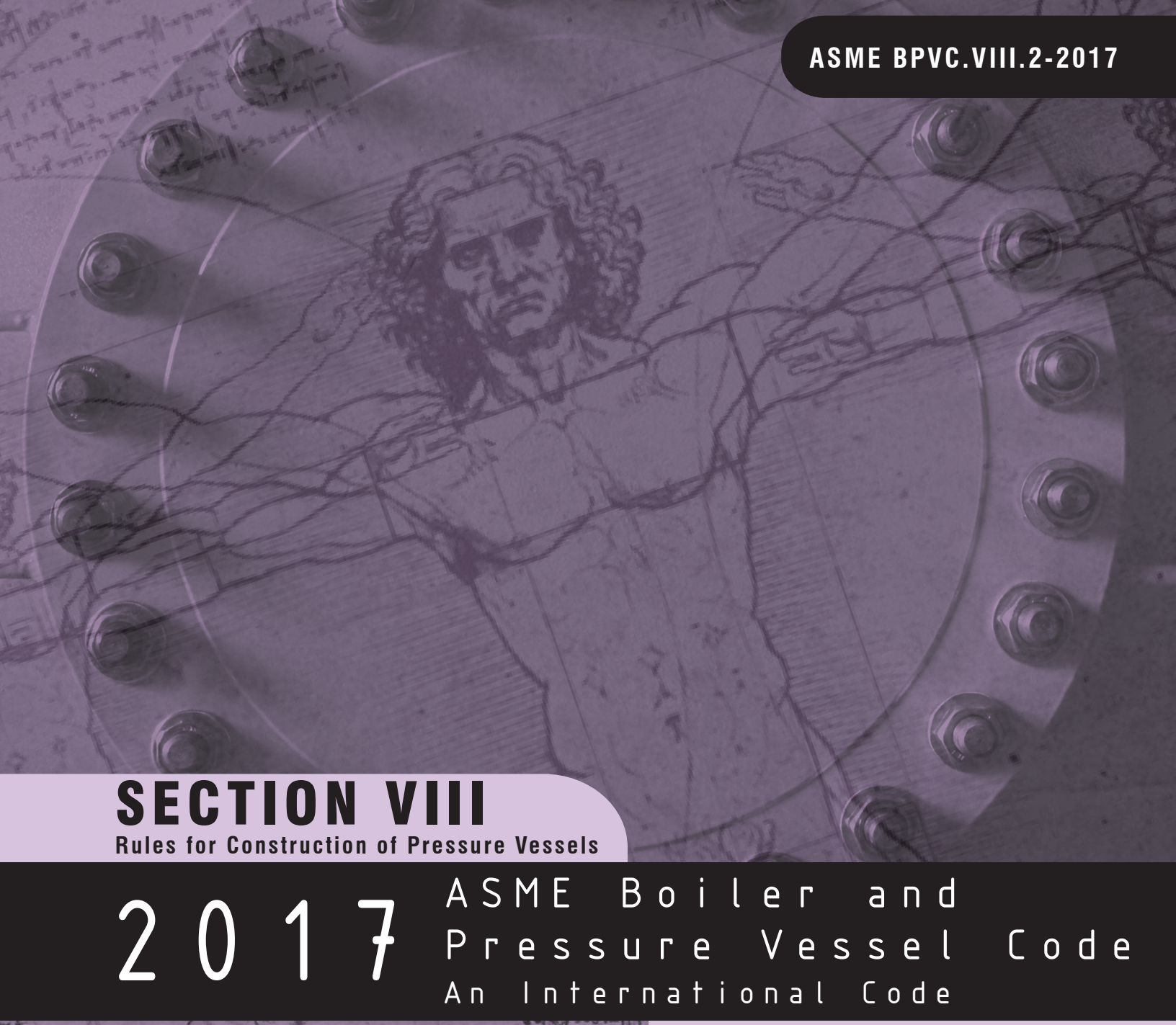


ASME BPVC.VIII.2-2017

SECTION VIII

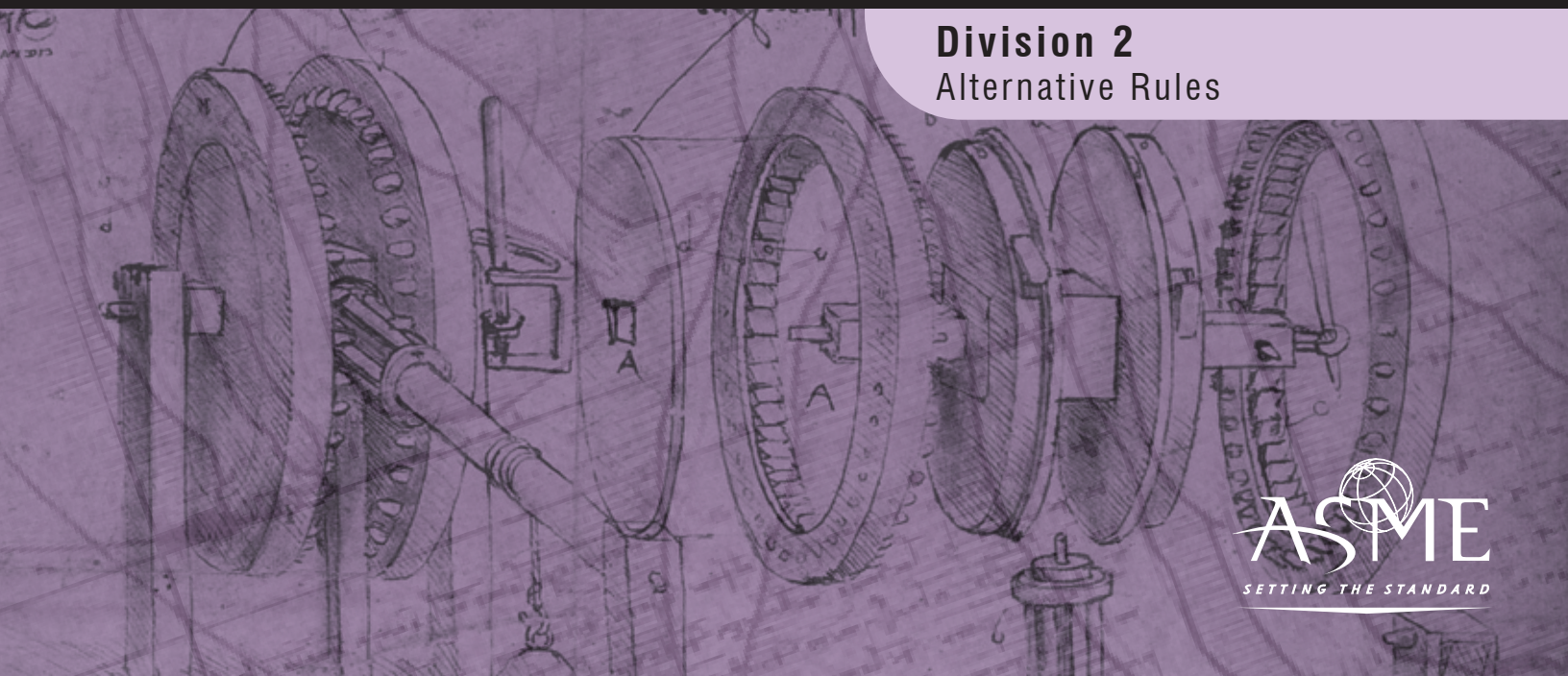
Rules for Construction of Pressure Vessels

2017 ASME Boiler and Pressure Vessel Code

An International Code

Division 2

Alternative Rules



ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

2017 ASME Boiler & Pressure Vessel Code

2017 Edition July 1, 2017

VIII

RULES FOR CONSTRUCTION OF PRESSURE VESSELS

Division 2

Alternative Rules

ASME Boiler and Pressure Vessel Committee
on Pressure Vessels

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2017

This international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

The endnotes and preamble in this document (if any) are part of this American National Standard.

ASME collective membership mark

Certification Mark

Library of Congress Catalog Card Number: 56-3934
Printed in the United States of America

Adopted by the Council of The American Society of Mechanical Engineers, 1914; latest edition 2017.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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[*] The 2015 Edition of Section III was the last edition in which Section III, Division 1, Subsection NH, *Class 1 Components in Elevated Temperature Service*, was published. The requirements located within Subsection NH were moved to Section III, Division 5, Subsection HB, Subpart B for the elevated temperature construction of Class A components.

INTERPRETATIONS

Interpretations are issued in real time in ASME's Interpretations Database at http://go.asme.org/Interpretations. Historical BPVC interpretations may also be found in the Database.

CODE CASES

The Boiler and Pressure Vessel Code committees meet regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2017 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2019 Code.

FOREWORD[*]

In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

(a) Committee on Power Boilers (I)

(b) Committee on Materials (II)

(c) Committee on Construction of Nuclear Facility Components (III)

(d) Committee on Heating Boilers (IV)

(e) Committee on Nondestructive Examination (V)

(f) Committee on Pressure Vessels (VIII)

(g) Committee on Welding, Brazing, and Fusing (IX)

(h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)

(i) Committee on Nuclear Inservice Inspection (XI)

(j) Committee on Transport Tanks (XII)

(k) Technical Oversight Management Committee (TOMC)

Where reference is made to "the Committee" in this Foreword, each of these committees is included individually and collectively.

The Committee's function is to establish rules of safety relating only to pressure integrity, which govern the construction[**] of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity. Except for Sections XI and XII, and with a few other exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgment* refers to technical judgments made by knowledgeable engineers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the

[*] The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

[**] *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at http://go.asme.org/BPVCPublicReview to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the Committee. ASME is to be notified should questions arise concerning improper use of an ASME Certification Mark.

When required by context in this Section, the singular shall be interpreted as the plural, and vice versa, and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

STATEMENT OF POLICY ON THE USE OF THE CERTIFICATION MARK AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use the Certification Mark for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the Certification Mark, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not "approve," "certify," "rate," or "endorse" any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding the Certification Mark and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities "are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code," or "meet the requirements of the ASME Boiler and Pressure Vessel Code." An ASME corporate logo shall not be used by any organization other than ASME.

The Certification Mark shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of the Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the Certification Mark. General usage is permitted only when all of a manufacturer's items are constructed under the rules.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the official Certification Mark described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL STANDARDS COMMITTEES (17)

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the applicable Boiler and Pressure Vessel (BPV) Standards Committee (hereinafter referred to as the Committee). See the guidelines on approval of new materials under the ASME Boiler and Pressure Vessel Code in Section II, Part D for requirements for requests that involve adding new materials to the Code. See the guidelines on approval of new welding and brazing materials in Section II, Part C for requirements for requests that involve adding new welding and brazing materials ("consumables") to the Code.

Technical inquiries can include requests for revisions or additions to the Code requirements, requests for Code Cases, or requests for Code Interpretations, as described below:

(1) Code Revisions. Code revisions are considered to accommodate technological developments, to address administrative requirements, to incorporate Code Cases, or to clarify Code intent.

(2) Code Cases. Code Cases represent alternatives or additions to existing Code requirements. Code Cases are written as a Question and Reply, and are usually intended to be incorporated into the Code at a later date. When used, Code Cases prescribe mandatory requirements in the same sense as the text of the Code. However, users are cautioned that not all regulators, jurisdictions, or Owners automatically accept Code Cases. The most common applications for Code Cases are as follows:

(-a) to permit early implementation of an approved Code revision based on an urgent need

(-b) to permit use of a new material for Code construction

(-c) to gain experience with new materials or alternative requirements prior to incorporation directly into the Code

(3) Code Interpretations

(-a) Code Interpretations provide clarification of the meaning of existing requirements in the Code and are presented in Inquiry and Reply format. Interpretations do not introduce new requirements.

(-b) If existing Code text does not fully convey the meaning that was intended, or conveys conflicting requirements, and revision of the requirements is required to support the Interpretation, an Intent Interpretation will be issued in parallel with a revision to the Code.

(b) Code requirements, Code Cases, and Code Interpretations established by the Committee are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or Owners to choose any method of design or any form of construction that conforms to the Code requirements.

(c) Inquiries that do not comply with the following guidance or that do not provide sufficient information for the Committee's full understanding may result in the request being returned to the Inquirer with no action.

2 INQUIRY FORMAT

Submittals to the Committee should include the following information:

(a) Purpose. Specify one of the following:

(1) request for revision of present Code requirements

(2) request for new or additional Code requirements

(3) request for Code Case

(4) request for Code Interpretation

(b) Background. The Inquirer should provide the information needed for the Committee's understanding of the Inquiry, being sure to include reference to the applicable Code Section, Division, Edition, Addenda (if applicable), paragraphs, figures, and tables. Preferably, the Inquirer should provide a copy of, or relevant extracts from, the specific referenced portions of the Code.

(c) Presentations. The Inquirer may desire to attend or be asked to attend a meeting of the Committee to make a formal presentation or to answer questions from the Committee members with regard to the Inquiry. Attendance at a BPV Standards Committee meeting shall be at the expense of the Inquirer. The Inquirer's attendance or lack of attendance at a meeting will not be used by the Committee as a basis for acceptance or rejection of the Inquiry by the Committee. However, if the Inquirer's request is unclear, attendance by the Inquirer or a representative may be necessary for the Committee to understand the request sufficiently to be able to provide an Interpretation. If the Inquirer desires to make a presentation at a Committee meeting, the Inquirer should provide advance notice to the Committee Secretary, to ensure time will be allotted for the presentation in the meeting agenda. The Inquirer should consider the need for additional audiovisual equipment that might not otherwise be provided by the Committee. With sufficient advance notice to the Committee Secretary, such equipment may be made available.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions should include the following information:

(a) Requested Revisions or Additions. For requested revisions, the Inquirer should identify those requirements of the Code that they believe should be revised, and should submit a copy of, or relevant extracts from, the appropriate requirements as they appear in the Code, marked up with the requested revision. For requested additions to the Code, the Inquirer should provide the recommended wording and should clearly indicate where they believe the additions should be located in the Code requirements.

(b) Statement of Need. The Inquirer should provide a brief explanation of the need for the revision or addition.

(c) Background Information. The Inquirer should provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request, that will allow the Committee to adequately evaluate the requested revision or addition. Sketches, tables, figures, and graphs should be submitted, as appropriate. The Inquirer should identify any pertinent portions of the Code that would be affected by the revision or addition and any portions of the Code that reference the requested revised or added paragraphs.

4 CODE CASES

Requests for Code Cases should be accompanied by a statement of need and background information similar to that described in 3(b) and 3(c), respectively, for Code revisions or additions. The urgency of the Code Case (e.g., project underway or imminent, new procedure) should be described. In addition, it is important that the request is in connection with equipment that will bear the Certification Mark, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and should be written as a Question and a Reply, in the same format as existing Code Cases. Requests for Code Cases should also indicate the applicable Code Editions and Addenda (if applicable) to which the requested Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations should be accompanied by the following information:

(1) Inquiry. The Inquirer should propose a condensed and precise Inquiry, omitting superfluous background information and, when possible, composing the Inquiry in such a way that a "yes" or a "no" Reply, with brief limitations or conditions, if needed, can be provided by the Committee. The proposed question should be technically and editorially correct.

(2) Reply. The Inquirer should propose a Reply that clearly and concisely answers the proposed Inquiry question. Preferably, the Reply should be "yes" or "no," with brief limitations or conditions, if needed.

(3) Background Information. The Inquirer should provide any need or background information, such as described in 3(b) and 3(c), respectively, for Code revisions or additions, that will assist the Committee in understanding the proposed Inquiry and Reply.

If the Inquirer believes a revision of the Code requirements would be helpful to support the Interpretation, the Inquirer may propose such a revision for consideration by the Committee. In most cases, such a proposal is not necessary.

(b) Requests for Code Interpretations should be limited to an Interpretation of a particular requirement in the Code or in a Code Case. Except with regard to interpreting a specific Code requirement, the Committee is not permitted to consider consulting-type requests such as the following:

(1) a review of calculations, design drawings, welding qualifications, or descriptions of equipment or parts to determine compliance with Code requirements

(2) a request for assistance in performing any Code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation

(3) a request seeking the rationale for Code requirements

6 SUBMITTALS

(a) Submittal. Requests for Code Interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt. If the Inquirer is unable to use the online form, the Inquirer may mail the request to the following address:

Secretary
ASME Boiler and Pressure Vessel Committee
Two Park Avenue
New York, NY 10016-5990

All other Inquiries should be mailed to the Secretary of the BPV Committee at the address above. Inquiries are unlikely to receive a response if they are not written in clear, legible English. They must also include the name of the Inquirer and the company they represent or are employed by, if applicable, and the Inquirer's address, telephone number, fax number, and e-mail address, if available.

(b) Response. The Secretary of the appropriate Committee will provide a written response, via letter or e-mail, as appropriate, to the Inquirer, upon completion of the requested action by the Committee. Inquirers may track the status of their Interpretation Request at http://go.asme.org/Interpretations.

(17)

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January 1, 2017

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SUMMARY OF CHANGES

Errata to the BPV Code may be posted on the ASME Web site to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in the BPV Code. Such Errata shall be used on the date posted.

Information regarding Special Notices and Errata is published by ASME at http://go.asme.org/BPVCerrata.

Changes given below are identified on the pages by a margin note, **(17)**, placed next to the affected area.

The Record Numbers listed below are explained in more detail in "List of Changes in Record Number Order" following this Summary of Changes.

Page	*Location*	*Change (Record Number)*
xvi	List of Sections	Updated
xxi	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Revised in its entirety *(13-2222)*
xxiv	Personnel	Updated
2	1.2.1.2	First paragraph revised *(14-553)*
	1.2.3	In subpara. (a)(1), cross-reference revised *(12-880)*
3	1.2.4.2	In first paragraph, second sentence revised *(14-553)*
3	1.2.6.1	Revised *(16-598, 16-1539)*
4	1.2.6.2	First sentence revised *(16-598)*
4	1.4	In subpara. (h), second sentence revised *(09-619)*
5	Table 1.1	Revised *(13-1791, 14-2323, 15-1843, 15-2605, 16-533, 16-1102)*
7	1-B.2	*(1)* Paragraphs 1-B.2.2, 1-B.2.3, and 1-B.2.17 (formerly 1-B.2.15) revised *(12-603, 13-1791)* *(2)* New 1-B.2.9 and 1-B.2.10 added, and existing 1-B.2.9 through 1-B.2.16 redesignated as 1-B.2.11 through 1-B.2.18, respectively *(14-553)*
15	2.1.3	Revised *(14-554)*
15	2.2.1	Revised *(14-554)*
15	2.2.2	Paragraph 2.2.2.3 deleted *(14-554)*
17	2.3.1.2	First sentence revised *(14-554, 16-1539)*
17	2.3.3	Revised *(14-554)*
19	2.4.3.1	Last sentence revised *(08-921)*
19	2.4.3.2	First sentence revised *(08-921)*
21	2-A.1	First sentence revised *(14-554)*
21	2-A.2.2	Subparagraphs (b) and (c) revised *(16-1213)*
22	Table 2-A.1	Revised *(14-554, 16-1213)*
23	2-B.1	First sentence revised *(14-554)*

Page	Location	Change (Record Number)
23	2-B.2.2	Subparagraphs (b) and (c) revised *(16-1213)*
24	Table 2-B.1	Revised *(14-554, 16-1213)*
25	2-C.1	Revised *(13-1858, 14-554, 16-598, 16-1539)*
26	2-C.2	Revised *(13-1858, 14-645, 16-598)*
26	2-C.3.1	Subparagraphs (d) and (d)(9) revised *(13-1858, 15-2606)*
28	2-D.1.3	Revised *(13-1858, 16-598)*
28	2-D.1.6	Revised *(13-1858)*
28	Table 2-D.1	Revised *(13-1858, 14-554, 14-1595, 16-1095)*
31	Form A-1	Revised *(13-1858, 14-554, 16-1095)*
34	Form A-1P	Added *(14-1595)*
36	Form A-2	Revised *(13-1858, 14-554, 16-1095, 16-1539)*
38	Form A-3	Revised *(13-1858, 16-1095)*
39	Form A-3L	Revised *(13-1858, 16-1095)*
40	Form A-4	Revised *(13-1858, 16-1095)*
44	2-F.1	First paragraph and subparas. (a) and (g) through (j) revised *(14-554, 16-1539)*
45	2-F.3	Revised *(14-554, 16-1539)*
45	2-F.4.1	Subparagraph (a) revised *(14-554, 16-1539)*
46	2-F.6	Second sentence revised *(14-554)*
48	Figure 2-F.1	Revised *(14-554, 16-1539)*
49	Annex 2-G	Revised in its entirety *(13-1791, 14-554, 16-1539)*
52	Table 2-H.1	Revised *(14-554, 16-1539)*
53	Figure 2-H.1	Updated by ASME Conformity Assessment
55	3.2.2.2	First sentence revised *(11-737)*
56	3.2.3.2	Revised *(11-737)*
57	3.2.6.1	Revised *(12-603)*
57	3.2.7.1	Subparagraph (b) revised *(11-737)*
61	3.2.12	Revised *(06-1384)*
62	3.3.4.1	Revised *(16-1102)*
62	3.3.5.1	First sentence revised *(16-1303)*
63	3.3.6.4	Second sentence revised *(11-737)*
64	3.4.4	Title and 3.4.4.1, 3.4.4.2, and 3.4.4.5 revised *(14-2323, 14-2496)*
65	3.5.3.1	Revised *(14-1176)*
65	3.5.3.3	Added *(14-1176)*
69	3.8.2.2	Subparagraphs (d) and (e) revised *(15-2591)*
70	3.8.2.3	Subparagraphs (b) and (b)(1) revised *(15-2591)*
72	3.10.3.2	Revised *(16-449)*

Page	*Location*	*Change (Record Number)*
75	3.11.2.1	Subparagraph (b)(1) revised *(13-940)*
76	3.11.2.4	Former subpara. (b)(10) deleted, and former subpara. (b)(11) redesignated as (b)(10) *(16-234)*
76	3.11.2.5	In subpara. (a), Steps 5(a) and 5(b) revised *(14-920)*
77	3.11.2.6	In subpara. (b), penultimate sentence revised *(13-940)*
78	3.11.2.9	Subparagraphs (a) and (b) revised *(13-940, 14-920)*
78	3.11.2.10	Subparagraph (a) revised *(13-567)*
79	3.11.3.1	Subparagraphs (b), (c)(1), and (c)(2) revised *(14-920, 16-234)*
79	3.11.3.2	In subpara. (d), cross-reference revised *(13-881)*
80	3.11.4.3	In subpara. (e), first sentence revised *(14-920)*
81	3.11.4.5	In subpara. (d)(3), second sentence revised *(11-737)*
83	3.11.7.6	In subpara. (b)(2), second sentence revised *(13-940)*
84	3.11.8.2	In subpara. (c), second sentence added *(14-248)*
84	3.11.8.3	Subparagraph (g) added *(15-2021)*
92	Table 3.13	Title revised *(13-940)*
95	Table 3.18	Added *(14-248)*
98	Figure 3.3	Editorially revised
99	Figure 3.3M	Editorially revised
100	Figure 3.4	*(1)* Title revised *(13-940)* *(2)* Notes editorially revised
101	Figure 3.4M	*(1)* Title revised *(13-940)* *(2)* Notes editorially revised
104	Figure 3.7	Under “Material Assignment” for Curves B and D, entry for SA-299 added *(13-1110)*
106	Figure 3.7M	Under “Material Assignment” for Curves B and D, entry for SA-299 added *(13-1110)*
108	Figure 3.8	Under “Material Assignment” for Curves B and D, entry for SA-299 added *(13-1110)*
110	Figure 3.8M	Under “Material Assignment” for Curves B and D, entry for SA-299 added *(13-1110)*
113	Figure 3.10	Illustrations (b) and (c) revised *(13-597)*
115	Figure 3.12	Revised *(14-920)*
116	Figure 3.12M	Revised *(14-920)*
117	Figure 3.13	Revised *(14-920)*
118	Figure 3.13M	Revised *(14-920)*
120	Figure 3.16	Added *(14-248)*
121	3-A.1.2	Revised *(16-537)*
122	Table 3-A.1	SA/EN 10028-2, Grade 13CrMo4–5, and Note (1) added *(11-1276, 16-537)*

Page	*Location*	*Change (Record Number)*
127	Table 3-A.2	Duplicate entries for SA-333 and SA-334 deleted *(15-1583)*
128	Table 3-A.3	Note (1) added *(16-537)*
134	Table 3-A.6	Note (1) added *(16-537)*
137	Table 3-A.7	Note (1) added *(16-537)*
152	Annex 3-F	Revised in its entirety *(08-841)*
169	4.1.1.2	Revised *(14-813)*
169	4.1.1.5	Revised *(14-813)*
170	4.1.5.1	Revised *(14-813)*
172	4.1.6.2	Revised in its entirety *(11-1266)*
174	4.1.13	Definitions of P_T, β, β_T, $\gamma_{\min}$, and $\gamma_{St/S}$ added *(11-1266)*
175	Table 4.1.3	Added *(11-1266)*
175	4.2.2	Penultimate sentence revised *(16-100)*
176	4.2.5.1	Subparagraph (h) revised *(14-1176)*
176	4.2.5.3	Subparagraph (e) revised *(12-880)*
179	4.2.5.6	Subparagraphs (a)(2), (a)(5), (a)(6), (b)(2), (c), (c)(1), and (d) revised *(14-1176)*
181	4.2.5.9	Added *(12-880)*
181	4.2.5.10	Added *(16-100)*
181	4.2.6	Definitions of t, t_o, and t_{rn} added *(12-880, 16-100)*
183	Table 4.2.3	For Material Type 1, P-No. 4 entry revised *(11-1276)*
183	Table 4.2.4	Former Details 7 and 8 deleted, and subsequent Details renumbered *(12-880)*
193	Table 4.2.10	Detail 8 deleted *(16-522)*
198	Table 4.2.13	Detail 7 added *(16-522)*
201	Table 4.2.15	Added *(12-880)*
201	Table 4.2.16	Added *(16-100)*
206	Figure 4.2.4	Illustration (f) revised *(15-2177)*
211	4.3.10.1	Subparagraph (a) revised *(08-780)*
212	4.3.10.2	In Step 4, first sentence revised *(09-1361)*
215	4.3.12.2	In Step 3, eq. (4.3.63) corrected by errata to "$t_k \geq t_L$" *(15-2710)*
222	Table 4.3.4	In the equation in Note (1), each instance of "a" corrected to "α" and the plus sign at the end of the numerator deleted by errata *(17-239)*
236	4.4.4.1	Paragraph title revised *(13-1552)*
237	4.4.4.4	Last sentence added *(15-1794)*
241	4.4.7.1	In Step 3, eq. (4.4.55), equal sign inserted after "F_{ic}" by errata *(15-2793)*

Page	Location	Change (Record Number)
243	4.4.12.2	*(1)* Equations (4.4.72), (4.4.73), and (4.4.90), and subparas. (e)(1) and (e)(2) revised *(15-96)* *(2)* Subparagraph (e)(4) added *(15-96)*
248	4.4.12.4	*(1)* In subpara. (b), eq. (4.4.126) revised *(10-1522)* *(2)* In subpara. (c), "σ" corrected by errata to "σ_2," and "value of determined" corrected by errata to "value of F_{ha} determined" *(15-96, 15-1382)*
249	4.4.15	Definition of F_{ca} revised *(15-96)*
265	4.5.10.1	In Step 10, eq. (4.5.148), "2s"corrected by errata to "2S" *(15-2793)*
270	4.5.11	Revised *(14-1888)*
273	4.5.14.3	In Step 2(a), eq. (4.5.196), closing parenthesis added to the denominator by errata *(16-2176)*
275	4.5.16.2	Revised *(15-2173)*
279	Table 4.5.2	"Minimum Thickness, mm" entry for DN 6 (NPS $^1/_8$) corrected by errata to 1.51 *(15-2793)*
289	Figure 4.5.10	Revised *(14-1888)*
315	4.10.2.1	In subpara. (f)(2), SI units revised *(14-1745)*
404	4.15.3.4	Subparagraphs (e)(1) and (e)(2) revised *(09-378)*
420	4.16.4.3	First sentence and subpara. (a) revised *(05-768)*
421	4.16.7.2	In Step 6, eq. (4.16.15), "h_t" corrected by errata to "h_T" *(16-2176)*
444	4.17.1	Second sentence revised *(15-1228)*
453	4.18.1	In subpara. (b), cross-reference to Part 5 revised to 4.1.1.2 *(13-2016)*
455	4.18.5.4	In subpara. (a), eq. (4.18.1a), and subpara. (c), eq. (4.18.1b), "S" revised to "S_{fe}" *(16-991)*
462	4.18.8.4	In Step 6, eq. (4.18.93), "P_w" added to the numerator by errata *(16-2176)*
472	4.18.8.9	Added *(07-218)*
485	4.18.11	Revised *(11-1693)*
486	4.18.12	*(1)* Title and 4.18.12.1(a) revised *(16-100)* *(2)* Subparagraph 4.18.12.1(c) added *(11-1693)*
486	4.18.13	Revised *(16-154)*
488	4.18.15	*(1)* In subpara. (a), definition of S deleted, and definition of S_{fe} added *(16-991)* *(2)* In subpara. (d), definitions of $D_{\mathrm{ecc},L}$; $D_{\mathrm{ecc},S}$; $D_{s,L}$; E_{ecc}; $E_{\mathrm{ecc},w}$; $E_{s,L}$; $E_{s,L,w}$; L_{ecc}; L_s; $L_{s,L}$; S_{ecc}; $S_{\mathrm{ecc},b}$; $S_{s,L}$; $S_{s,L,b}$; $S_{PS,\mathrm{ecc}}$; $S_{PS,s,L}$; t_{ecc}; $t_{s,L}$; X_L'; X_S'; $\alpha_{\mathrm{ecc},m}$; $\alpha_{s,m,L}$; Δ_J; Δ_s; θ_{ecc}; ν_{ecc}; and $\nu_{s,L}$ added, and definition of S revised *(07-218, 11-1693, 16-991)*
496	Table 4.18.5	Title revised *(16-100)*
513	Figure 4.18.17	Added *(07-218)*
513	4.19.1	Revised *(13-2017, 16-98)*

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513	4.19.2	In subpara. (g), cross-references revised *(16-98)*
514	4.19.3.1	Subparagraph (d) revised *(16-154)*
515	4.19.5.1	Revised *(14-1629, 16-98)*
515	4.19.5.2	Subparagraphs (e) and (f) added *(14-1629)*
516	4.19.5.6	Subparagraph (b) and eqs. (4.19.13) and (4.19.14) revised *(14-1629)*
517	4.19.6.1	Revised *(14-1629, 16-98)*
517	4.19.6.2	Revised *(14-1629)*
518	4.19.7.1	Cross-reference revised *(16-98)*
519	4.19.7.6	Subparagraph (a) revised *(13-360, 13-2017)*
519	4.19.8	Title revised *(16-98)*
522	4.19.11	*(1)* Definition of e_{eq} deleted *(14-1629)* *(2)* Definitions of E_s and t_{eq} added *(14-1629)* *(3)* Definitions of q and S_1''' revised *(14-1629, 16-98)*
525	Table 4.19.2	Revised *(14-1629, 16-102)*
531	Table 4.19.9	*(1)* In second equation for "Circumferential membrane stress in reinforcing collar," operational sign following "L_{rt}" corrected by errata to ">" *(15-2793)* *(2)* Before nomenclature, the word "where" inserted by errata *(15-2793)*
534	Figure 4.19.1	Former Figure 4.19.1-1 redesignated as Figure 4.19.1, and illustration (a) revised *(14-1629, 16-98)*
535	Figure 4.19.2	*(1)* Former Figure 4.19.1-2 redesignated as Figure 4.19.2, and subsequent figures editorially redesignated *(16-98)* *(2)* Illustration (a) revised *(14-1629)*
537	Figure 4.19.5	Formerly Figure 4.19.4, title revised *(16-98)*
537	Figure 4.19.6	Formerly Figure 4.19.5, title revised *(16-98)*
545	Form 4.19.1	Revised *(13-2017, 16-154)*
546	Form 4.19.2	Revised *(13-2017, 16-154)*
547	4.20	Title revised *(16-100)*
547	4.20.1	Revised *(14-138, 16-100)*
547	4.20.2	Subparagraphs (d) and (e) revised *(16-100)*
548	4.20.6	Subparagraph (b)(2) revised *(14-138)*
548	4.20.7	Definition of t_o added *(16-100)*
549	Figure 4.20.1	Revised *(16-100)*
550	Figure 4.20.2	Revised *(16-100)*
565	Annex 4-E	"(Informative)" added following title by errata *(15-1382)*
575	5.1.1.3.1	Added *(14-824)*
577	5.2.2.2	In first paragraph, last sentence deleted *(11-1266)*
579	5.2.2.5	Added *(11-1266)*

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580	5.2.3.6	Added *(11-1266)*
581	5.2.4.5	Added *(11-1266)*
585	5.5.2.4	Steps 4, 6, and 7 revised *(15-2852)*
589	5.5.5.1	Subparagraph (c) deleted *(15-2781)*
599	5.13	Definitions of β, β_T, and P_T added *(11-1266)*
603	Table 5.2	Entry for P_T added *(11-1266)*
604	Table 5.3	Under "Design Load Combination," entry (9) added *(11-1266)*
605	Table 5.4	Revised *(11-1266)*
605	Table 5.5	Revised *(11-1266)*
609	Table 5.12	"Definition" entry for Fatigue-Strength-Reduction Factor 1.7 revised *(14-2485)*
628	Figure 5-A.9	Note (1) inserted by errata *(15-1382)*
639	5-D.2.1	Designation of eq. (5-D.5) corrected by errata *(15-1382)*
656	Table 5-E.5	Second equation under "Generalized Plane Strain" revised *(16-2737)*
657	Table 5-E.6	Second equation under "Generalized Plane Strain" revised *(16-2737)*
658	Table 5-E.7	Second equation under "Generalized Plane Strain" revised *(16-2737)*
685	6.1.1.2	In subpara. (a), third sentence revised *(11-737)*
686	6.1.2.1	Revised *(14-668)*
686	6.1.2.2	Revised *(14-668)*
686	6.1.2.3	Subparagraph (c)(4) added *(14-668)*
688	6.1.3.1	Subparagraph (a) revised *(14-668)*
689	6.1.4.2	Revised *(14-668)*
690	6.2.1	Revised *(14-669, 15-1848)*
690	6.2.2.1	*(1)* Subparagraphs (c) and (c)(1) revised *(14-669)* *(2)* Subparagraph (c)(5) and Note added *(14-669)*
692	6.2.4.2	Title of subpara. (c) revised *(14-669)*
692	6.2.4.3	In subpara. (b), spelling of "corner" corrected *(14-669)*
693	6.2.5.4	Subparagraph (a) revised *(14-669)*
695	6.4.1.1	Last sentence added *(14-670)*
696	6.4.2.2	Subparagraphs (a) and (e)(8) revised *(14-670, 15-2608, 16-676)*
696	6.4.2.4	Revised *(14-670)*
696	6.4.2.5	Revised *(14-670)*
697	6.4.2.7	Revised *(06-5, 14-670)*
697	6.4.2.9	Added *(16-538)*
698	6.4.3.5	Revised *(14-670)*
699	6.4.4	Subparagraphs (a), (b), and (e) revised *(15-1229, 15-1579, 16-629)*
699	6.4.5.2	Subparagraphs (b) and (f)(1) revised *(14-670)*

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700	6.4.6.3	Revised *(16-629)*
701	6.4.6.5	Added *(14-670)*
701	6.5.2	Revised *(14-671)*
702	6.5.6.3	First sentence revised *(14-671)*
702	6.6.1	Revised *(14-671, 15-1000, 16-676)*
703	6.6.5.2	Revised *(14-671)*
707	6.7.3	Subparagraph (a) revised *(14-672)*
707	6.7.5.2	Revised *(14-672)*
708	6.7.6.1	Revised *(14-672)*
708	6.7.6.3	Subparagraph (c) added *(14-672)*
708	6.7.7.1	Last sentence added *(14-672)*
709	6.7.7.2	*(1)* Subparagraphs editorially redesignated *(2)* First paragraph revised *(14-672)*
709	6.7.8.3	Subparagraph (b)(2) revised *(14-672)*
710	6.7.9.1	Revised *(14-672)*
710	6.7.9.3	Cross-reference revised *(14-672)*
713	6.9.2	Revised in its entirety *(16-100)*
716	Table 6.2.B	Minimum Heat Treatment Temperature, °C, for Grade 321H revised, and entry for Grade 347LN added *(14-668)*
717	Table 6.3	Entries for UNS No. N06230 and Grade 600 added *(14-668)*
717	Table 6.5	In second column, third and fifth entries revised *(14-669)*
718	Table 6.6	In first column, first entry revised *(16-866)*
718	Table 6.7	Entry for P-No. 10F deleted *(14-670)*
720	Table 6.8	In first column, subpara. (a)(3) added *(14-670)*
721	Table 6.9	In first column, subpara. (c)(5) added *(15-2352)*
722	Table 6.10	In first column, subparas. (b)(4) and (b)(5) added, and in second column, holding times for Class 1 and Class 2 added *(14-670, 15-2352)*
723	Table 6.11	In first column, subparas. (a)(4) and (a)(5) added, and in second column, holding times for Class 1 and Class 2 added *(14-670, 15-2352)*
724	Table 6.11.A	In first column, subpara. (a) revised, and in second column, minimum holding temperatures revised *(15-2553)*
725	Table 6.12	In first column, subpara. (a) revised, and in second column, holding times for Class 1 and Class 2 added *(14-670, 15-1063)*
725	Table 6.13	In first column, subpara. (a) revised, and in second column, holding times for Class 1 and Class 2 added *(14-670, 15-1063)*
726	Table 6.14	In first column, subparas. (b)(1)(-b) and (d) for P-No. 9A, and subpara. (e) for P-No. 9B revised *(15-1063, 16-629)*
728	Table 6.15	Revised *(14-670, 15-2608, 16-322, 16-629)*

Page	*Location*	*Change (Record Number)*
731	Table 6.17	Revised *(14-671, 16-676)*
732	Table 6.20	Entries in third column revised *(14-672)*
733	Table 6.21	In Note (1), cross-reference revised *(16-98)*
741	6-A.4.1	Revised *(13-233)*
741	6-A.4.3	Revised *(13-233)*
748	7.3	Revised in its entirety *(15-2605)*
749	7.4.3.1	Last sentence added *(14-1781)*
749	7.4.3.3	First paragraph revised *(15-2471)*
749	7.4.3.4	First paragraph revised *(15-2471)*
750	7.4.5	First sentence revised *(15-2591)*
750	7.4.8.2	Subparagraph (a) revised, and subpara. (c)(4) added *(14-863)*
751	7.4.9.3	In subpara. (b), first sentence revised *(15-2591)*
752	7.4.11.4	In subpara. (a), first sentence revised *(14-863)*
754	7.4.12.2	Title and subparas. (b) and (c) revised *(16-100)*
754	7.5.2.1	First sentence revised *(14-864)*
756	7.5.4.1	First paragraph revised *(15-2471)*
756	7.5.5.1	First paragraph and subparas. (b)(3) and (f) revised *(14-1783)*
757	7.5.5.3	Subparagraph (c) revised *(14-2507)*
758	7.5.6.1	Subparagraph (a) revised *(15-1845)*
758	7.5.6.2	In first paragraph, penultimate sentence revised *(14-865)*
760	7.5.8.4	Subparagraph (c) revised *(16-1888)*
761	7.6.1	Revised *(15-2591)*
762	Table 7.1	Revised in its entirety *(14-862)*
763	Table 7.2	Revised in its entirety *(14-862, 15-2607, 16-522, 16-2887)*
768	Table 7.6	In third entry under “Acceptance Criteria,” reference to Note (2) added by errata *(15-1382)*
789	7-A.3.2.3	In subpara. (a), last sentence revised *(11-737)*
790	Table 7-A.1	“Acceptance Criteria” and Manufacturer’s Responsibilities” entries for “Nondestructive examinations” revised *(15-2606)*
795	8.2.1	Subparagraphs (a), (c), and (d), and eqs. (8.1) and (8.2) revised *(11-1266)*
796	8.3.1	*(1)* Subparagraphs (a) and (c), and eq. (8.3) revised *(11-1266)* *(2)* Equation (8.4) added *(11-1266)*
797	8.6	Definitions of β_T, $\gamma_{\min}$, and $\gamma_{St/S}$ added *(11-1266)*

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
05-768	Editorially corrected the English in 4.16.4.3.
06–5	Revised 6.4.2.7 to clarify nominal thickness definitions for purposes of PWHT, to address double-groove welds and tube-to-tubesheet welds. Added new 6.4.2.7(h) to clarify thickness that may be used in the case of plate materials.
06-1384	Revised 3.2.12 to address the proper and complete recertification process.
07-218	Added new equations for the calculation of kettle shell stiffness to use in 4.18.
08-780	Replaced the term “major” with “gross” in 4.3.10.1(a).
08-841	Developed new fatigue curve-fit equations and added them to Annex 3-F. Generated new fatigue curves using the new curve-fit equations and placed them in a newly created 3-F.5. Developed new 3-F.1.1 to inform the user of the necessity of correcting the stress amplitude for temperature, and redesignated existing 3-F.1.1 and 3-F.1.2 as 3-F.1.2 and 3-F.1.3, respectively. Deleted Tables 3-F.1 through 3-F.9, inserted new Table 3-F.1, and redesignated existing Table 3-F.10 as Table 3-F.2. In the nomenclature, added S_{ac}, redefined Y, and deleted nonapplicable variables.
08-921	Removed redundant requirement in 2.4.3.1 and clarified Inspector’s responsibilities for design calculations in 2.4.3.2.
09-378	In 4.15.3.4, revised the procedure for determining the acceptance criteria for shear stresses based on whether or not the material carries Section II, Part D, Table 5A, Note G2, or Table 5B, Note G1.
09-619	Replaced a sentence in 1.4(h).
09-1361	Removed the term “meridional” and replaced it with “axial membrane” in 4.3.10.2, Step 4.
10-1522	Corrected eq. (4.4.126) of 4.4.12.4.
11-737	In various paragraphs, deleted the word “certified” with regard to Material Test Reports.
11-1266	Revised 4.1.6.2. Added Table 4.1.3. Deleted a sentence in 5.2.2.2. Added 5.2.2.5, 5.2.3.6, and 5.2.4.5. Added several variables to the nomenclatures in 4.1.13, 5.13, and 8.6. Revised Tables 5.2, 5.3, 5.4, and 5.5. Revised 8.2.1(a), 8.2.1(d), 8.3.1(a), and 8.3.1(c). All changes made to clarify the limits regarding evaluation of stresses for the hydrostatic and pneumatic test condition and to parameterize the equations to simplify the equations for multiple classes of construction.
11-1276	Added SA/EN 10028-2, Grade 13CrMo4–5 to Tables 3-A.1 and 4.2.3.
11-1693	Added new paragraphs to 4.18.11 and 4.18.12.1.
12-603	Revised 1-B.2.15 definition of “Material Test Report” and revised 3.2.6.1(b).
12-880	Revised 1.2.3(a)(1) and 4.2.5.3(e). Added the definition of t_{rn} to 4.2.6 and added new 4.2.5.9. Removed Details 7 and 8 from Table 4.2.4. Added new Table 4.2.15 with Details 7 and 8 formerly of Table 4.2.4 corrected and redesignated as Details 1 and 2.
13-233	Revised 6-A.4.1 and 6-A.4.3 of the Positive Material Identification Practice to state that positive material identification of carbon steels should be considered when certain service conditions are anticipated.
13-360	Revised 4.19.7.6(a) to state the following: “Toroidal bellows designed per the rules of this Division are suitable for external design pressures up to 103 kPa (15 psi) or full vacuum. For external design pressures greater than 103 kPa (15 psi), see Part 5.”
13-567	Revised 3.11.2.10(a) to eliminate conflicts with the requirements of 3.11.8.3(b) and 3.11.4.3.
13-597	Revised Figure 3.10, illustrations (b) and (c) to clarify the governing thickness with flat components.
13-881	Revised 3.11.3.2(d) to clarify lateral expansion acceptance criteria for all Table 3-A.2 quenched and tempered high-strength low alloy steels.
13-940	Revised 3.11.2.1(b)(1), 3.11.2.6(b), 3.11.2.9(b), 3.11.7.6(b)(2), Table 3.13, and Figures 3.4 and 3.4M to indicate applicability of the rules to nonwelded parts.
13-1110	Added “SA-299” to Curve C and “SA-299 if normalized” to Curve D of the Impact Exemption Curve notes in Figures 3.7, 3.7M, 3.8, and 3.8M.
13-1552	Deleted the words “and Spherical” in 4.4.4.1.

Record Number	Change
13-1791	Added reference to ASME CA-1 (latest edition) to Table 1.1. Replaced conformity assessment requirements in Annex 2-G and in other paragraphs with references to ASME CA-1.
13-1858	Revised Annex 2-C and Annex 2-D.
13-2016	Revised 4.18.1.
13-2017	Revised 4.19.1 to indicate that bellows expansion joints outside the scope of 4.19 shall be in accordance with 4.1.1.2. Revised 4.19.7.6 to indicate that the design of toroidal bellows under external pressure greater than 103 kPa (15 psi) shall be in accordance with 4.1.1.2. Added class of vessel to the metric and U.S. Customary specification sheets in 4.19.4.
13-2222	Revised the front guidance on interpretations in its entirety.
14-138	Revised 4.20.1(b). Revised 4.20.6(b)(2) to read “new and corroded spring rates.”
14-248	Revised 3.11.8.2(c), and added Table 3.18 and Figure 3.16.
14-553	Revised 1.2.1.2 and 1.2.4.2. Added definitions for “Class 1 Vessel” and “Class 2 Vessel” in 1-B.2.9 and 1-B.2.10, respectively.
14-554	Revised 2.1.3, 2.2.1, 2.2.2.3, 2.3.1.2, 2.3.3, 2.3.3.2, 2-A.1, 2-B.1, 2-C.1.1(b), 2-F.1, 2-F.1(a), 2-F.1(g), 2-F.1(i), 2-F.3, 2-F.4.1(a), 2-F.6, 2-G.1, and 2-G.5. Revised Tables 2-A.1 and 2-B.1, and Table 2-D.1, Notes (12), (42), and (49). Revised Forms A-1 and A-2, and Figure 2-F.1. Added Class 1 and Class 2 to Table 2-H.1.
14-645	Revised 2-C.2.3 to clarify who signs Form A-1 if there are both shop and field components to assembly of a pressure vessel.
14-668	Revised 6.1.2.1, 6.1.2.2, 6.1.3.1, 6.1.4.2, and Tables 6.2.B and 6.3. Added 6.1.2.3(c)(4).
14-669	Added 6.2.1.1(b) and 6.2.5.4(b). Revised 6.2.1.2, 6.2.2.1(c), 6.2.4.2(c), 6.2.4.3(b), and 6.2.5.4(a), and Table 6.5.
14-670	Revised 6.4.1.1, 6.4.2.2(e)(8), 6.4.2.4, 6.4.2.5, 6.4.3.5, 6.4.5.2(b), 6.4.5.2(f)(1), and Tables 6.7, 6.8, 6.10, 6.11, 6.12, 6.13, and 6.15. Added new 6.4.2.7(e)(2), renumbered subsequent subparagraphs, and revised 6.4.2.7(e)(3). Added 6.4.6.5.
14-671	Added 6.5.2(b). Revised 6.5.6.3, 6.6.1, 6.6.5.2(e)(6), and Table 6.17. Designated 6.6.5.2(c) and 6.6.5.2(d) as applicable to Class 2 vessels only.
14-672	Revised 6.7.3(a), 6.7.7.1, 6.7.7.2(a), 6.7.8.3(b)(2), 6.7.9.1, 6.7.9.3, and Table 6.20. Added 6.7.5.2(b), 6.7.6.1(c), and 6.7.6.3(c).
14-813	Added Class 1 and Class 2 design by rule and design by analysis to 4.1.1.2. Added Class 1 and Class 2 limitations to 4.1.1.5. Added Class 1 and Class 2 design thickness to 4.1.5.1.
14-824	Revised 5.1.1.3 to define limitations for the use of the design-by-analysis methodology for Class 1 and Class 2 vessels.
14-862	Revised Tables 7.1 and 7.2.
14-863	Revised 7.4.8.2(a) and added 7.4.8.2(c)(4). Revised 7.4.11.4(a) to correct incorrect dimension.
14-864	Revised 7.5.2.1. Extended the existing content in 7.5.1 through 7.5.4 to cover Class 1 vessels.
14-865	Extended the existing content in 7.5.5 through 7.8 to cover Class 1 vessels.
14-920	Added stress ratio of 0.3 for Class 1 in 3.11.2.5, 3.11.2.9, 3.11.3.1, 3.11.4.3, and Figures 3.12, 3.12M, 3.13, and 3.13M. Deleted “or computed” in last sentence of 3.11.2.5(a), Step 5(b).
14-1176	Added the words “other than minor attachments specified in 3.5.3.3” in the first sentence of 3.5.3.1. Added the requirements for minor attachments in 3.5.3.3. Added the words “less than or equal to” after “Parts of small size” in 4.2.5.1(h). Revised Type 2 to Type 3 in 4.2.5.6(a)(2) and 4.2.5.6(a)(6). Revised Type 3 to Type 2 in 4.2.5.6(a)(5). Added the words “other than minor attachments [see 3.5.3.3 and 4.2.5.1(h)]” after “all permanent structural attachments” in 4.5.6.2(b)(2). Replaced “may be of non-certified material” with “made from material that does not conform to a material specification permitted in this Division may be used” in 4.2.5.6(c) and 4.2.5.6(d). Added the words “in accordance with 3.2.1.3” after “suitable for welding” in 4.2.5.6(c)(1).
14-1595	Added new Form A-1P to Annex 2-D.
14-1629	In 4.19, added new rules for bellows internally attached to the shell.
14-1745	Revised 4.10.2.1(f)(2) to update metric conversions.
14-1781	Revised 7.4.3.1 to clarify that the extents of examination shown in Table 7.2 do not supersede examination requirements specified elsewhere in Section VIII, Division 2.
14-1783	Revised 7.5.5.1(f) to clarify the inclusion of semi-automated ultrasonic examinations within its scope.

Record Number	Change
14-1888	Revised the title of 4.5.11. Moved sentences in existing 4.5.11 to new 4.5.11.2. Added new 4.5.11.1 for a spherical shell or hemispherical head. Added the sketch for a spherical shell or hemispherical head in Figure 4.5.10.
14-2323	Added ASTM E139 to Table 1.1. Revised 3.4.4.5 to reference ASTM E139 (or other equivalent national or international test standard) for the performance of stress rupture testing when required.
14-2485	Deleted the words “or ground weld” in Table 5.12.
14-2496	Revised the title of 3.4.4 and the first sentence of 3.4.4.1. Added a sentence after the first sentence of 3.4.4.2.
14-2507	Revised 7.5.5.3(c).
15-96	In 4.4.12.2(b)(2) and eqs. (4.4.72) and (4.4.73), revised “1.147” to “1.2.” Revised eq. (4.4.90) by errata. Added two sentences at the end of 4.4.12.2(e)(1), revised 4.4.12.2(e)(2), and added 4.4.12.2(e)(4). Revised 4.4.12.4(c) by errata. Revised the definition of F_{ca} in 4.4.15.
15-1000	Revised 6.6.1 to correctly reference Table 3-A.2.
15-1063	Revised Tables 6.12, 6.13, and 6.14 to mirror the wording in Section VIII, Division 1, Table UHA-32-2.
15-1228	Revised 4.17.1.
15-1229	Revised 6.4.4(b).
15-1382	Errata correction. See Summary of Changes for details.
15-1579	Revised 6.4.4(e) to implement thermal gradient limitations during the cooling phase of the PWHT process.
15-1583	Deleted duplicate lines from Table 3-A.2.
15-1794	Added the following statement in 4.4.4.4: “For spherical shells, the out-of-roundness requirements in 4.3.2.1 shall also be satisfied.”
15-1843	Removed reference to ACCP CP-1 in Table 1.1.
15-1845	Revised 7.5.6.1(a) to correct references for magnetic particle examination documentation requirements.
15-1848	Revised 6.2.1.
15-2021	Added 3.11.8.3(g) to address testing requirements for impact test qualifications of multiple-process welding procedures.
15-2173	Revised 4.5.16.2 to indicate exemptions to the requirement for inspection openings on the shell side of some shell-and-tube heat exchangers.
15-2177	Revised text associated with Figure 4.2.4, sketch (f).
15-2352	Revised Tables 6.9, 6.10, and 6.11 to add PWHT exemptions for tube-to-tubesheet seal welds.
15-2471	Revised 7.4.3.3, 7.4.3.4, and 7.5.4.1 to clarify when 7.5.4 may be used for performing UT examinations, and when 7.5.5 is required for performing UT examinations in lieu of radiography.
15-2553	In Table 6.11.A, revised the minimum holding temperatures from 730°C (1,350°F) to 705°C (1,300°F), and the minimum holding temperature in subpara. (a) from 720°C (1,325°F) to 675°C (1,250°F).
15-2591	Changed “nonmagnetic” to “nonferromagnetic” in 3.8.2.2(e), 3.8.2.3(b)(1), 7.4.9.3(b), and 7.6.1. Changed “magnetic” to “ferromagnetic” in 3.8.2.2(d). Changed “nonmagnetic” to “nonferromagnetic” and “magnetic” to “ferromagnetic” in 3.8.2.3(b). Changed “nonmagnetic” to “nonferromagnetic,” “non-magnetic” to “nonferromagnetic,” and “magnetic” to “ferromagnetic“ in 7.4.5.
15-2605	Revised Tables 1.1 and 7.3 to reference Section V, Article 1, T-120(e), T-120(f), T-120(g), T-120(h), or T-120(i), as applicable, for NDE personnel qualification and certification requirements.
15-2606	Revised Table 7-A.1 to clarify the Manufacturer’s responsibilities in documenting their acceptance of NDE results.
15-2607	Consolidated notes in Table 7.2 for greater clarity and user friendliness.
15-2608	In 6.4.2.2(e)(8) and Table 6.15, revised references to “P-No. 10B, Group 2” to “P-No. 10B, Group 1.” Also in Table 6.15, deleted references and PWHT requirements for P-No. 10E, Group 1; P-No. 10F, Group 6; and P-No. 10G, Group 1.
15-2710	Errata correction. See Summary of Changes for details.
15-2781	Deleted 5.5.5.1(c).
15-2793	Errata correction. See Summary of Changes for details.

Record Number	Change
15-2852	In 5.5.2.4, Step 4, replaced "3" in the denominator with "C_1." In 5.5.2.4, Steps 6 and 7, replaced "2" in the denominator with "C_2."
16-98	Editorially revised 4.19.
16-100	Updated 4.20.1 and 4.20.2, specifically Figures 4.20.1 and 4.20.2, to include corner-corner and flued-only flexible shell element expansion joints and to allow thin liners. Generalized the terminology from "flanged-and-flued or flanged-only" to "flexible shell element" expansion joints in 4.18.12.1, 4.20, 6.9.2, and 7.4.12.2. Added references to "outer shell elements," the cylinder between flexible elements, to 4.20.2(d), 4.20.2(e), 6.9.2(b), 6.9.2(d), 7.4.12.2(c), and Figures 4.20.1 and 4.20.2. Separated fabrication requirements for welds within the flexible element from welds attaching the flexible element to the shell in 6.9.2(a) and 6.9.2(b). Clarified flexible shell element corner weld categorization, design, and fillet sizing in 4.2.2, 4.2.5.9, and 6.9.2(b)(2). Added permission to use a thin liner in 6.9.2(c). Added requirement for welds to Type 1 butts in the shell adjacent to the flexible element in 6.9.2(d). Separated inspection requirements for welds within the flexible element from welds attaching the flexible element to the shell in 7.4.12.2(b) and 7.4.12.2(c).
16-102	Revised Table 4.19.2 to restrict circumferential membrane stress in end convolution of externally attached bellows to short tangents.
16-154	Revised 4.18.13, 4.19.3.1(d), and Forms in 4.19.14 to ensure that bellows expansion joints are properly hydrotested.
16-234	Deleted SA-723 from 3.11.2.4(b). Revised 3.11.3.1(b).
16-322	Deleted "P-No. 10F, Group 6" from the title of Table 6.15.
16-449	Editorially revised 3.10.3.2 to correct the PWHT Table reference.
16-522	Revised Tables 4.2.10, 4.2.13, and 7.2.
16-533	Revised Table 1.1 to update year of acceptable edition for those standards that were reviewed.
16-537	Revised 3-A.1.2. Added notes to Tables 3-A.1, 3-A.3, 3-A.6, and 3-A.7.
16-538	Added 6.4.2.9.
16-598	Added references to Form A-1P in 1.2.6 and Annexes 2-C and 2-D.
16-629	Revised 6.4.4(a), 6.4.4(b), 6.4.4(e), 6.4.6.3, and Tables 6.14 and 6.15 to correct metrication values for 800°F in accordance with the approved metrication guidelines.
16-676	Editorially revised 6.4.2.2(a), 6.6.1, and Table 6.17.
16-866	Revised the first line in Table 6.6 for applicability to thicknesses less than 2.5 mm ($^3/_{32}$ in.).
16-991	Revised 4.18.5.4 and 4.18.15 by replacing S with S_{fe} in the nomenclature and in both equations of 4.18.5.4.
16-1095	Changed "Nat'l Board (inc. Endorsements)" to "National Board Commission Authorized Inspector number" on all Manufacturer's Data Reports.
16-1102	Revised Table 1.1 to include referenced document SA-388, Standard Practice for Ultrasonic Examination of Steel Forgings, and added information to 3.3.4.1 to communicate its location in Section V.
16-1213	Revised 2-A.2.2(b) and 2-B.2.2(b) to add requirement for engineer to have received proper approval from applicable authority. Revised 2-A.2.2(c) and 2-B.2.2(c) to update Engineer Mobility Forum to current format for International Professional Engineers Agreement. Revised Tables 2-A.1 and 2-B.1 to have engineers document the registration authority, the location of the registration authority, and the engineer's registration number, if applicable.
16-1303	Revised 3.3.5.1 for improved clarity.
16-1539	Established a new Certificate of Authorization for organizations fabricating parts without design responsibility. Revised 1.2.6.1(c), 2.3.1.2, 2-C.1.1, 2-F.1, 2-F.3, 2-F.4, 2-G.1, 2-G.4.1, 2-G.5, 2-G.6.1, Form A-2, Figure 2-F.1, and Table 2-H.1.
16-1888	Revised 7.5.8.4(c) to point toward 7.3 for examination personnel qualification and certification requirements.
16-2176	Errata correction. See Summary of Changes for details.
16-2737	Revised the Generalized Plane Strain equation in Tables 5-E.5, 5-E.6, and 5-E.7 such that the last term is subtracted instead of added.
16-2887	Removed Note (3) from Table 7.2 concerning volumetric examination of Class 1 vessels.
17-239	Errata correction. See Summary of Changes for details.

CROSS-REFERENCING AND STYLISTIC CHANGES IN THE BOILER AND PRESSURE VESSEL CODE

There have been structural and stylistic changes to BPVC, starting with the 2011 Addenda, that should be noted to aid navigating the contents. The following is an overview of the changes:

Subparagraph Breakdowns/Nested Lists Hierarchy

- First-level breakdowns are designated as (a), (b), (c), etc., as in the past.
- Second-level breakdowns are designated as (1), (2), (3), etc., as in the past.
- Third-level breakdowns are now designated as (-a), (-b), (-c), etc.
- Fourth-level breakdowns are now designated as (-1), (-2), (-3), etc.
- Fifth-level breakdowns are now designated as (+a), (+b), (+c), etc.
- Sixth-level breakdowns are now designated as (+1), (+2), etc.

Footnotes

With the exception of those included in the front matter (roman-numbered pages), all footnotes are treated as endnotes. The endnotes are referenced in numeric order and appear at the end of each BPVC section/subsection.

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees has been moved to the front matter. This information now appears in all Boiler Code Sections (except for Code Case books).

Cross-References

It is our intention to establish cross-reference link functionality in the current edition and moving forward. To facilitate this, cross-reference style has changed. Cross-references within a subsection or subarticle will not include the designator/identifier of that subsection/subarticle. Examples follow:

- *(Sub-)Paragraph Cross-References.* The cross-references to subparagraph breakdowns will follow the hierarchy of the designators under which the breakdown appears.
  - If subparagraph (-a) appears in X.1(c)(1) and is referenced in X.1(c)(1), it will be referenced as (-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(c)(2), it will be referenced as (1)(-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).
- *Equation Cross-References.* The cross-references to equations will follow the same logic. For example, if eq. (1) appears in X.1(a)(1) but is referenced in X.1(b), it will be referenced as eq. (a)(1)(1). If eq. (1) appears in X.1(a)(1) but is referenced in a different subsection/subarticle/paragraph, it will be referenced as eq. X.1(a)(1)(1).

PART 1
GENERAL REQUIREMENTS

1.1 GENERAL

1.1.1 INTRODUCTION

1.1.1.1 This Division contains mandatory requirements, specific prohibitions, and nonmandatory guidance for the design, materials, fabrication, examination, inspection, testing, and certification of pressure vessels and their associated pressure relief devices.

1.1.1.2 The Code does not address all aspects of these activities. Those aspects that are not specifically addressed should not be considered prohibited and shall be addressed by appropriate engineering judgment. Engineering judgment shall be consistent with the philosophy of this Division, and such judgments shall never be used to overrule mandatory requirements or specific prohibitions of this Division.

1.1.2 ORGANIZATION

1.1.2.1 The requirements of this Division are contained in the nine Parts listed below. Each of these Parts and Annexes is composed of paragraphs that are identified by an alphanumeric numbering system in accordance with the ISO Standard Template for the Preparation of Normative-Type Documents. References to paragraphs are made directly by reference to the paragraph number. For example, the Scope is referenced as 1.2.

(a) Part 1 – General Requirements, provides the scope of this division and establishes the extent of coverage

(b) Part 2 – Responsibilities and Duties, sets forth the responsibilities of the user and Manufacturer, and the duties of the Inspector

(c) Part 3 – Materials Requirements, provides the permissible materials of construction, applicable material specification and special requirements, physical properties, allowable stresses, and design fatigue curves

(d) Part 4 – Design by Rule Requirements, provides requirements for design of vessels and components using rules

(e) Part 5 – Design by Analysis Requirements, provides requirements for design of vessels and components using analytical methods

(f) Part 6 – Fabrication Requirements, provides requirements governing the fabrication of vessels and parts

(g) Part 7 – Examination and Inspection Requirements, provides requirements governing the examination and inspection of vessels and parts

(h) Part 8 – Pressure Testing Requirements, provides pressure testing requirements

(i) Part 9 – Pressure Vessel Overpressure Protection, provides rules for pressure relief devices

1.1.2.2 Mandatory and nonmandatory requirements are provided as normative and informative annexes, respectively, to the specific Part under consideration. The Normative Annexes address specific subjects not covered elsewhere in this Division and their requirements are mandatory when the subject covered is included in construction under this Division. Informative Annexes provide information and suggested good practices.

1.1.2.3 The materials, design, fabrication, examination, inspection, testing, and certification of pressure vessels and their associated pressure relief devices shall satisfy all applicable Parts and Normative Annexes shown above in order to qualify the construction in accordance with this Division.

1.1.3 DEFINITIONS

The definitions for the terminology used in this Part are contained in Annex 1-B.

1.2 SCOPE

1.2.1 OVERVIEW

1.2.1.1 In the scope of this division, pressure vessels are containers for the containment of pressure, either internal or external. This pressure may be obtained from an external source or by the application of heat from a direct or indirect source as a result of a process, or any combination thereof.