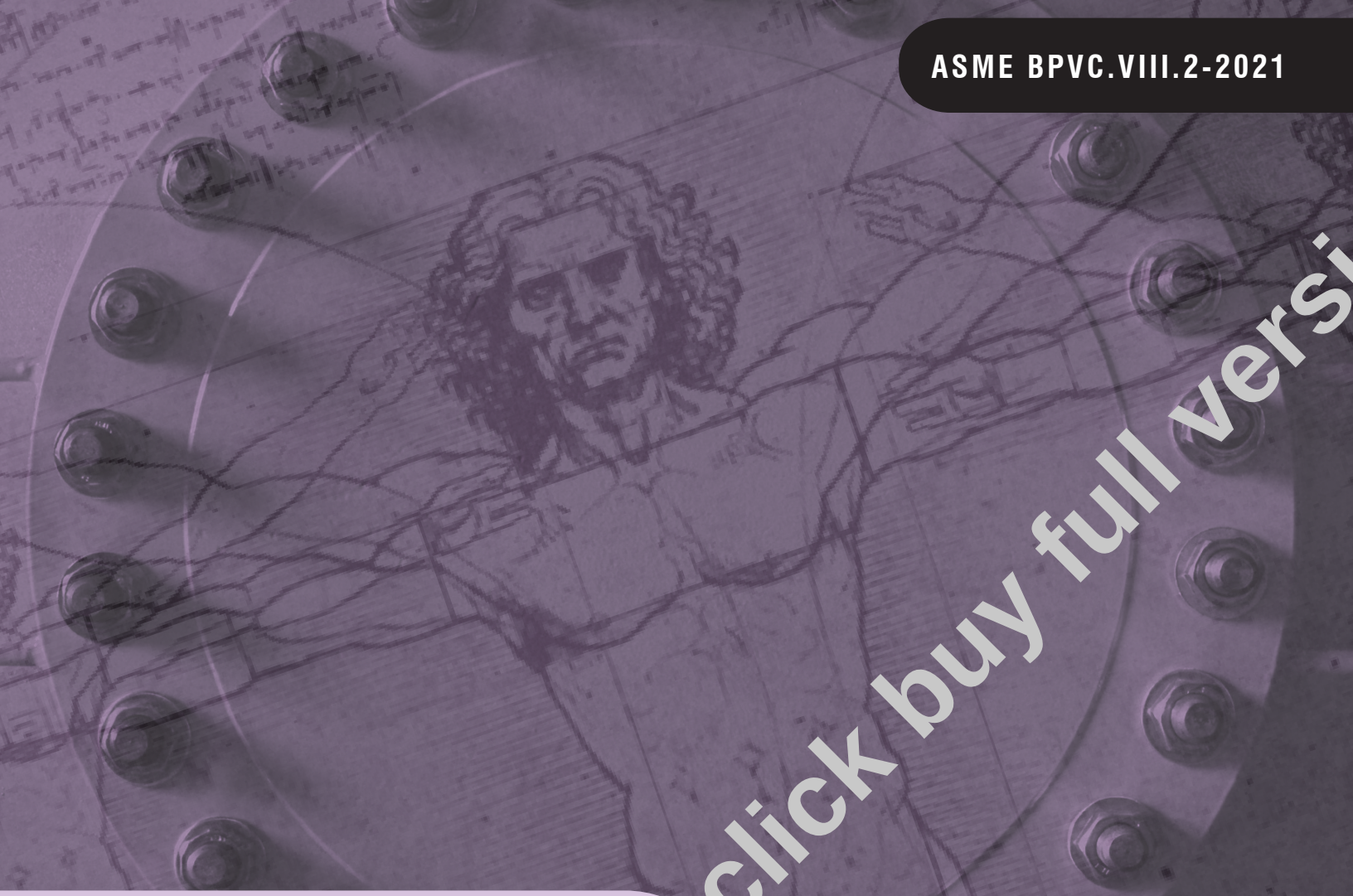
ASME BPVC.VIII.2-2021



SECTION VIII

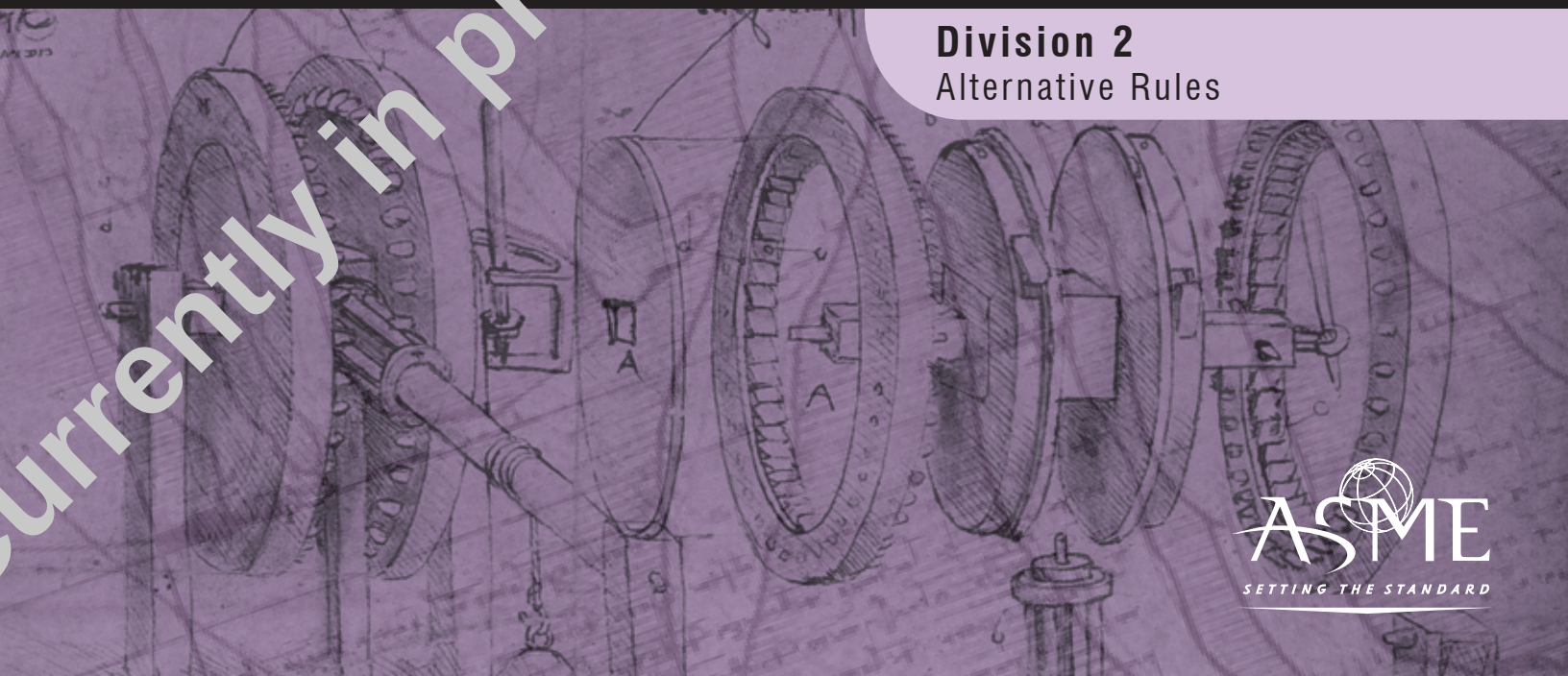
Rules for Construction of Pressure Vessels

2021 ASME Boiler and Pressure Vessel Code

An International Code

Division 2

Alternative Rules



ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

2021 ASME Boiler & Pressure Vessel Code

2021 Edition July 1, 2021

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, 2021

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

ASME Single Certification Mark

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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 2021 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements. Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2023 Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. Code Case users can check the current status of any Code Case at http://go.asme.org/BPVCCDatabase. Code Case users can also view an index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases at http://go.asme.org/BPVCC.

FOREWORD[*]

(21)

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) Committee on Overpressure Protection (XIII)
(l) 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 overpressure protection.

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 the ASME Single 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.

The words "shall," "should," and "may" are used in this Standard as follows:

- *Shall* is used to denote a requirement.
- *Should* is used to denote a recommendation.
- *May* is used to denote permission, neither a requirement nor a recommendation.

STATEMENT OF POLICY ON THE USE OF THE ASME SINGLE 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 ASME Single 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 ASME Single Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the ASME Single 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 ASME Single 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 ASME Single 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 ASME Single 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 ASME Single Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the ASME Single Certification Mark.

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 ASME Single Certification Mark described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the ASME Single 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.

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

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) Interpretations will be issued only if existing Code text is ambiguous or conveys conflicting requirements. If a 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. This information should include a statement indicating why the included paragraphs, figures, or tables are ambiguous or convey conflicting requirements. 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 ASME Single 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 include a statement indicating why the included paragraphs, figures, or tables are ambiguous or convey conflicting requirements. 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.

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(21)

January 1, 2021

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SUMMARY OF CHANGES

Errata to the BPV Code may be posted on the ASME website 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, **(21)**, placed next to the affected area.

Page	*Location*	*Change*
xvii	List of Sections	*(1)* Listing for Section III updated *(2)* Section XIII added *(3)* Code Case information updated
xix	Foreword	*(1)* Subparagraph (k) added and subsequent subparagraph redesignated *(2)* Second footnote revised *(3)* Last paragraph added
xxii	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Paragraphs 1(a)(3)(-b), 2(b), and 5(a)(3) revised
xxv	Personnel	Updated
1	1.1	Paragraphs 1.1.1.1, 1.1.2.1(i), and 1.1.2.3 revised
4	1.2.7	Revised
5	Table 1.1	Revised
8	1-B.2.16	Revised
15	2.2	Former 2.2.2.1 and 2.2.2.2 redesignated as 2.2.1.1 and 2.2.1.2, respectively
15	2.2.3.1	Subparagraphs (f)(4)(-a), (f)(4)(-b), and (i)(2)(-b) revised
17	2.3.1	Paragraph 2.3.1.3 added and subsequent paragraph redesignated
18	2.3.3	*(1)* In 2.3.3.1, subpara. (b) revised *(2)* In 2.3.3.3, former subparagraphs below (d) moved under subpara. (c)
19	2.3.7	Revised in its entirety
21	Annex 2-A	*(1)* In 2-A.1(b), first cross-reference updated *(2)* In 2-A.2.1, first paragraph, cross-references updated
23	2-B.3	Revised
28	Table 2-D.1	For Note (56), instructions revised
31	Form A-1	Line 18 revised
34	Form A-1P	Lines 9, 12, and 13 revised
36	Form A-2	Line 20 revised
42	2-E.1	In 2-E.1.1 and 2-E.1.4, last sentence deleted
44	2-E.16	Revised in its entirety

Page	*Location*	*Change*
46	2-F.4.1	Last paragraph added
46	2-F.5	Subparagraph (c)(1) revised in its entirety
48	2-F.7.1	Revised
49	Figure 2-F.1	Under “Certified by,” text below fourth line revised
50	2-G.1	First line revised
50	2-G.6.3	Deleted
53	Annex 2-J	*(1)* Title revised *(2)* Paragraphs 2-J.1, 2-J.2(a), 2-J.3.1(b), 2-J.3.2, 2-J.3.3, 2-J.4.1(b), and 2-J.4.2(a) revised
57	3.2.5.2	Subparagraph (b)(4)(-b) revised
63	3.3.4.1	First paragraph and subpara. (b) revised
66	3.4.4.1	Last sentence deleted
76	3.11.2.1	In subpara. (a), last sentence deleted
78	3.11.2.5	*(1)* In subpara. (a), Step 4, second sentence added *(2)* In supbara. (a), Step 5(b), last two sentences revised *(3)* Subparagraph (e) added
79	3.11.2.6	In subpara. (a), last sentence added
81	3.11.4.1	Subparagraphs (c) and (c)(1) revised
83	3.11.4.5	Subparagraphs (a) and (d)(1) revised
85	3.11.7.6	Subparagraphs (b)(1)(-a) and (b)(2) revised
86	3.11.8.1	In subpara. (b), third cross-reference updated
115	Figure 3.10	Revised and Note (2) added
124	Table 3-A.1	Material Specification SA/NF A36-215 deleted
130	Table 3-A.3	For SA-249, UNS No. S31266 added below TP310S
145	Annex 3-C	Deleted
146	3-D.1	Revised
146	3-D.3	Equation (3-D.2) added and subsequent equations renumbered
147	3-D.4	Equations renumbered and cross-references to equations updated
148	3-D.5.1	Equations renumbered and cross-reference to equation updated
170	4.1.5.3	In subpara. (b), cross-references to ASCE/SEI 7 updated
172	4.1.11.1	Revised
174	Table 4.1.2	In Note (4), cross-reference to ASCE/SEI 7 updated
244	4.4.12.3	In subpara. (a), t corrected by errata to t_c
257	4.5.2.1	Last sentence deleted
258	4.5.5.1	Step 9 and eqs. (4.5.32) and (4.5.58) revised
263	4.5.10.1	Equation (4.5.120) revised
268	4.5.12.1	Equation (4.5.164) editorially revised and eq. (4.5.164a) added
272	4.5.15	Revised

Page	*Location*	*Change*
274	4.5.17	*(1)* Title revised *(2)* In 4.5.17.2, last sentence added *(3)* Paragraph 4.5.17.4 merged with 4.5.17.3 *(4)* Former 4.5.17.5 redesignated as 4.5.17.4 and revised
274	4.5.18	Definitions of A_5 and S revised
279	Figure 4.5.2	Legend revised
300	4.7.1.4	Added
303	4.7.5.3	Equation (4.7.32) revised
306	Table 4.7.1	Under "Operating Conditions" and "Gasket Seating Conditions" equations for S_{hlbi} and S_{hlbo} revised
318	4.11.1.3	Revised
319	4.11.4	Paragraph 4.11.4.1 revised in its entirety, 4.11.4.2 added, and subsequent paragraph redesignated
320	4.11.6.4	Equation (4.11.5) revised
320	4.11.7	Definition of C_{ul} added
327	Table 4.11.2	For Detail 1, requirements revised
400	4.15.3.1	Subparagraph (c) revised and eqs. (4.15.1) and (4.15.2) deleted
401	4.15.3.2	Equations renumbered and revised
401	4.15.3.3	Equations renumbered and their cross-references updated
402	4.15.3.4	*(1)* Equations renumbered and their cross-references updated *(2)* In subpara. (d)(2), eqs. (4.15.15) and (4.15.16) [former eqs. (4.15.17) and (4.15.18)] revised
402	4.15.3.5	*(1)* Equations renumbered and their cross-references updated *(2)* Subparagraph (c)(3) revised in its entirety
406	4.15.5.2	Subparagraph (b) revised
406	4.15.6	*(1)* Definitions of h_2 and R_i deleted *(2)* Definitions of h_m and R_{mh} added
409	Figure 4.15.1	Revised
410	Figure 4.15.2	Revised
411	Figure 4.15.3	Revised
418	4.16.4.3	Subparagraphs (b) and (c) deleted by errata
421	4.16.13	Definitions of h_n and h_p added
427	Table 4.16.4	Equation for X_h revised for both flange type
431	Table 4.16.7	Revised
443	4.17.3.5	Metric value revised
449	Table 4.17.1	For Flange, last row of equations revised
456	4.18.7.3	Subparagraph (a)(2) revised in its entirety
456	4.18.7.4	In Step 9(a), in-line equation revised
460	4.18.8.3	Subparagraph (a)(2) revised

Page	*Location*	*Change*
461	4.18.8.4	*(1)* In Step 8(a), in-line equation revised *(2)* In Step 9(c)(2), cross-references updated
473	4.18.9.1	Subparagraph (d) added
473	4.18.9.3	Subparagraph (b)(2) revised
474	4.18.9.4	*(1)* In Step 8(a), in-line equation revised *(2)* In Step 9(c)(2), cross-references updated
482	4.18.10	Deleted
485	4.18.15	Subparagraph (e) deleted
505	Figure 4.18.13	Deleted
519	4.19.8.6	In eq. (4.19.62), $\Delta q_{e,1}>$ corrected by errata to $\Delta q_{e,1}$
544	Form 4.19.1	Line 24 and Note (1) revised
545	Form 4.19.2	Line 24 and Note (1) revised
550	4.21	Added
558	Figure 4.21.1	Added
559	Figure 4.21.2	Added
560	Figure 4.21.3	Added
565	Annex 4-C	Deleted
580	5.1.3.2	Cross-references to ASCE/SEI 7 updated
609	Table 5.3	In Note (2), cross-reference to ASCE/SEI 7 updated
699	6.2.4.9	Subparagraph (b) revised
705	6.4.5.2	Subparagraph (f)(1) revised in its entirety
714	6.7.6.3	Subparagraph (b) revised in its entirety
717	6.7.12	Revised
719	6.8.10	In subpara. (b)(3), cross-reference to table updated
721	Table 6.1	Second column head revised
724	Table 6.5	Revised
724	Table 6.6	Second column head revised
726	Table 6.8	In subpara. (a)(3)(-e) revised
727	Table 6.9	In subparas. (b)(1), (c)(4), (d), and (e) revised
728	Table 6.10	In subpara. (c), cross-reference updated
729	Table 6.11	In subparas. (b) and (c), cross-reference updated
731	Table 6.12	In subpara. (b), cross-reference updated
732	Table 6.13	For Materials P-No. 7, cross-reference updated in subpara. (b)
733	Table 6.14	*(1)* For Materials P-No. 9A, subparas. (a)(2), (b)(5), (c), and (e) revised *(2)* For Materials P-No. 9B, subparas. (a)(1), (b)(3), (d), and (f) revised
735	Table 6.15	Revised

Page	*Location*	*Change*
738	Table 6.17	Under Plate Steels, thickness revised for SA-553
764	7.5.5.2	In first paragraph and subpara. (c), second cross-reference updated
764	7.5.5.3	Cross-references to figures updated
768	7.6.1	In second line, "(if nonferromagnetic)" corrected by errata to "(if ferromagnetic)"
769	Table 7.1	Note (3) revised
770	Table 7.2	*(1)* Under Type of Weld, entries for Joint Categories D and E revised *(2)* Former Note (11) deleted, and subsequent Note renumbered
778	Table 7.10	General Note (f) revised and general notes (g) and (h) added
779	Table 7.11	General Note (e) revised and general notes (f) through (i) added
788	Figure 7.11	Revised and Note (1) added
789	Figure 7.12	Added
791	Figure 7.13	Added
793	Figure 7.14	Former Figure 7.12 redesignated
794	Figure 7.15	Former Figure 7.13 redesignated
795	Figure 7.16	Former Figure 7.14 redesignated
796	Figure 7.17	*(1)* Former Figure 7.15 redesignated *(2)* General Note added and Note (3) revised in its entirety
797	Figure 7.18	Former Figure 7.16 redesignated
797	Figure 7.19	Former Figure 7.17 redesignated
800	Table 7-A.1	For "Certification of qualification of nondestructive radiographic, ultrasonic, magnetic particle, liquid penetrant, and eddy current test examiners," paragraph reference for Procedure, corrected by errata from "7-A.3.2.4" to "7.3"
804	8.1.3.3	In subpara. (b), cross-reference to equation number corrected by errata from "(8.2)" to "(8.1)"
805	8.1.5	Added
808	Part 9	Revised in its entirety
813	9-A.2	Revised in its entirety
817	Annex 9-B	Added

LIST OF CHANGES IN RECORD NUMBER ORDER

DELETED

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 (21)

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, overpressure protection, and certification of pressure vessels.

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 overpressure protection requirements

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, overpressure protection, and certification of pressure vessels 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.