

SECTION IV

2021

ASME Boiler and
Pressure Vessel Code
An International Code

Rules for Construction
of Heating Boilers

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AN INTERNATIONAL CODE

2021 ASME Boiler & Pressure Vessel Code

2021 Edition

July 1, 2021

IV

RULES FOR CONSTRUCTION OF HEATING BOILERS

ASME Boiler and Pressure Vessel Committee
on Heating Boilers



The American Society of
Mechanical Engineers

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* In the 2021 Edition, Subsections NC and ND have been incorporated into one publication, Subsection NCD (BPVC.III.1.NCD), Class 2 and Class 3 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 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*

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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees: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 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 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 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.

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.

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

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>.

PERSONNEL

(21)

ASME Boiler and Pressure Vessel Standards Committees, Subgroups, and Working Groups

January 1, 2021

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 A. R. Patil

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PREAMBLE

The rules of this Section of the Code cover minimum construction requirements for the design, fabrication, installation, and inspection of steam heating, hot water heating, and hot water supply boilers that are directly fired with oil, gas, electricity, coal, or other solid or liquid fuels, and for operation at or below the pressure and temperature limits set forth in this document. Similar rules for potable water heaters are also included.

For Section IV application, the boiler proper or other vessels terminate at the supply and return connections to the system or the supply and feedwater connections of a hot water supply boiler. These connections may be any of the following:

- (a) the first circumferential joint for welding end connections
- (b) the face of the first flange in bolted flanged connections
- (c) the first threaded joint in that type of connection

Included within the scope of the boiler are pressure-retaining covers for inspection openings, such as manhole covers, handhold covers, and plugs; and headers required to connect individual coils, tubes, or cast sections within a boiler.

The rules are divided into four major Parts: Part HG, applying to all materials of construction except as provided for in Part HLW; Part HF, applying to assemblies fabricated of wrought material, except as provided for in Part HLW; Part HC, applying to cast iron assemblies; Part HA, applying to boilers constructed of cast aluminum; and Part HLW, applying to potable water heaters. Part HF is further subdivided into Subpart HW, containing rules for welded construction, and Subpart HB, containing rules for brazed construction.

The Parts and Subparts of this Section are divided into Articles. Each Article is given a number and a title, as for example, Part HG, Article 3, Design. Articles are divided into paragraphs that are given a three-digit number, the first of which corresponds to the Article number. Thus, under Article 3 of Part HG, paragraph HG-307 will be found. Paragraphs are further subdivided into subparagraphs. Major subdivisions of paragraphs are designated by three- or four-digit numbers followed by a decimal point and a digit or digits. Where necessary, further subdivisions are represented by letters and then by numbers in parentheses. Minor subdivisions of the paragraphs are also represented by letters. A reference to one of these paragraphs in the text of the Section includes all of the applicable rules in that paragraph. Thus, reference to HG-307 includes all the rules in HG-307.1 through HG-307.4.

This Section does not contain rules to cover all possible details of design and construction. Where complete details are not given, it is intended that the manufacturer, subject to the acceptance of the Authorized Inspector, shall provide details of design and construction that will be as safe as otherwise required by these rules.

When the strength of any part cannot be computed with a satisfactory assurance of safety, these rules provide procedures for establishing its maximum allowable working pressure.

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.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xiv	List of Sections	(1) Listing for Section III updated (2) Section XIII added (3) Code Case information updated
xvi	Foreword	(1) Subparagraph (k) added and subsequent subparagraph redesignated (2) Second footnote revised (3) Last paragraph added
xix	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Paragraphs 1(a)(3)(-b), 2(b), and 5(a)(3) revised
xxii	Personnel	Updated
1	HG-100	In subpara. (b), first sentence revised
3	HG-200.7	Table cross-references revised
4	HG-300	Subparagraph (c) revised
4	HG-301.1	Definitions of <i>E</i> and <i>S</i> revised
4	HG-301.2	Subparagraph (f) revised
4	HG-305.1	In definition of <i>S</i> , table cross-references revised
5	HG-307.1	(1) Second paragraph editorially revised (2) In definition of <i>S</i> , table cross-references revised
9	HG-309	(1) First sentence editorially revised (2) In definition of <i>S</i> , table cross-references revised
11	HG-312.1	Subparagraphs (a) and (b) revised
15	HG-320.3	In definition of <i>S</i> , table cross-references revised
16	Table HG-321	(1) Variable <i>h</i> revised to <i>d</i> (2) Editorially reformatted
17	HG-326.4	In definition of <i>S</i> , table cross-references revised
22	HG-340.1	In definition of <i>S</i> , table cross-references revised
27	Figure HG-345.1(a)	In General Note (a), table cross-references revised
28	Figure HG-345.1(b)	In General Note (a), table cross-references revised
29	HG-346.1	In definition of <i>S</i> , table cross-references revised
31	HG-360.3	In subpara. (e)(6), table cross-references revised
33	Part HG, Article 4	Requirements restructured and relocated to Article 4A and Section XIII
34	Part HG, Article 4A	Added
37	HG-501.1	Subparagraphs (a) and (b) revised
41	HG-511	Subparagraph (h) revised
41	HG-512	Title, first sentence, and subpara. (a) revised
42	HG-515.3	Subparagraph (a) revised
44	HG-530.1	(1) Subparagraphs (a)(3) and (a)(4) revised (2) Subparagraph (b) revised in its entirety
44	Figure HG-530.2	General Note revised
45	Figure HG-530.3	General Note revised
45	HG-530.2	Subparagraphs (c)(3) and (f) revised
47	Figure HG-530.7	Title revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
47	Figure HG-530.8	Title revised
47	HG-530.3	Subparagraphs (a) and (b) revised
48	HG-531	Subparagraph (c) added and subsequent subparagraphs redesignated
49	HG-532.3	Title and first sentence revised
49	HG-533.1	First sentence revised
49	HG-533.7	First and second sentences revised
49	HG-540.1	Revised
53	HG-611	Subparagraphs (b) and (c)(2) revised
56	HG-701Part HG, Article 7	Title and HG-701.1, HG-701.2, and HG-701.4 through HG-701.7 revised
58	Figure HG-703.1(a)	Revised
59	Figure HG-703.1(b)	Revised
57	HG-703.2	Subparagraph (c) revised
57	HG-705	Subparagraphs (a) and (b) revised
61	HG-709.3	Second sentence revised
62	Table HG-715	First column heading and Note (1) revised
62	HG-716	Subparagraphs (a)(2)(-a), (a)(3)(-a), and (b)(4) revised
63	HG-725.6	In last sentence, table cross-reference revised
66	HF-201	Table cross-references revised throughout
66	HF-202	In last sentence, table cross-references revised
67	HF-204	Table cross-references revised
67	HF-204.1	In subparas. (b) and (c), table cross-references revised
69	HF-207	In first paragraph, last sentence added
70	HF-300	Table cross-references revised
70	Table HF-300.1	Deleted
70	Table HF-300.1M	Deleted
71	Table HF-300.2	Deleted
71	Table HF-300.2M	Deleted
70	HF-301.1	Subparagraphs (b), (c)(1), and (c)(2) revised
70	HF-302	Table cross-references revised
73	HW-500	In first sentence, table cross-references revised
76	HW-703	Table cross-references revised
80	Table HW-713	Note (2) added
90	HW-812	In subpara. (a), first column of in-text table editorially revised
91	HW-820.8	Subparagraph (a)(5) revised
95	HB-1100	In first sentence, table cross-references revised
103	Figure HC-204.1	Editorially revised
119	HA-300	In subparas. (a) and (b), table cross-references revised
121	HA-407	First sentence and subpara. (h) revised
124	HA-502.12.2	In subpara. (c), table cross-references revised
126	Part HLW, Introduction	(1) In last sentence of Article 3, table cross-references revised (2) Article 8 revised
128	HLW-100	Subparagraph (b) revised
130	HLW-200	Titles of subparas. (a) through (f), (i), and (j) editorially revised
131	HLW-201	(1) In subpara. (a), table cross-references revised (2) Subparagraphs (a)(1) and (a)(2) deleted
132	HLW-203	In subpara. (b), table cross-references revised
132	HLW-205	Table cross-references revised
133	HLW-300	In subparas. (b) and (g), table cross-references revised
133	Table HLW-300	Deleted
133	HLW-301	(1) Table cross-references revised throughout (2) First sentence of last paragraph editorially revised
133	Table HLW-301	Deleted

Page	Location	Change
134	HLW-303	In definition of <i>S</i> , table cross-references revised
134	HLW-305.1	In definition of <i>S</i> , table cross-references revised
137	Table HLW-401.3-1	First column editorially revised
152	HLW-505.1	Revised in its entirety
152	HLW-505.2	Revised
153	HLW-600.1	First sentence revised
154	HLW-602	(1) HLW-602.1, HLW-602.3, and HLW-602.4 revised (2) HLW-602.5 deleted
156	HLW-701.1	First paragraph corrected by errata
157	HLW-800	Title revised
157	HLW-800.1	Revised in its entirety
157	HLW-801	Title and HLW-801.1, HLW-801.2, HLW-801.3, HLW-801.5, HLW-801.6, and HLW-801.7 revised
158	HLW-805	HLW-805.1 and HLW-805.2 revised
158	HLW-809.1	Second sentence revised
160	Table HLW-809.1	General Note (a) revised
158	HLW-810	(1) Subparagraph (a) editorially revised (2) Subparagraph (c) added
162	HLW-903	Revised
164	Table 2-100	References updated
165	3-100	Revised in its entirety
165	3-101	Subparagraph (c)(3) revised
167	Table 4-1	Instructions (25) and (75) revised
170	Form H-2	On front page, “safety valve” revised to “pressure relief valve”
172	Form H-3	On front and back pages, “safety valve” revised to “pressure relief valve”
174	Form H-4	On back page, “safety valve” revised to “pressure relief valve” throughout
176	Form H-5	On back page, “Witness of test(s)” revised to “Certified Individual”
178	Form H-5A	On back page, “Witness of test(s)” revised to “Certified Individual”
181	Form HC-1	Editorially revised
182	Form HC-2	Editorially revised
183	Form HC-3	Editorially revised
184	Form HA-1	Editorially revised
185	Form HA-2	Editorially revised
186	Form HA-3	Editorially revised
187	Form HLW-6	Line 10, Certificate of Shop Compliance, and Certification of Shop Inspection revised
193	5-600	Subparagraph (c) revised
203	10-100	Cross-reference to “Section VIII, Division I” corrected to “Section VIII, Division 1”
203	10-300	Cross-references revised throughout
204	A-100	Cross-references revised throughout
204	Table A-100	General Notes (a), (b), and (c) revised
205	Nonmandatory Appendix B	“Safety valve” and “safety relief valve” revised to “pressure relief valve” throughout
212	E-100	(1) Definitions of <i>action, popping, or pop; blowdown; pressure, accumulation test; rated, officially; valve, safety, lift of; and valve, temperature and pressure safety relief</i> deleted (2) Definitions of <i>surface, heating, square feet of; valve, safety; and valve, safety relief</i> revised (3) Definitions of <i>valve, pressure relief</i> and <i>valve, temperature and pressure relief</i> added
213	E-101	In definition of <i>joint efficiency</i> , table cross-references revised
216	F-100.1	First and second paragraphs revised
217	F-202.11	Former F-202.11 deleted and former F-202.12 redesignated as F-202.11

<i>Page</i>	<i>Location</i>	<i>Change</i>
219	Nonmandatory Appendix K	(1) Item (1) revised (2) Under item (3), Certification Mark with HV Designator deleted
225	Nonmandatory Appendix N	Information relocated to Section XIII, Nonmandatory Appendix C
226	Nonmandatory Appendix P	Added

NOTE: Throughout Section IV, the words “mark,” “marked,” and “marking” have replaced “stamp,” “stamped,” and “stamping,” respectively, in references to the marking of the nameplate or the application of the Certification Mark.

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).

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PART HG

GENERAL REQUIREMENTS FOR ALL MATERIALS OF CONSTRUCTION

ARTICLE 1

SCOPE AND SERVICE RESTRICTIONS

(21) HG-100 SCOPE

(a) The rules of [Part HG](#) apply to steam heating boilers, hot water heating boilers, hot water supply boilers, and to appurtenances thereto. They shall be used in conjunction with the specific requirements in [Part HF](#) (boilers of wrought materials), [Part HC](#) (cast iron boilers), and [Part HA](#) (cast aluminum boilers), as applicable. The Foreword provides the basis for these rules. [Part HG](#) is not intended to apply to potable water heaters except as provided for in [Part HLW](#). Boilers with economizers shall follow the rules of Mandatory [Appendix 10](#).

(b) This Part contains mandatory requirements, specific prohibitions, and nonmandatory guidance for materials, designs, fabrication, examination, inspection, testing, certification, and overpressure protection. When detailed rules are not given in Section IV, the Manufacturer, subject to the acceptance of the Authorized Inspector, shall provide details of design that will be as safe as those provided by the rules of Section IV. This may be done by appropriate analytical methods, the appropriate use of rules from other design Codes or, as permitted in [HG-500](#), by proof test.

(c) The Manufacturer shall establish the effective Code edition, addenda, and cases in accordance with Mandatory [Appendix 9](#). Laws or regulations issued by a municipality, state, provincial, federal, or other enforcement or regulatory body having jurisdiction at the location of an installation, establish the mandatory applicability of these rules, in whole or in part.

HG-101 SERVICE RESTRICTIONS

HG-101.1 Service Restrictions. The rules of this Section are restricted to the following services:

(a) steam boilers for operation at pressures not exceeding 15 psi (100 kPa)

(b) hot water heating boilers and hot water supply boilers for operation at pressures not exceeding 160 psi (1 100 kPa)

(c) hot water heating boilers and hot water supply boilers for operation at temperatures not exceeding 250°F (120°C), at or near the boiler outlet, except that when some of the wrought materials permitted by [Part HF](#) are used, a lower temperature is specified

HG-101.2 Services in Excess of Those Covered by This Section. For services exceeding the limits specified in [HG-101.1](#), the rules of Section I shall apply.

HG-102 UNITS

Either U.S. Customary, SI, or any local customary units may be used to demonstrate compliance with all requirements of this edition (e.g., materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection).

In general, it is expected that a single system of units shall be used for all aspects of design except where unfeasible or impractical. When components are manufactured at different locations where local customary units are different than those used for the general design, the local units may be used for the design and documentation of that component. Similarly, for proprietary components or those uniquely associated with a system of units different than that used for the general design, the alternate units may be used for the design and documentation of that component.

For any single equation, all variables shall be expressed in a single system of units. When separate equations are provided for U.S. Customary and SI units, those equations must be executed using variables in the units associated with the specific equation. Data expressed in other units shall be converted to U.S. Customary or SI units for use in these equations. The result obtained from execution of these equations may be converted to other units.