is straightforward and can be used when the available flange dimensions, pressure-temperature relationships, service conditions, and flange performance suit your needs. If not, then a custom flange must be designed.

Custom flanges fall under several categories. For the purposes of this article, the discussion will be limited to flanges covered by Appendices 2 and Y.

When a custom flange is needed, many designers turn to Appendix 2. Appendix 2 calculations can be very tedious and intimidating, so designers frequently rely on a software program. For flanges over NPS-12, Appendix 2 designs generally result in a thicker flange than similar B16.5/B16.47 flanges. This increased thickness is one reason most fabricators try to use standard B16.5/B16.47 flanges. Clients often ask if other options are available.

Since it is a non-mandatory appendix, Appendix Y is often overlooked as an alternative. Designers may have assumed it will not yield a significant reduction in thickness. Or, they may have software for Appendix 2, but not Appendix Y, so don't consider it. However, it may prove desirable for some applications.

We recently conducted a comparison of various approaches to designing a body flange for a 36 inch OD pressure vessel made of SA-240-316L, 0.3125 inch thick, rated for 150 PSI @ -20 to 70°F. It was to be a hubless, loose, flat-faced flange, essentially as shown in sketch (a) of Figure Y-5.1.1. The flanges are identical, except an o-ring groove is cut into the face of one flange. An elastomeric o-ring gasket was to be used ($m = 0$ and $y = 0$). A flange thickness of 1.5 inches or less was desired.

To have a basis of comparison, the flange was initially designed per Appendix 2, assuming no contact outside the bolt circle. The flange was calculated as both loose and integral with an o-ring gasket. It was also calculated per WRC Bulletin 314 with a full-face gasket.

For Appendix Y, the flange was calculated as both a loose and integral type.

One consequence of designing Appendix Y flanges is that the bolting stresses often will be limiting unless the size or number of bolts is adjusted upwards. A review of the background work

Continued on next page

to Appendix Y confirms the need for more bolting.[1] To make the Appendix Y design work in this application, we increased the bolt size. B16.47 (Class 75 and 150) flanges use more bolts (40 and 44, respectively) than proposed for this design (36), so these specifications may provide a good starting point for determining the size and number to use in bolting selections.

The Appendix Y calculations resulted in lower stresses and thinner flanges than those designed per Appendix 2. The resultant limiting stress in an Appendix Y flange is the radial stress at the bolt circle. This being the case, the differences between integral and loose designs were insignificant for the Appendix Y design.

We also ran some examples for diameters of 10 inches and 60 inches under Appendices 2 and Y as a comparison. At larger diameters, the differences in calculated flange thickness become greater. For this example, the Appendix Y flanges were an attractive alternative.

A summary of the results is shown in the following table:

Code Appendix	Description of Design	36”	10”	60”
Appendix 2	Hubless Loose Type	2.5625”	0.9375”	7.9688”
Appendix 2	Hubless Integral Type	2.5313”	NA	NA
WRC Bulletin 314	Full Face Gasketed Flange	2.5938”	NA	NA
Appendix Y	Hubless Loose Type	1.0625“	0.625”	1.625”
Appendix Y	Hubless Integral Type	1.0625”	NA	NA

NA = not analyzed

Some reports of excessive leakage with Appendix Y flanges have been received from industry. This appears to be more prevalent in vessels operating over a wide temperature range. We recommend applying the lower stress values for stainless or other yield limited materials (those to which note G5 of Table 1A in Section II, Part D does not apply) to minimize the potential for unwanted distortion and/or leakage under operating conditions.

It is important to evaluate the suitability of the flange design for the intended service. Proper assembly procedures are also a critical factor in achieving acceptable service performance.

[1] “Flat Face Flanges with Metal-to-Metal Contact beyond the Bolt Circle,” R. W. Schneider, Transactions of the ASME, Journal of Engineering for Power, January 1968.

AROUND THE WORLD

European Directives Attempt to Harmonize Standards

By Sandy Babka, Engineering Technology Division

Have you ever tried to export one of your pressure vessels to Europe? If you have, you know that it can be a trying experience, depending on the country where the unit is to be installed. Some countries will accept a vessel constructed in accordance with the ASME Boiler and Pressure Vessel Code. Some may impose additional requirements on testing of materials, welding procedures, or on the design itself, and yet others will only accept vessels constructed in accordance with their design code and inspected by an organization appointed by their government. This will soon change with the implementation of the European Directives.

The objective of the Treaty of Rome (1957) was to remove the restrictions on freedom of movement for people, finance, services, and goods throughout the European Union (EU). To remove the technical barriers to trade, the EU created Directives, which are incorporated into national legislation and become law for the Member States of the EU. Initially, the Directives tried to incorporate all the requirements for design, fabrication, and testing. This proved to be an overwhelming task due to the fact that a Directive requires unanimous agreement in order to pass.

In the mid- to late 1980s, the European Commission introduced “New and Global Approaches” that changed the purpose of the Directives. These new approaches described the essential safety requirements that must be followed, and introduced such topics as conformity assessment procedures, Notified Bodies, and the CE Marking, and generalized the use of European standards related to quality assurance.

Declaration of Conformity. Organizations such as The European Committee for Standardization (CEN), CENELEC, and ETSI were charged with the responsibility for developing harmonized standards that would provide a “presumption of conformity” with a Directive. These standards are not mandatory, but they do compel national authorities to recognize that products manufactured to these harmonized standards conform to the essential requirements of the relevant Directive. These new directives also allow for a manufacturer to use a recognized national standard, as long as the design meets the essential requirements of the Directive and approval is obtained from a Notified Body.

Notified Bodies. A Notified Body is an organization appointed by and under the jurisdiction of a Member State. In the U.S., the equivalent would be the Authorized Inspection Agency (AIA). To become a Notified Body, an organization must meet the minimum requirements of technical and administrative competency established by the European Commission. A Notified Body performs the activities specified by a Directive, including quality system approval, design review, and inspection. They may delegate these activities, but they retain responsibility.

CE Marking. Following the issuance of a Declaration of Conformity by a Notified Body, the manufacturer may affix the CE Marking to the finished product. Once marked, the product is presumed to be in compliance with the relevant Directive(s) and can be installed anywhere within the EU and other non-Member States that accept the CE marking under other agreements.

Some Directives that are already in force are the Simple Pressure Vessel (87/404/EEC), Machinery (98/37/EC), and Low Voltage (73/23/EEC). The Pressure Equipment Directive (97/23/EC) begins its interim period November 29, 1999.

In future issues we’ll explore in more detail the steps (QC program, design, materials, welding specifications, fabrication, and testing) necessary to obtain a “Declaration of Conformity” for a pressure vessel to be exported to Europe.

For more information regarding the Pressure Equipment Directive and CE Marking, please contact Bryce Hart at 1-800-345-1122, ext. 2364, or email at Bryce_Hart@hsb.com, or Sandy Babka at 1-800-472-1866, ext. 5197 or email at Sandy_Babka@hsb.com.

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January 20	Repairs and Alterations to Boilers and Pressure Vessels	New Orleans, Louisiana	$ 250.00	990102
January 21 - 22	Section IX, Welding Qualifications	New Orleans, Louisiana	$ 530.00	990103
	Full week schedule: Intro. to Section VIII, Repairs, Section IX		**$ 1,160.00**	**990101-X**
January 18 - 20	Process Piping, ASME B31.3 - API-570	New Orleans, Louisiana	$ 650.00	990105
January 21 - 22	ASME Quality Control Programs	New Orleans, Louisiana	$ 530.00	990106
	Full week schedule: Process Piping and QC Programs		**$ 1,060.00**	**990105-X**
January 18	ISO Overview and Transition from ASME to ISO	New Orleans, Louisiana	$ 250.00	990107
January 19 - 20	ISO Quality Manual and Procedure Development	New Orleans, Louisiana	$ 450.00	990108
January 21	ISO 9000 as a Management Tool for Continuous Improvement	New Orleans, Louisiana	$ 250.00	990109
	Full week schedule: ISO Overview, QCM, Management Tool		**$ 850.00**	**990107-X**
January 18 - 20	Section VIII, Div. 1 Pressure Vessel Design	Cincinnati, Ohio	$ 900.00	990118
January 25 - 26	Introduction to Section VIII Div. 1	Calgary, Alberta, Canada	$ 530.00*	990110
January 27	Repairs and Alterations to Boilers and Pressure Vessels	Calgary, Alberta, Canada	$ 250.00*	990111
January 28 - 29	Section IX, Welding Qualifications	Calgary, Alberta, Canada	$ 530.00*	990112
	Full week schedule: Intro. to Section VIII, Repairs, Section IX		**$ 1,160.00***	**990110-X**
February 8 - 10	Process Piping, ASME B31.3 - API-570	Houston, Texas	$ 650.00	990201
February 11 - 12	Basic NDE Methods	Houston, Texas	$ 530.00	990202
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February 9 - 26	National Board Examination Preparation	San Diego, California	$ 3,150.00	990210
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March 9	Air Conditioning & Refrigeration Equipment Operation & Maintenance	Denver, Colorado	$ 169.00	990302
March 10	Electrical Equipment Operation & Maintenance	Denver, Colorado	$ 169.00	990303
March 11 - 12	Operation & Maintenance of Manufacturing Machines	Denver, Colorado	$ 530.00	990304
	Full week schedule: BOM, AC & Refrig., Electrical, Manufacturing		**$ 930.00**	**990301-X**
March 8	Introduction to Section VIII Div. 1	Hartford, Connecticut	$ 265.00	990207
March 9 - 10	Pressure Vessel Basic Design & Fabrication	Hartford, Connecticut	$ 565.00	990208
March 11 - 12	Pressure Vessel Advanced Design	Hartford, Connecticut	$ 735.00	990209
	Full week schedule: Intro. to Section VIII, PV Design & Fab., PV Advanced Design		**$ 1,380.00**	**990207-X**
March 22 - 26	API-653 Above Ground Storage Tank Examination Preparation	Toronto, Ontario, Canada	$ 995.00*	990305
March 15 - 17	Process Piping, ASME B31.3 - API-570	Buffalo, New York	$ 650.00	990306
March 18 - 19	Basic NDE Methods	Buffalo, New York	$ 530.00	990307
	Full week schedule: Process Piping and Basic NDE		**$ 1,060.00**	**990306-X**
March 22 - 23	Section I Power Boilers	Hartford, Connecticut	$ 530.00	990308
March 24	ASME B31.1 Fabrication	Hartford, Connecticut	$ 250.00	990309
March 25 - 26	ASME B31.1 Design	Hartford, Connecticut	$ 625.00	990310
	Full week schedule: Section I, B31.1 Fab., B31.1 Design		**$ 1,265.00**	**990308-X**

*Prices are in U.S. Dollars

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Do you have a question or topic suggestions for future issues? Contact Jill Smolnik in Hartford, CT at 800-472-1866, extension 5294, or via the Internet at jill_smolnik@hsb.com.

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