

2017 EDITION | MAJOR CHANGES

# ASME Boiler & Pressure Vessel Code

Design, fabricate and maintain  
reliable and safe boilers and  
pressure vessels

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## 2017 EDITION | MAJOR CHANGES

**This document represents a general summary of some of the major changes that will appear in the 2017 Edition of the ASME Boiler and Pressure Vessel Code (BPVC).**

All changes to the Code will be available when the 2017 Edition is issued on July 1, 2017. The specific detailed changes should be carefully reviewed and verified as published in the 2017 Edition to ensure compliance with Code requirements.

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## SECTION I MAJOR CHANGES

### **Revise PG-75 to Clarify Visual Examination Requirements for Section I Fabrication**

Visual examination is required in certain Section I paragraphs and implied in others, however there are no specific rules for technique, e.g., direct, remote, magnification, etc. The revision to PG-75 provides guidance for visual examination. Specific rules are not mandated by this revision, but specific requirements would be defined in the manufacturer's quality program in line with non-mandatory appendix A-302.

### **Add a New Nonmandatory Appendix A-X to Incorporate Code Case 2235 for Ultrasonic Testing**

Code Case 2235 was incorporated in Section I as a nonmandatory appendix to allow the use of ultrasonic examination and fracture mechanics based acceptance criteria in lieu of the workmanship based criteria specified in PW-52.

### **Revise PW-51.4 to Allow the Retention of Radiographs as Digital Images**

Current technology provides for accurate and secure conversion of radiographs from analog film to digital images. This revision adds rules addressing the practice allowing for retention of the radiographic images into digital format.

### **Revise PG-77 to Clarify Material Identification Requirements for Pressure Part Material Other Than Plate**

PG-77 addresses identification and traceability of plate material but does not address other pressure part material. This revision provides the requirement for a Section I Certificate Holder to maintain the identity of the pressure part material until the required Data Report is completed. Once a partial data report or Master Data report is certified the material identity requirement is satisfied. Material identification for the Part that is masked, removed, or otherwise obliterated due to subsequent processing need not be reestablished.

### **Revisions to PG-25.2.4 and PW-50 for Mandatory the Mandatory Training, Experience, and Examination Requirements Listed In Section V, Article 1, Mandatory Appendix II for CR, DR, PAUT and TOFD**

PG-25.2.4 and PW-50 were revised so the mandatory training, experience, and examination requirements listed in Section V, Article 1, Mandatory Appendix II that must be incorporated into the employer's written practice for the qualification of NDE personnel if the techniques of computed radiography (CR), digital radiography (DR), phased array ultrasonic (PAUT), or ultrasonic time of flight diffraction (TOFD) are to be used.

### **Revision to PG-73.5.2.2.2 for Auxiliary Lift Assist Devices**

At the time of lift assist devices were incorporated into the Code, the state of the art comprised only hydraulic and pneumatic actuated devices. The previous wording excluded other suitable means of device actuation. This revision to PG-73.5.2.2.2 adopts new wording that will permit any suitable means of lift assist device actuation. The proposed terminology "auxiliary lift assist device" is consistent with the terminology used in PTC 25.

### **Revisions to PW-54 for the Hydrostatic Test of Repair and Replacement Parts**

PW-54.1 was revised to clarify that welded pressure parts are to be subjected to a hydrostatic test with the completed boiler as required by PG-99. Revise PW-54.2 and PW-54.3 were revised by replacing the word “part” with the word “boiler.” PW-54.4 was added to refer the reader to paragraph A-64 for guidance when supplying repair or replacement parts.

### **Revise Table A-320 to Reference the 2016 Edition of B31.1, Power Piping**

Table A-320 was revised to reference B31.1 - 2016. Also included are two additional footnotes: (1) Figure PG-58.3.1(b) in Section I shall apply for boiler external piping (BEP) in lieu of Figure 100.1.2 (B.2) in B31.1, and (2) The 2017 Edition of Section I shall apply for BEP in lieu of that specified in B31.1 Mandatory Appendix F.

## **SECTION II PART A MAJOR CHANGES**

### **Over thirty-five ASTM Specifications Adopted into the 2017 Edition**

The list of ASTM Specifications adopted into the 2017 Edition are shown on the following pages. Please consult the specification in the 2017 Edition to determine if the ASTM specification and the ASME specification are identical or if any requirements were added to the corresponding ASME specification in Section II, Part A.

### **Seven International Material Specifications Adopted into the 2017 Edition**

The list of CSA, EN and JIS Specifications adopted into the 2017 Edition are shown on the following pages. Please consult the specification in the 2017 Edition to determine if the international material specification and the ASME specification are identical or if any requirements were added to the corresponding ASME specification in Section II, Part A.

## **ASTM SPECIFICATIONS ADOPTED INTO THE 2017 EDITION OF SECTION II, PART A**

### **ASTM A6/A6M-14**

Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

### **ASTM A20/A20M-15**

Standard Specification for General Requirements for Steel Plates for Pressure Vessels

### **ASTM A31/A31M-14**

Standard Specification for Steel Rivets and Bars for Rivets, Pressure Vessels

### **ASTM A36/A36M-14**

Standard Specification for Carbon Structural Steel

### **ASTM A182/A182M-14a**

Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

### **ASTM A213 / A213M-15**

Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes

### **ASTM A266/A266M-13**

Standard Specification for Carbon Steel Forgings for Pressure Vessel Components

### **ASTM A249/A249M-15a**

Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat Exchanger, and Condenser Tubes

### **ASTM A299/A299M-09**

Standard Specification for Pressure Vessel Plates, Carbon Steel, Manganese-Silicon

### **ASTM A312 / A312M-15**

Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

### **ASTM A333/A333M-13**

Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness

### **ASTM A335/A335M-15a**

Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service

### **ASTM A336/A336M-15**

Standard Specification for Alloy Steel Forgings for Pressure and High-Temperature Parts

### **ASTM A403/A403M-15**

Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

**ASTM A409/A409M-15**

Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service

**ASTM A426/A426M-13**

Standard Specification for Centrifugally Cast Ferritic Alloy Steel Pipe for High Temperature Service

**ASTM A455/A455M-12a**

Standard Specification for Pressure Vessel Plates, Carbon Steel, High-Strength Manganese

**ASTM A508/A508M-16**

Standard Specification for Quenched and Tempered Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels

**ASTM A515/A515M-10**

Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

**ASTM A516/A516M-10**

Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

**ASTM A517/A517M-10**

Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered

**ASTM A533/A533M-16**

Standard Specification for Pressure Vessel Plates, Alloy Steel, Quenched and Tempered, Manganese-Molybdenum and Manganese-Molybdenum-Nickel

**ASTM A542/A542M-13**

Standard Specification for Pressure Vessel Plates, Alloy Steel, Quenched-and Tempered, Chromium-Molybdenum, and Chromium-Molybdenum-Vanadium

**ASTM A553/A553M-14**

Standard Specification for Pressure Vessel Plates, Alloy Steel, Quenched and Tempered 7, 8, and 9 % Nickel

**ASTM A562/A562M-10**

Standard Specification for Pressure Vessel Plates, Carbon Steel, Manganese-Titanium for Glass or Diffused Metallic Coatings

**ASTM A572/A572M-13a**

Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

**ASTM A587-96**

Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry

**ASTM A645/A645M-10**

Standard Specification for Pressure Vessel Plates, 5% and 5 1/2% Nickel Alloy Steels, Specially Heat Treated

**ASTM A656/A656M-13**

Standard Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability

**ASTM A671/A671M-16**

Standard Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures

**ASTM A688/A688M-15**

Standard Specification for Seamless and Welded Austenitic Stainless Steel Feedwater Heater Tubes

**ASTM A723/A723M-10 (R2015)**

Standard Specification for Alloy Steel Forgings for High-Strength Pressure Component Application

**ASTM A765/A765M-07 (R2012)**

Standard Specification for Carbon Steel and Low-Alloy Steel Pressure-Vessel-Component Forgings with Mandatory Toughness Requirements

**ASTM A788/A788M-15**

Standard Specification for Steel Forgings, General Requirements

**ASTM A941-15**

Standard Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

**ASTM A962/A962M-11a**

Standard Specification for Common Requirements for Bolting Intended for Use at Any Temperature from Cryogenic to the Creep Range

**ASTM A965/A965M-14**

Standard Specification for Steel Forgings, Austenitic, for Pressure and High Temperature Parts

**ASTM A999/A999M-14**

Standard Specification for General Requirements for Alloy and Stainless Steel Pipe

## **INTERNATIONAL SPECIFICATIONS ADOPTED INTO THE 2017 EDITION OF SECTION II, PART A**

**CSA G40.21-13**

Specification for structural quality steels

**EN 10088-2:2013**

Specification for stainless steels Part 2: Technical Delivery Conditions for Sheet/Plate and Strip of Corrosion Resisting Steels for General Purposes

**EN 10088-3:2014**

Specification for stainless steel Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.

**EN 10216-2:2013**

Seamless steel tubes for pressure purposes — Technical delivery conditions Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties

**EN 10222-2:1999**

Specification for steel forgings for pressure purposes Part 2: Ferritic and martensitic steels with specified elevated temperature properties

**JIS G3118:2010**

Carbon steel plates for pressure vessels for intermediate and moderate temperature services

**JIS G 4303:2012**

Specification for Stainless Steel Bars

## SECTION II PART B MAJOR CHANGES

### **Ten ASTM Specifications Adopted into the 2017 Edition**

The list of ASTM Specifications adopted into the 2017 Edition are shown on the following pages. Please consult the specification in the 2017 Edition to determine if the ASTM specification and the ASME specification are identical or if any requirements were added to the corresponding ASME specification in Section II, Part B.

## **ASTM SPECIFICATIONS ADOPTED INTO THE 2017 EDITION OF SECTION II, PART B**

### **B111/B111M-11**

Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock

### **B251-10**

Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube

### **B367-13**

Standard Specification for Titanium and Titanium Alloy Castings

### **B543/B543M-12**

Standard Specification for Welded Copper and Copper-Alloy Heat Exchanger Tube

### **ASTM B574-10**

Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod

### **ASTM B575-14**

Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip

### **B620-03 (R2013)**

Standard Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Plate, Sheet, and Strip

### **B674-05**

Standard Specification for UNS N08904, UNS N08925, and UNS N08926 Welded Tube

### **B706-00 (R2011)**

Standard Specification for Seamless Copper Alloy (UNS No. C69100) Pipe and Tube

### **B928/B928M-13**

Standard Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments

## SECTION II PART C MAJOR CHANGES

### **Three AWS Specifications for Arc Welding Electrodes, Gas Welding Rods and Other Filler Metals Adopted into the 2017 Edition**

The list of ASTM Specifications adopted into the 2017 Edition are shown on the following pages.

## **ASTM SPECIFICATIONS ADOPTED INTO THE 2017 EDITION OF SECTION II, PART C**

**AWS A5.20/A5.20M:2005 (R2015)**

Specification for Carbon Steel Electrodes for Flux Cored Arc Welding

**AWS A5.28/A5.28M:2005 (R2015)**

Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding

**AWS A5.36/A5.36M:2016**

Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

## **SECTION II PART D MAJOR CHANGES**

### **Add Materials to Tables 2A and 2B for the New Class 1 Vessels that will be Adopted in 2017 Edition of Section VIII, Division 2**

In Section II, Part D Tables 2A and 2B were revised by adding the applicability/max temp limits and stress values for the new Class 1 vessels that will be adopted in 2017 Edition of Section VIII, Division 2.

### **Transfer Charts and Tables for Material Properties for Elevated Temperature from Section III, Subsection NH to Section II, Part D**

In the 2015 Edition the elevated temperature materials property data was moved from Subsection NH to Section III-Division 5. Subsection NH will be deleted in the 2017 Edition and. Some of the material properties data is also be moved to Section II, Part D to avoid any confusion of determining which Code rules apply if Section I or VIII applications were to reference Section III-Division 5 for elevated temperature data.

## SECTION III NCA MAJOR CHANGES

### **Certifying Engineer**

There was a revision to the designation of the individual tasked with certifying design documents on behalf of the Owner and N-Certificate Holder. The revision changed the designation from “Registered Professional Engineer” to “Certifying Engineer.” Additional requirements were also added to for this new designation.

### **Move Quality Assurance System Requirements to NCA-4000**

As part an effort towards consolidation, some quality assurance system requirements were moved to NCA-4000 without substantive changes other than renumbering into NCA-4200, 4300 and 4400. The revisions were as follows:

- Move NCA-3850 through NCA-3859.2 to NCA-4200. Change numbering from NCA-38XX to NCA-42XX.
- Move NCA-3950 through NCA-3963 to NCA-4300. Change numbering from NCA-39XX to NCA-43XX.
- Move NCA-3970 through NCA-3973 to NCA-4400. Change numbering from NCA-39XX to NCA-44XX.
- Update NCA-4000 title to read "Quality Assurance Requirements"
- Update paragraph citations throughout NCA 4200, 4300, 4400.
- Update NCA-4131 and NCA-4132

## **SECTION III APPENDICES MAJOR CHANGES**

### **Consolidate, Simplify and Modernize the Design by Analysis Rules**

There was a major rewrite to consolidate, simplify and modernize the Design by Analysis rules in Section III. The revision incorporates most of NB-3200 and all of Appendix XIV. It should be noted that Appendix XIV on Design Based on Fatigue Analysis was deleted as part of the rewrite.

### **New Mandatory Appendix XXVII for Level D Analysis**

A new Mandatory Appendix XXVII for Level D Analysis was added. The previous Non-Mandatory Appendix F was converted to a mandatory appendix, with some editorial and minor technical updates. The component design rules that were previously in appendix F were moved to the corresponding subsection. It should be noted that non-mandatory appendix will remain in the Code for one revision cycle and is scheduled for deletion in the 2019 edition. All cross references to this appendix, in all subsections, have been updated to reference Appendix XXVII.

### **Qualifications and Duties of Certifying Engineers Performing Certification Activities**

There was a revision to Appendix XXIII to specify three available means of initial qualification for a Certifying Engineer and also specify the means for maintenance of the Certifying Engineer qualification. One means of qualification retains the Registered Professional Engineer credential currently permitted in Section III. The proposal also makes mandatory certain elements of qualification which are currently non-mandatory.

## **SECTION III DIVISION 1 MAJOR CHANGES**

### **Changes to Division 1 to Accommodate the New Mandatory Appendix XXVII for Level D Analysis**

There are a series of changes in Division 1 to handle from transition of Non Mandatory Appendix F to Mandatory Appendix XXVII. All references throughout Division 1 were updated to the new Mandatory Appendix number and the Level D component design rules will be transferred into the appropriate subsection rather than appearing in the new mandatory appendix.

### **Changes to Division 1 Based on Rewrite of Appendix XIII**

The design by analysis rules from the subsection(s) were moved into Appendix XIII and the references throughout Division 1 were updated to Appendix XIII. It should be noted most of NB-3200 has been deleted from Subsection NB and incorporated into Appendix XIII.

### **Subsection NH will no Longer be Published Starting with 2017 Edition**

The content of Subsection NH on elevated temperature was incorporated into BPV III, Division 5, in the 2015 edition. Subsection NH was published with the 2015 but will be deleted for the 2017 Edition.

## **SECTION III DIVISION 3 MAJOR CHANGES**

### **New Subsection WD**

Subsection WD will be published in the 2017 edition for requirements related to internal support structures for use in transportation (Class TC) or storage (Class SC) containments. Additional revisions were made throughout Division 3 relating to the new Subsection WD.

## GENERAL SECTION III MAJOR CHANGE

### **Incorporation of End Notes**

Throughout all Section III Divisions and Subsections the end notes were reviewed and in many case incorporated into the body of the Code. If an endnote was incorporated into the body of the Code, the endnote was deleted from the Code.

## SECTION IV MAJOR CHANGES

### **Mandatory Appendix for Feedwater Economizers**

A Mandatory Appendix for the Requirements for Feedwater Economizers was added to Section IV along with and implementing revisions to HG-100 and H3 data report. A feedwater economizer is a heat exchanger in which feedwater to be supplied to a boiler or water heater is heated by flue gasses exiting the boiler or water heater. When such an economizer is supplied with a Section IV boiler or water heater, it shall be a certified pressure vessel which may be constructed in accordance with Section IV or accordance with Section VIII, Division I.

### **Adoption of the ASME CA-1 Standard on "Conformity Assessment Requirements"**

Various paragraph were revised to replace conformity assessment requirements with a reference to CA-1. This standard now covers the conformity assessment requirements formerly covered by the deleted requirements.

### **Clarification of the Scope for Part HLW**

The Scope of Part was clarified as shown below:

- Potable water heaters that exceed an input greater than 200,000 btu/hr (60kW) or a nominal water containing capacity of 120 gallons (450 L).
- Potable water storage tanks with a nominal water containing capacity of 120 gallons (450 L) or greater.
- Potable water heaters and water storage tanks designed for pressures not exceeding 160 psi (1100 kPa) or water temperatures not exceeding 210°F (99°C)

### **Corrosion Resistant Materials**

The Code clear states that internal tank surfaces must be corrosion resistant. It is less clear, however, in relation to heat exchangers installed into storage tanks or water heaters. The revision to HLW-310.1 will specifically require that heat exchangers installed in HLW stamped vessels shall be made out of corrosion resistant materials.

### **Clarification of Requirements for Modular Boilers**

Various paragraphs were revised or added for modular boilers to clarify the rules for their certification and add additional details for the required trim items on individual modules. Other revisions clarify the requirements for inspection openings and accessibility to nameplate stamping. Finally the current limit of 400,000 Btu/hr limit per module in HG-716 was deleted.

## SECTION V MAJOR CHANGES

### **Article 4, Revisions to Table IV-422 in Mandatory Appendix IV and Table V-422 in Mandatory Appendix V; Define the Essential Variables for Wedge Parameters**

Currently the only wedge essential variable is the "wedge angle" in Table IV-422 and "wedge natural refracted angle" in Table V-422. These do not fully cover the essential parameters associated with phased array wedges, or even properly define the wedge angle (natural refracted angle is different for different materials under examination). The revisions will change "wedge angle" to "wedge cut angle" and add more essential variables for wedges.

### **Article 4, Revisions to T-434.1.2 to Add Requirements for Alternative Materials for Calibration Blocks**

T-434.1.2 has no requirements for the use of alternative calibration blocks which were manufactured from a different product form or do not have the same heat treatment as the component to be examined. This addition of paragraph (c) will add the necessary rules so that alternative calibration blocks may be used.

### **Article 1, Revisions to T-110 Concerning Effective Date for a New Edition of Section V**

The addition of paragraph (c) clarifies that Section V may be used beginning with the date of issuance and becomes mandatory 6 months after the date of issuance unless modified by the referencing document. The new paragraph (d) tells users that Code Cases may be used beginning on the date they are approved by ASME.

### **Article 6, Revision to T-673.1 Concerning the Removal of Excess Water-Washable Penetrants**

A new paragraph was added to T-673.1 to permit removal of water washable penetrants with a clean, dry, lint-free cloth or absorbent paper followed by water-moistened wiping as an alternative to water spray.

### **Article 11, Multiple Revisions to Update the Rules of Acoustic Emission**

#### **Multiple ASTM Standards were either added or updated.**

The list of ASTM Specifications adopted into the 2017 Edition are shown on the following pages.

## **ASTM SPECIFICATIONS ADOPTED INTO THE 2017 EDITION OF SECTION V**

**ASTM A388/A388M-15**

Standard Practice for Ultrasonic Examination of Steel Forgings as an update to SA-388

**ASTM A745/A745M-15**

Standard Practice for Ultrasonic Examination of Austenitic Steel Forgings as an update to SA-745

**ASTM D129-13**

Standard Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)

**ASTM D7091-13**

Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

**ASTM E213-14e1**

Standard Practice for Ultrasonic Testing of Metal Pipe and Tubing

**ASTM E243-13**

Standard Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes

**ASTM E273-15**

Standard Practice for Ultrasonic Testing of the Weld Zone of Welded Pipe and Tubing

**ASTM E709-15**

Standard Guide for Magnetic Particle Testing

**ASTM E999-15**

Standard Guide for Controlling the Quality of Industrial Radiographic Film Processing

**ASTM E1114-09 (2014)**

Standard Test Method for Determining the Size of Iridium-192 Industrial Radiographic Sources

**ASTM E1165-12**

Standard Test Method for Measurement of Focal Spots of Industrial X-Ray Tubes by Pinhole Imaging

**ASTM E1419/E1419M-15**

Standard Practice for Examination of Seamless, Gas-Filled, Pressure Vessels Using Acoustic Emission

**ASTM E2075/E2075M-15**

Standard Practice for Verifying the Consistency of AE-Sensor Response Using an Acrylic Rod

**ASTM E2261/E2261M-12**

Standard Practice for Examination of Welds Using the Alternating Current Field Measurement Technique

**ASTM E2297-15**

Standard Guide for Use of UV-A and Visible Light Sources and Meters used in the Liquid Penetrant and Magnetic Particle Methods

**ASTM E2700-14**

Standard Practice for Contact Ultrasonic Testing of Welds Using Phased Arrays

**ASTM E2775-11**

Standard Practice for Guided Wave Testing of Above Ground Steel Pipework Using Piezoelectric Effect Transduction

**ASTM E2929-13**

Standard Practice for Guided Wave Testing of Above Ground Steel Piping with Magnetostrictive Transduction

**ASTM E3022-15**

Standard Practice for Measurement of Emission Characteristics and Requirements for LED UV-A Lamps Used in Fluorescent Penetrant and Magnetic Particle Testing

## SECTION VI MAJOR CHANGES

A total rewrite and update of Section VI will be published in the 2017 Edition of the ASME Boiler & Pressure Vessel Code. This update will make Section VI more consistent with current industry practice.

## SECTION VII MAJOR CHANGES

A total rewrite of Section VII was published with the 2015 Edition of the ASME Boiler & Pressure Vessel Code. There were no major changes to Section VII in the 2017 Edition.

## SECTION VIII DIVISION 1 MAJOR CHANGES

### Quick-Opening and Quick-Actuating Closures

UG-35.2 was revised to specifically address quick-actuating closures and UG-35.3 was added to address quick-opening closures. Appendix FF were revised to address the needs of both quick-actuating and quick-opening closures. The safety improvements include:

- Clear definitions of a quick-actuating closure and a quick-opening closure
- Consistency on usage of holding and locking elements
- Requirement to have a pressure release device (or allowance for operating and maintenance procedures) for a quick-opening closure
- Requirement for a Partial Data Report when a closure is provided as a part

### Openings in Pressure Vessels

The references to Appendix 1-9 and Appendix 1-10 in UG-36 were removed. Appendix 1-9 and Appendix 1-10 were removed in their entirety. The nozzle design methods of Appendices 1-9 and 1-10 were updated and moved to Part 4.5 of Section VIII, Division 2.

### Adoption of the ASME CA-1 Standard on "Conformity Assessment Requirements"

Added reference to CA-1 (Latest Edition) to Table U-3; replaced conformity assessment requirements in UG-117 and UG-131 with a reference to CA-1; replaced definitions in Appendix 3 with references to CA-1; deleted Appendix 25 (Rules for Acceptance of Testing Labs). CA-1 now covers the conformity assessment requirements formerly covered by the deleted requirements.

### Manual UT Examinations

UW-11(a)(8), UW-11(d), UW-12, UW-51(a)(4), and UW-53 were revised to clarify when manual and automated UT examination methods are acceptable.

### New PRT Certificate of Authorization and Certification Program for Organizations Fabricating Parts Without Design Responsibility.

Organizations fabricating parts are currently required to demonstrate design capabilities and are also required to obtain separate ASME Certificates of Authorization for fabricating parts under each Section of the Boiler Code. This program will permit organizations that fabricate parts and do not take design responsibility to obtain an ASME Certificate. The new program will also allow a Manufacturer who holds the PRT Stamp to fabricate parts for multiple Code Sections based on demonstrated capabilities. This change was also made in other Sections of the Code.

## SECTION VIII DIVISION 2 MAJOR CHANGES

### Incorporation of Vessel Classes in Division 2

Two vessel classes will be added in 2017 Edition of Section VIII Division 2

- Class 1 vessels have a Design Margin of 3.0, which is the same as 2004 Edition of Section VIII Division 2
- Class 2 vessels have a Design Margin of 2.4, which is the same as 2015 Edition of Section VIII Division 2

For both classes the toughness, material, design, fabrication and examination requirements are essentially the same

For Class 1 vessels, certification of the User's Design Specification is only required if a fatigue analysis is necessary

For Class 1 vessels, certification of the Manufacturer's Design Report is only required if Part 5 Design-by-Analysis is used to determine the pressure thickness of a component not covered by Part 4 Design-by-Rule or if a fatigue analysis is required.

For Class 2 certification of the User's Design Specification and Manufacturer's Design Report is required, same as requirement as in 2015 Edition.

The introduction of Class 1 vessels in Section VIII, Division 2 will allow U2 Certificate Holders to design and construct an ASME vessel with a U2 Certification Designator that is lighter than a Section VIII, Division 1 vessel but without all of the additional requirements of a U2 Class 2 vessel.

Class 1 vessels will also provide a means for Certificate Holders to build a vessel to a User's Design Specification without needing to go to a full U2 Class 2 vessel design.

### Paragraph 4.15.3.4 (e) Acceptance Criteria for Shear Stresses

The current basis for determining the acceptance criteria is based on whether a material is ferritic material or not; however there is no strict definition of what constitutes a ferritic material. A revised acceptance criteria is being introduced based on if the material carries Note G2 [*Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short-time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed 662/3% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain. These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y-2 lists multiplying factors that, when applied to the yield strength values shown in Table Y-1, will give allowable stress values that will result in lower levels of permanent strain.*] in Table 5A or Note G1 [*Due to the relatively low yield strength of these materials, these higher stress values were established at temperatures where the short-time tensile properties govern to permit the use of these alloys where slightly greater deformation is acceptable. The stress values in this range exceed 662/3% but do not exceed 90% of the yield strength at temperature. Use of these stresses may result in dimensional changes due to permanent strain.*]

*These stress values are not recommended for the flanges of gasketed joints or other applications where slight amounts of distortion can cause leakage or malfunction. Table Y–2 lists multiplying factors that, when applied to the yield strength values shown in Table Y–1, will give allowable stress values that will result in lower levels of permanent strain.] in Table 5B of Section II Part D.*

### **Adoption of the ASME CA-1 Standard on "Conformity Assessment Requirements"**

This is similar to the change discussed for Section VIII, Division 1. CA-1 on "Conformity Assessment Requirements" was added to Table 1.1. Various paragraphs were revised to replace conformity assessment requirements with a reference to CA-1.

### **Axial Compressive Stress and Hoop Compression**

Code Case 2286-5 was previously incorporated into Section VIII, Division 2. Paragraphs 4.4.12.2 (b) and (e), 4.4.12.4 (b) and (c), and 4.4.15 were revised to correct the limits for the compressive stress factors.

### **New PRT Certificate of Authorization and Certification Program for Organizations Fabricating Parts Without Design Responsibility.**

This change is similar to the one previously discussed for Section VIII, Division 1. This program will permit organizations that fabricate parts and do not take design responsibility to obtain an ASME Certificate.

### **Correct Equation 4.4.126 in Paragraph 4.4.12.4**

Equation 4.4.126 correctly bounds the stress when both stresses are compressive and equal (pressure stress) but diverges in a different path when the stress tends towards uni-axial with certain bounding stresses. This change corrects Equation 4.4.126.

## **SECTION VIII DIVISION 3 MAJOR CHANGES**

### **Multiple Revisions to Section VIII, Division 3 to Remove the Laminate Material Requirements for Composite Pressure Vessels**

The requirements for laminates used for load sharing metallic shells were removed from Section VIII, Division 3. All requirements for the materials, design, fabrication, qualification, examination and testing of laminates as part of the fabrication of a Section VIII, Division 3 composite pressure vessel were added to Mandatory Appendix 10 of Section X on Laminates with Load Sharing Metallic Shells for High Pressure Service. KS-720 was also revised by removing the requirement for a manufacturer of a composite reinforced vessels to have both the Section VIII, Division 3 “U3” certification designator and the Section X “RP” certification designator.

### **Revise KG-130 to Clarify the Requirements for Assembly and Testing of Vessels at Field or Intermediate Sites**

The requirements for field assembly and testing of Section VIII, Division 3 were clarified and requirements for assembly and testing at so-called “intermediate sites” were added as part of the revisions to KG-130. These revisions and additions define what Code related activities can be performed in the field or at intermediate sites.

## SECTION IX MAJOR CHANGES

### Revisions to QW-290 Concerning the Temper Bead Welding

A number of revisions were made to the QW-290 paragraphs and tables in response to concerns raised by the industry. These changes were proposed to have hardness testing, toughness testing, and no additional testing as independent methods. The method of acceptance and the acceptance criteria are to be specified by the Construction Section of the BPV Code or the Design Specification if required to be either hardness or toughness. If hardness or toughness are not specified, the qualification test requirement is bend testing.

### Proposed Addition to QF-302.2 to Allow the Use of the High Speed Tensile Impact Test (HSTIT)

This revision is applicable to plastic fusing methods. This addition to QF-302.2 allows HSTIT to be used as an alternative to the bend test for performance qualification in the same manner HSTIT is used for procedure qualification.

### Various Revisions to Section IX to Allow the Use of Low Power Density Laser Beam Welding (LLBW)

Several additions and changes were made to Section IX to allow the use of Low Power Density Laser Beam Welding (LLBW) that are more applicable when using a laser beam process without keyhole welding.

### Revisions to Form QW-483 to Facilitate Recording of Data Used for the Calculation of Heat Input

Form QW-483 for Procedure Qualification Records was revised to include Waveform Control, Power or Energy, Arc Time and Weld Bead Length in the Electrical Characteristics portion of the form. This facilitates the recording of data used for the calculation of heat input.

### Revise QW-303.1, QW-303.2 and Table QW-461.9 to Clarify the Intent of Section IX Regarding Performance Qualification Requirements for Welders Depositing Tack Welds.

The Construction Sections of the BPV Code do not have alternative qualification requirements for welders who only deposit tack welds and there are varying opinions within industry as to what the qualification requirements are for welders depositing tack welds. The revisions to QW-303.1, QW-303.2 and Table QW-461.9 clarify that a welder depositing tack welds is required to have the same qualifications as a welder depositing the production weld within the same weld joint. The only thing new is a provision which excludes diameter qualification limits on welders depositing tack welds which do not exceed 25% of the weld circumference.

### Various Revisions to Section IX Replacing "Notch Toughness Testing" and "Charpy V-Notch Testing" with "toughness testing"

There are many types of toughness testing methods (ASTM E 1820 JIC, etc) referenced in the Construction Sections of the BPV Code that are applicable to toughness testing of specimens for welding procedure qualification. Section IX is being revised to use the term "toughness testing" since the current language may be misconstrued as only being applicable when conducting "Notch Toughness Testing" and "Charpy V-Notch Testing."

**Revise QW-403.16 for Welder Qualification Diameter Limits for Set-On and Set-In Nozzle or Branch Connections**

Several interpretations exist (including IX-80-08 and IX-80-67) describing how to apply performance qualification diameter limits for “set-on” and “set-in” nozzle or branch welds. QW-403.16 is being revised to define welder qualification diameter limits for set-on and set-in nozzles or branch connections.

**Revise QW-322 to Clarify the Requirements for Expiration, Revocation and Renewal of Performance Qualifications for Welders and Welding Operators**

The revision to QW-322 clarifies the requirements pertaining to the continuity, expiration, revocation and renewal of qualifications for welders and welding operators.

**Various Revisions to Section IX regarding Terms such as “...omission of inert backing gas...”**

Various revisions to Section IX are being made to no longer require the requalification of a welder when an inert gas backing is not used. QW-408.8 is an essential variable for performance qualification for welders qualifying for GMAW/FCAW, GTAW, and PAW. By strict application of this rule, a welder who qualifies for GTAW using argon as the backing gas must requalify if he wants to weld using a reactive gas mixture such as 90 % argon/10 % nitrogen, which is commonly used in Europe. This requirement to requalify is not justified in these cases because once a welder has proved he has the skill to deposit sound weld metal welding in the presence of backing gas pressure, the gas composition is no longer important.

**Revisions to Forms QF-484(a), QF-484(b), QW-484A, QW-484B, QW-485 and QB-484 to Record When a Qualification Coupon is Welded or Fused and When the Qualification Record is Certified**

The date a procedure qualification or personnel qualification coupon is welded or fused is different than the date the PQR, WPQ, WOPQ, or FOPQ is certified (when all of the required tests have been completed). The current format of the nonmandatory forms offer no way to differentiate between the two dates. The revisions to Forms QF-484(a), QF-484(b), QW-484A, QW-484B, QW-485 and QB-484 will require a Manufacturer to differentiate between those two dates.

**Revision to QB-409 Regarding the Post Brazing Heat Treatment (PBHT) Qualification Requirements**

QB-409 was revised to require a separate procedure qualification when (1) a PBHT is either added or deleted or (2) a change in PBHT temperature with certain newly proscribed parameters.

## SECTION X MAJOR CHANGES

### **Add a New Mandatory Appendix Covering Laminates with Load Sharing Metallic Shells for High Pressure Service**

This new appendix was added for new requirements for laminates with load sharing metallic shells for high pressure service. This Appendix defines the requirements for the materials, design, fabrication, qualification, examination and testing of laminates to be applied as part of the fabrication of a Section VIII, Division 3 composite pressure vessel. The completed vessels are defined as composite reinforced pressure vessels for storage of fluids at high pressure. This appendix incorporates many of the requirements that were contained in Section VIII, Division 3 and shall only be used per Section VIII, Division 3. Additionally, the latest ASTM standard on acoustic emissions testing is incorporated.

### **Add a New Nonmandatory Appendix on Micromechanics**

This appendix add micromechanics as an alternative method to testing, for determining elastic properties of a lamina. This nonmandatory appendix contains the equations that can be used to predict elastic constants for both a unidirectional lamina and for a randomly distributed reinforced lamina. Determination of the elastic constants using micromechanics would be permissible as an alternative to determination via testing per RT-7. This proposal also includes the changes required to various paragraphs to permit the use of micromechanics to determine the elastic constants as an alternate to testing per RT-7.

### **Revise RT-223 to Clarify the Requirements for Cyclic Pressure and Hydrostatic Pressure Qualifications Tests**

RT-223 was revised to clarify the temperatures required for the cyclic pressure test and the hydrostatic pressure test. This revision allows a test fluid temperature to be at least the maximum design temperature of the vessel for the hydrostatic pressure qualification tests. RT-223.1 and RT-223.5 were reformatted for clarity regarding the requirements for the cyclic test and the hydrostatic pressure qualification test.

### **Add a new Nonmandatory Appendix Providing Guidance on Fire and Excessive Heat Exposure for FRP Pressure Vessels**

This new nonmandatory appendix provides guidance to owners or users of Fiber Reinforced Plastic (FRP) pressure vessels to mitigate the effects of fire and exposure to excessive heat on FRP vessels covered by this Section. FRP vessels generally cannot be protected by an overpressure protection device if exposed to fire since the laminate will lose its structural integrity if exposed to fires within a short amount of time before pressures in the vessels will increase enough to trip a relief device. This appendix offers some general guidance on how to protect a Section X vessel before it fails or leaks if exposed to fire.

### **Updating ASTM Standards in Section X**

The ASTM Standard Specifications listed in Section X were revised so the titles reflect the present versions and the years from the ASTM Standards were deleted noting instead that the most recent approved version of the standards apply. Also those ASTM Standards that were withdrawn were removed from Section X.

**Revise Article RT-6 on Test Procedure for Class II Vessels by Adopting ASTM E1067**

RT-6 was revised and now references ASTM E1067 Standard Practice for Acoustic Emission Examination of Fiberglass Reinforced Plastic Resin (FRP) Tanks/Vessels. The ASTM standard is being adopted to take advantage of the most up-to-date standard for acoustic emission.

## SECTION XI MAJOR CHANGES

### **Update the Inspection Requirements for Steam Generators**

IWB was revised to remove preservice steam generator inspection requirements. Paragraphs IWA-2312, IWA-2315, and Article VII were revised to properly address the eddy current training and qualification requirements. And revise the steam generator requirements to state steam generator inspections are conducted in accordance with the program technical specifications. The acceptance standards for steam generator inspections were also removed.

### **Revisions to Regulatory Requirements**

The owner responsibilities in the preface, as well as paragraphs IWA-1300, IWA-1400, IWA-2441 and IWA-6211 were revised. These various revisions contain a partial set of more broadly planned Section XI changes to paragraphs containing specific regulatory requirements. In recognition of the international use of ASME Section XI, the potential differing regulatory requirements in different countries, and need to address changes in regulatory requirements in the United States and internationally, applicable regulatory authorities should impose their specific requirements in their regulations rather than including the specific requirements in Section XI. However some general regulatory requirements and a description of the interface with the regulatory authorities is expected to be retained in Section XI.

### **Revisions to IWF-2420 and IWF-2430 to Clarify Requirements for Successive Inspections and Additional Examinations for Supports.**

Revise IWF-2420 to clarify repair/replacement activities are to be consistent with IWF-3112.2 and IWF-3122.2. IWF-2430(a) was also revised to indicate that additional examinations are required when repair/replacement activities are required to correct unacceptable support conditions.

### **Axial ID Flaw Equations for Implementation into Article A-3000 of Section XI Appendix A**

New axial ID flaw equations and tables were added to Article A-3000 of Section XI Appendix A. This addition provides closed form relations and numerical tables for stress intensity factor influence coefficients for axial ID surface flaws in cylinders.

### **Streamline IWA, IWB, IWC and IWD for Items Involving Regulatory Requirement Identification**

There were various revisions to IWA, IWB, IWC and IWD resulting from a Section XI committee review of all callouts of regulatory requirements, e.g. review, submit, etc. Regulatory requirements were deleted where they deemed unnecessary.

### **Clarification of IWA-4400 Defect Removal Rules**

This clarification revises IWA-4421 "General Requirements" to delete paragraph (e) referencing IWA-4340, and to modify paragraph (c) by adding subparagraphs (1) addressing defect removal by removing all or a portion of the defective item and (2) addressing restoration of thinned areas by welding. It also removes the term 'mitigation' from IWA-4421, to

make it clear that defect removal is mandatory when repairs are performed in accordance with IWA-4421.

### **Use of the Term “Evaluation” in Section XI**

The Section XI committee clarified several definitions concerning “evaluation” (e.g., engineering evaluation, analytical evaluation) and added a definition for “NDE Evaluation.” The use of the word “evaluation” was then assessed throughout Section XI to determine to leave as is, replace or revise it based on the context within a paragraph. These changes are intended to align with the new definitions.

## SECTION XII MAJOR CHANGES

### **Add a New Nonmandatory Appendix Covering Preheat**

A new nonmandatory appendix was added to Section XII to provide recommended minimum preheat temperatures for various materials. The temperatures are provided as a general guide for the materials listed by P-Numbers in Section IX. The user is cautioned that the preheating temperatures listed do not necessarily insure satisfactory completion of the weld joint and requirements for individual materials within the P-Number listing may have preheat requirements more or less restrictive than this nonmandatory appendix.

### **TG-110.2 Revised to Clarify the Internal Pressure Range for Vessels Fabricated in Accordance with Section XII**

TG-110.2 was revised to show an internal pressure range from full vacuum to 207 bar (3,000 psig) for vessels within the scope of Section XII.

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