

SECTION VIII

Rules for Construction of Pressure Vessels

2015

ASME Boiler and
Pressure Vessel Code
An International Code

Division 2

Alternative Rules

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Division 2

Alternative Rules

ASME Boiler and Pressure Vessel Committee
on Pressure Vessels



The American Society of
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* The 2015 Edition of Section III is the last edition in which Section III, Division 1, Subsection NH, *Class 1 Components in Elevated Temperature Service*, will be published. The requirements located within Subsection NH have been moved to Section III, Division 5, Subsection HB, Subpart B for the elevated temperature construction of Class A components.

INTERPRETATIONS

Interpretations of the Code have historically been posted in January and July at <http://cstools.asme.org/interpretations.cfm>. Interpretations issued during the previous two calendar years are included with the publication of the applicable Section of the Code in the 2015 Edition. Interpretations of Section III, Divisions 1 and 2 and Section III Appendices are included with Subsection NCA.

Following the 2015 Edition, interpretations will not be included in editions; they will be 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 2015 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 2017 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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees: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 judgement* 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 (15)

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the committees. See Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code in Section II, Parts C and D for additional requirements for requests involving adding new materials to the Code. Technical inquiries include requests for revisions or additions to the Code rules, requests for Code Cases, and requests for Code Interpretations, as described below.

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

(2) *Code Cases.* Code Cases represent alternatives or additions to existing Code rules. 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 jurisdictions or owners automatically accept Code Cases. The most common applications for Code Cases are:

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

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

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

(3) *Code Interpretations.* Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an interpretation, an Intent Interpretation will be issued and the Code will be revised.

(b) The Code rules, Code Cases, and Code Interpretations established by the committees 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 rules.

(c) Inquiries that do not comply with these provisions or that do not provide sufficient information for a committee's full understanding may result in the request being returned to the inquirer with no action.

2 INQUIRY FORMAT

Submittals to a committee shall include:

(a) *Purpose.* Specify one of the following:

(1) revision of present Code rules

(2) new or additional Code rules

(3) Code Case

(4) Code Interpretation

(b) *Background.* 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, provide a copy of the specific referenced portions of the Code.

(c) *Presentations.* The inquirer may desire 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 committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the committee.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

(a) *Proposed Revisions or Additions.* For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

(b) *Statement of Need.* Provide a brief explanation of the need for the revision or addition.

(c) *Background Information.* 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 proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate. When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

4 CODE CASES

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined 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, etc.) must be defined and it must be confirmed 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 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 proposed Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations shall provide the following:

(1) *Inquiry.* Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a “yes” or a “no” *Reply*, with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

(2) *Reply.* Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the *Reply* should be “yes” or “no,” with brief provisos if needed.

(3) *Background Information.* Provide any background information that will assist the committee in understanding the proposed *Inquiry* and *Reply*.

(b) Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The committee cannot 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

Submittals to and responses from the committees shall meet the following:

(a) *Submittal.* Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will also be considered. They shall include the name, address, telephone number, fax number, and e-mail address, if available, of the inquirer and be mailed to the following address:

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

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org or via our online tool at <http://go.asme.org/InterpretationRequest>.

(b) *Response.* The Secretary of the appropriate committee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the inquirer upon completion of the requested action by the committee.

PERSONNEL

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January 1, 2015

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M. Golliet	V. Rohatgi
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L. Fridlund	R. Wink
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SUMMARY OF CHANGES

After publication of the 2015 Edition, 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, **(15)**, 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.

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
xvi	List of Sections	Revised
xviii	Foreword	(1) Revised (2) New footnote added by errata (13-860)
xxi	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	In last line of 6(a), URL revised
xxiii	Personnel	Updated
3	1.2.5	Revised (13-1240)
5	Table 1.1	(1) “SNT-TC-1A” revised to “ASNT SNT-TC-1A” (13-1295) (2) Year revised for ASME B16.5, ASME PTC 25, ASME PCC-1, and ANSI/UL-969 (13-1295)
15	2.2.2.1	New subpara. (f)(4) added (12-1041)
17	2.2.2.2	Subparagraph (g) revised (12-1041)
29	Table 2-D.3	(1) In Forms A-1 and A-2, Section 20, “Bolting Material” corrected by errata to read “Washer Material” (13-1750) (2) Form A-4 revised (14-997)
39	2-F.1	Subparagraph (h) revised (13-63)
43	Figure 2-F.1	(1) Text added above figure (13-63) (2) Text below figure revised (13-63) (3) In Note (2), “external working pressures” corrected by errata to read “working pressure (external)” (13-1345)
49	Annex 2-I	“Normative” added under title as errata correction (13-1750)
55	3.2.8.5	Reference to “UG-92” corrected by errata to read “7.2.2” (14-413)
58	3.3.6.2	Subparagraph (b) added (12-421)
58	3.3.7	Added (08-918)
61	3.6.6	Added (08-918)
69	3.11.2.1	Subparagraph (a) revised (11-1243)
69	3.11.2.2	Subparagraph (b) revised (11-1243)
71	3.11.2.5	Subparagraphs (a) and (d) revised (11-1243)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
72	3.11.2.6	Subparagraph (a) revised (11-1243)
73	3.11.2.9	Subparagraph (a) revised (11-1243)
73	3.11.3.1	Subparagraph (c) revised (11-1243)
74	3.11.3.3	Subparagraph (c) revised (12-2301)
74	3.11.4	Revised in its entirety (13-175)
81	Table 3.1	Fourth row added (11-997)
92	Figure 3.3	Editorially revised
93	Figure 3.3M	Editorially revised
94	Figure 3.4	Editorially revised
95	Figure 3.4M	Editorially revised
98	Figure 3.7	(1) For Curve C, (f) revised and (h) added (11-997) (2) Note (g) deleted (11-1243)
100	Figure 3.7M	(1) For Curve C, (f) revised and (h) added (11-997) (2) Note (g) deleted (11-1243)
102	Figure 3.8	(1) For Curve C, (f) revised and (h) added (11-997) (2) Note (g) deleted (11-1243)
104	Figure 3.8M	(1) For Curve C, (f) revised and (h) added (11-997) (2) Note (g) deleted (11-1243)
109	Figure 3.12	Editorially revised
110	Figure 3.12M	Editorially revised
111	Figure 3.13	Editorially revised
112	Figure 3.13M	Editorially revised
116	Table 3-A.1	(1) Last entry for SA-336 added (14-867) (2) For last two entries for SA-542, entries for Nominal Composition transposed (13-1455) (3) First entry for SA/EN 10028-2 added (11-997) (4) New entry for SA/NF A36-215 added (08-1299)
121	Table 3-A.3	Revised (08-1255 , 13-1423, 14-358)
127	Table 3-A.6	New entry for SB-564 N08825 added (12-511)
145	3-F.1.1	Subparagraph (c) revised (13-1423)
146	3-F.2.2	Subparagraph (c) revised (12-1041)
148	Table 3-F.3	Title revised (13-1423)
156	4.1.6.3	Added (13-1847)
156	4.1.8	4.1.8.1 and 4.1.8.2(a) and (b) revised (13-1240)
158	4.1.13	S_{ps} added (13-1847)
162	4.2.5.6	Subparagraph (h) redesignated by errata as (3) (14-1303)
165	Table 4.2.1	In Weld Category A, third entry added (08-29)
166	Table 4.2.3	Entry for Material Type 3 revised (13-132)
192	4.3.10.2	In equation (4.3.43), equal sign inserted after σ by errata (13-1750)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
198	4.3.13	L_c revised (08-764)
213	Figure 4.3.8	Callouts for L_c revised (08-764)
240	4.5.2.2	Added, and previous 4.5.2.2 redesignated as 4.5.2.3 (08-1506)
240	4.5.3.1	In equation (4.5.2), “0.75” corrected by errata to read “ $0.75d_{st}$ ” (13-1750)
241	4.5.3.2	Subparagraph (d) revised (11-1461)
241	4.5.5.1	In equation (4.5.53), “ f_n ” corrected by errata to read “ f_N ” (13-1345)
274	4.6.4.3	In equation (4.6.15), in numerator “ T ” corrected by errata to read “ t ” (14-143)
366	4.13.12.3	In equation (4.13.7), radical sign shortened to “0.25” (13-2179)
373	Figure 4.13.5	In illustration (a), callout for “Y” corrected by errata and subcaption revised (13-958)
385	4.15.3.5	In equation (4.15.26), minus sign inserted before “ K_5 ” by errata (13-1750)
413	Table 4.16.7	In last column, third equation, “1.05” corrected by errata to read “0.105” (14-736)
433	4.18.1	Revised (12-312)
434	4.18.4	Subparagraph (h) deleted (12-312)
442	4.18.8.4	In equation (4.18.102), first term in denominator “ u ” corrected by errata to read “ μ ” (13-1750)
453	4.18.9.4	In Step 10, subparas. (a) and (b), references to equation (4.18.122) corrected by errata to equation (4.18.123) (13-1345)
458	4.18.9.5	Subparagraph (b)(2) revised (13-1386)
463	4.18.11	Revised (12-312)
463	4.18.12.1	Revised (12-312, 13-1295, 13-1386)
464	4.18.14.3	Subparagraphs (b)(3) and (b)(4) revised (14-997)
464	4.18.15	(1) In subparagraph (c), nomenclature for $S_{PS,c}$ and $S_{PS,s}$ revised; terms W_{oc} , W_{os} , and $W_{o, \max}$ revised to W_{dc} , W_{ds} , and $W_{d, \max}$, respectively, and nomenclature revised (13-1386, 13-1847) (2) In subparagraph (d), terms P_{sox} and P_{tox} revised to $P_{sox, \min}$, $P_{sox, \max}$, $P_{tox, \min}$, $P_{tox, \max}$; nomenclature for S_{PS} , $S_{PS,c}$, $S_{PS,s}$, and $S_{PS,s,1}$ revised; terms W_{oc} , W_{os} , and $W_{o, \max}$ revised to W_{dc} , W_{ds} , and $W_{d, \max}$, respectively, and nomenclature revised (13-1386, 13-1847, 14-1322)
472	Table 4.18.5	Revised in its entirety (13-1386)
472	Table 4.18.6	Revised in its entirety (13-1386)
473	Table 4.18.8	Second and third columns revised (14-1322)
473	Table 4.18.9	Second and third columns revised (14-1322)
477	Figure 4.18.4	In illustration (d) caption, “Integral” corrected by errata to read “Gasketed” (13-1345)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
484	Figure 4.18.11	In illustration (d) caption, “Integral” corrected by errata to read “Gasketed” (13-1345)
489	4.19.1	Subparagraph (b) added (12-312)
489	4.19.2	Subparagraph (e) revised (14-1248)
489	4.19.3	(1) In 4.19.3.1, subpara. (d) revised and (f) deleted (13-359, 12-312) (2) 4.19.3.3 added (13-359)
491	4.19.5.1	Revised (13-1279)
493	4.19.6.1	Revised (13-1279)
497	4.19.11	G_b , L_{dt} , M_z , r_i , θ_z , τ_z added; r_{ic} , r_{ir} , and S_s revised (13-359, 13-1279)
499	Table 4.19.1	Added and subsequent tables redesignated (14-1248)
500	Table 4.19.2	Formerly Table 4.19.1, redesignated and revised (13-1279)
504	Table 4.19.7	Formerly Table 4.19.6, redesignated and revised (13-1279)
506	Table 4.19.9	Formerly Table 4.19.8, redesignated and revised (13-1279)
520	Form 4.19.1	New line 12 added, and subsequent lines renumbered (13-359)
521	Form 4.19.2	New line 12 added, and subsequent lines renumbered (13-359)
522	4.20.1	Subparagraph (b) added (12-312)
522	4.20.2	(1) In subpara. (d), “torii” revised to “tori” and “ $\sqrt{0.5Rt_f}$ ” corrected by errata to read “ $0.5\sqrt{Rt_f}$ ” (13-1847, 14-736) (2) Subparagraph (f) deleted (13-1847)
522	4.20.3	Subparagraph (e) revised and (f) deleted (12-312)
523	4.20.7	Nomenclature for S_{PS} revised (13-1847)
539	Annex 4-E	Added (13-1848)
549	5.1.1.2	Subparagraph (b) revised (11-7)
555	5.3	Revised (11-7, 13-1446)
563	5.5.5.2	In equation (5.62), “ $\frac{1}{I\bar{m}_{ss}}$ ” corrected by errata to read “ $\frac{1}{I\bar{m}_{ss}}$ ” (14-2385)
578	Table 5.4	Sixth entry in second column revised (11-7)
662	6.2.1.1	Revised (11-995)
663	6.2.2.2	Revised (13-655)
684	6.10	D_f revised, and D_o deleted (14-499)
685	Table 6.1	In first equation, D_o revised to D_f (14-499)
688	Table 6.5	Second column, fourth entry revised (08-1299)
692	Table 6.10	Subparagraphs (a)(1) and (b)(1)(-a) deleted and subsequent paragraphs redesignated (08-39, 13-292)
693	Table 6.11	Subparagraph (a)(1)(-b) deleted (08-39)
698	Table 6.15	(1) Second column for P-No. 10A, Group 1 revised (08-1299) (2) Alloy S32205 added to P-No. 10H, Group 1 (08-1255)

<i>Page</i>	<i>Location</i>	<i>Change (Record Number)</i>
		(3) Section on P-No. 45 added (14-358)
703	Table 6.21	Note (1) added (13-1279)
719	7.4.3.3	Subparagraph (a) revised (13-231)
727	7.5.5.1	First paragraph and (b)(3) revised (13-1261, 14-545)
727	7.5.5.2	Revised (13-899)
727	7.5.5.3	New subparagraphs (a) and (b) added, and redesignated (e) revised (13-899)
734	Table 7.2	(1) Eighth row added (08-29) (2) Under Joint Category C, Type of Weld, sixth through eighth entries revised (08-770) (3) Notes (19) and (20) added (08-29, 08-770)
738	Table 7.4	(1) Fifth and last rows added (13-1152) (2) Second column, second, third, and fourth entries revised (13-1152) (3) Last column revised (13-1152)
752	Figure 7.11	In illustration (b), callout for “a” corrected by errata (14-1750)
765	8.1.3.3	First sentences in (a) and (b) revised (13-1240)

NOTE: Volume 63 of the Interpretations to Section VIII, Division 2 of the ASME Boiler and Pressure Vessel Code follows the last page of Section VIII, Division 2.

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
08-29	Revised Table 4.2.1 to add butt welded joints in flat tubesheets to Type 1. Revised Table 7.2 to require full radiography of butt welded joints in flat tubesheets and added new Note (11).
08-39	Deleted the maximum NPS 4 restriction on the PWHT exemption for circumferential butt welds P-No. 4 and P-No. 5 materials as shown in PWHT Requirements (b)(1)(-a) in Table 6.10 and (a)(1)(-b) in Table 6.11.
08-764	Updated the definition of L_c in paragraph 4.3.13. Updated Figure 4.3.8.
08-770	Revised Table 7.2 to add new Note (7) to define the terms d and t_n .
08-918	Added 3.3.7 and 3.6.6 to provide rules for clad tubesheets when the tubes are to be strength welded to the cladding.
08-1255	Incorporated Code Case 2637 in Table 3-A.3 and Table 6.15 for use of S32205 and added Section VIII, Division 2 applicability.
08-1299	Incorporated Code Case 2562 into 3.11.2.1, Table 3-A.3, Table 6.5, and Table 6.15.
08-1506	Revised 4.5.2 to clarify that material in flanges, tubesheets, and flat heads shall not be used for reinforcement of openings in adjacent shells or heads.
11-7	Clarified when "Protection Against Local Failure" is required in 5.1.1.2. Clarified when "Protection Against Local Failure" is required in 3.5. Revised paragraph 5.3.2 similar to previous version of Division 2. Revised equation (5.5) to the average of the principal stresses and set the limit to $1.5*S$ (or F_y). Provided additional wording in 5.3.3 to clarify what strains apply. Updated Table 5.4 to include a "Local Criteria" load combination. Updated Table 4.5; changed "Local Criteria Design Conditions" to Table 5.4.
11-995	Revised 6.2.1.1 to include hybrid welding.
11-997	Updated Notes to Figures 3.7, 3.7M, 3.8, and 3.8M with Curve C if material is normalized and tempered; updated Table 3-A.1 and Table 3.1.
11-1243	Revised 3.11.2.2(b) to clarify that toughness testing is mandatory for high yield (greater than 65 ksi) materials. Rules revised to clarify that equation (3.4) of paragraph 3.11.2.5 applies to parts subject to PWHT. Notes for Figures 3.7, 3.7M, 3.8 and 3.8M revised from SA-533 Grades B and C, which are currently designated as Curve C materials, to SA-533 Types B and C Class 1 only, as not all the classes for these two Types are below 65 ksi in yield strength. Revised 3.11.2.5 Step 5(d), 3.11.2.6(a), 3.11.2.9(a), and 3.11.3.1(c)(1) and (c)(2) by making references to 3.11.2.5, Step 4 and Step 5 for the definition of coincident stress ratio and for the procedure to determine the allowable MDMT reduction.
11-1461	Revised 4.5.3.2(d) to delete the words "to test for tightness of welds that seal off the inside of the vessel."
12-312	Revised 4.18, 4.19, and 4.20 for consistency with Division 1.
12-421	Revised 3.3.6.2 to require the plate to have the cladding joints made by a Manufacturer, receive full RT, and be provided with a partial data report and certification mark prior to bonding to the base material. Interpretation states that the Code requires that welding of cladding material used in design calculations shall be made by a Manufacturer holding a Certificate of Authorization.
12-511	Revised Table 3-A.6 to add SB-564 N08825 forgings.
12-1041	Added new paragraph 2.2.2.1(f)(4) to include information on corrosion fatigue. Revised 2.2.2.2(g) to point user to 2.2.2.1(f)(4)(-c). Revised 3-F.2.2(c).
12-2301	Revised 3.11.3.3(c).
13-63	Revised 2-F.1(h) and Figure 2-F.1.
13-132	Revised Table 4.2.3, "Types IV & V" for Material Type 3 to read "Grade D and Class 70 of Grades E, F, G, H, and J."
13-175	Revised 3.11.4.1(a), (b), and (c); 3.11.4.2, first paragraph; 3.11.4.5(b) and (d); 3.11.4.6(b). Deleted 3.11.4.3(a)(1) and 3.11.4.6(d).
13-231	Revised 7.4.3.3.
13-292	Removed SA-202 material from Table 6.10.
13-359	Added new 4.19.3.3.

Record Number	Change
13-655	Revised 6.2.2.2 to change previous references to Section IX paragraphs to reference QG-106.
13-860	In the Foreword, the subtitle has been deleted and replaced with an ANSI disclaimer as a footnote.
13-899	Revised 7.5.5.1 and 7.5.5.2 to clarify the application of acceptance criteria for surface and sub-surface flaws.
13-958	Errata correction. See Summary of Changes for details.
13-1152	Revised Table 7.4 to be consistent with the requirements of paragraph 7.4.11.
13-1240	Revised 4.1.8 and 8.1.3 to add the word "dependent" in the description of chambers and deleted the word "independent" from 1.2.5.
13-1261	Revised 7.5.5.1.
13-1279	Corrected membrane stress due to pressure in collar of reinforced bellows in Part 4.19.
13-1295	Revised Table 1.1 to update "year of acceptable edition" for those standards that were reviewed. Corrected Standard Number for ASNT STN-TC-1A.
13-1345	Errata correction. See Summary of Changes for details.
13-1386	Updated nomenclature in 4.18.5, 4.18.9.5, Table 4.18.5, and Table 4.18.6.
13-1423	Added UNS S32906 (29Cr-6.5Ni-2Mo-N) to Table 3-A.3. Added Austenitic-Ferritic Stainless Steel to Table 3-F.3 and paragraph 3-F.1.1 (c).
13-1446	Revised equation (5.10) in 5.3.3.2.
13-1455	Corrected nominal compositions in Table 3-A.1 for SA-542 classes C and D.
13-1750	Errata correction. See Summary of Changes for details.
13-1847	Added 4.1.6.3, deleted paragraph 4.20.2(f), and revised paragraphs 4.1.13, 4.3.13, 4.18.15(c), 4.18.15(d) and 4.20.7 to define SPS consistent with Division 1.
13-1848	Added Annex 4-E for tube expanding procedures and qualification.
13-2179	Revised equation (4.13.7) to be identical to that in AF-815.2 of Section VIII, Division 2, 2006 Addenda.
14-358	Added S31266 to Table 3-A.3, revised Table 6.15 to add UNS S31266, and revised table references in 6.4.2.2.
14-413	Errata correction. See Summary of Changes for details.
14-499	Revised the equation for calculation of forming strain in one-piece heads in Table 6.1.
14-545	Revised 7.5.5.1 to provide direct guidance to 7.5.4.1(e)
14-736	Errata correction. See Summary of Changes for details.
14-867	Added SA-336 F91 in Table 3-A.1 for Section VIII, Division 2 use.
14-997	Revised 4.18.14.3(b)(3) and (b)(4) and Form A-4.
14-1248	Revised Part 4.19 and added new Table 4.19.1 with maximum design temperature with regard to type of material.
14-1303	Errata correction. See Summary of Changes for details.
14-1322	Revised Tables 4.18.8 and 4.18.9.
14-1750	Errata correction. See Summary of Changes for details.
14-2385	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).

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PART 1

GENERAL REQUIREMENTS

1.1 GENERAL

1.1.1 INTRODUCTION

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

1.1.1.2 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 non-mandatory 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.