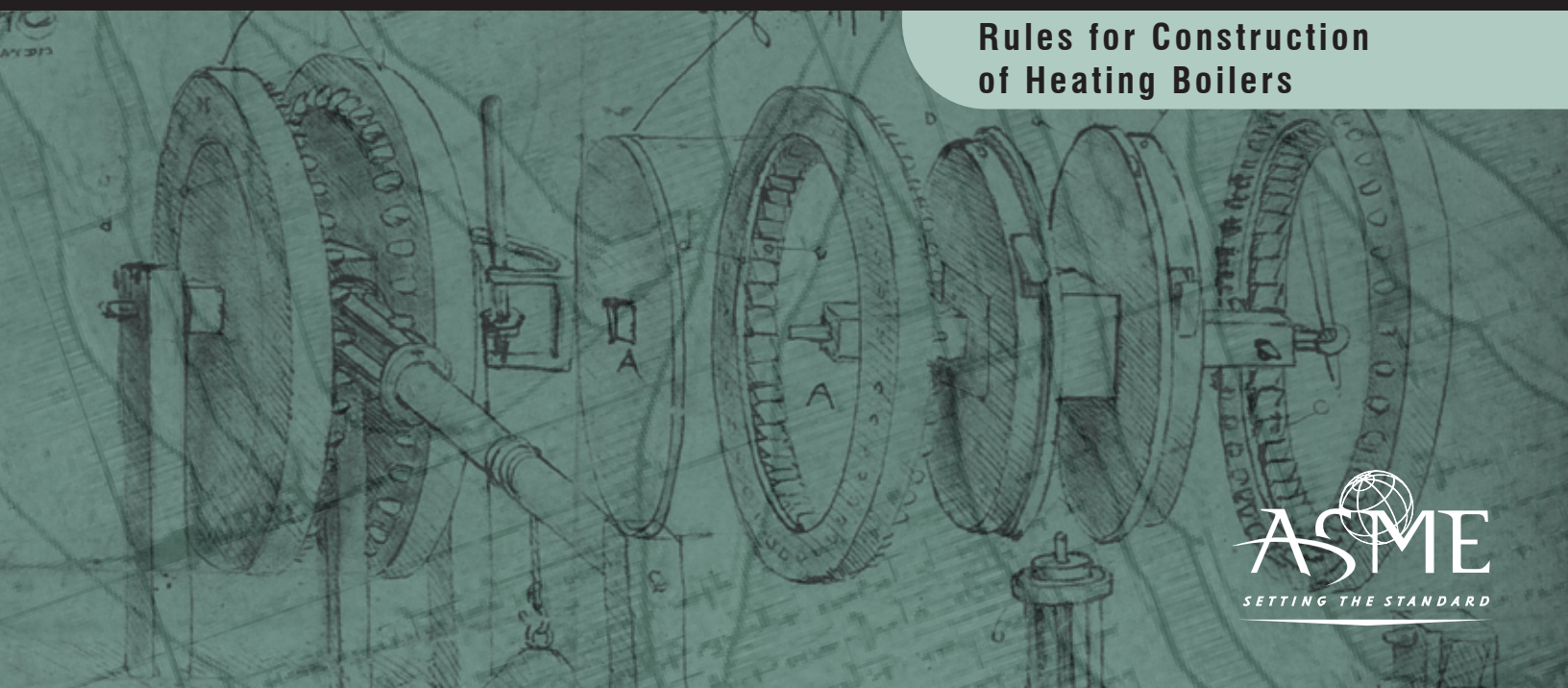
ASME BPVC.IV-2017

SECTION IV

2017 ASME Boiler and Pressure Vessel Code

An International Code

Rules for Construction of Heating Boilers



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AN INTERNATIONAL CODE

2017 ASME Boiler & Pressure Vessel Code

2017 Edition July 1, 2017

IV

RULES FOR CONSTRUCTION OF HEATING BOILERS

ASME Boiler and Pressure Vessel Committee
on Heating Boilers

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2017

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

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

INTERPRETATIONS

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

CODE CASES

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

FOREWORD[*]

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

(a) Committee on Power Boilers (I)

(b) Committee on Materials (II)

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

(d) Committee on Heating Boilers (IV)

(e) Committee on Nondestructive Examination (V)

(f) Committee on Pressure Vessels (VIII)

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

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

(i) Committee on Nuclear Inservice Inspection (XI)

(j) Committee on Transport Tanks (XII)

(k) Technical Oversight Management Committee (TOMC)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 INTRODUCTION

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

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

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

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

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

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

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

(3) Code Interpretations

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

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

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

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

2 INQUIRY FORMAT

Submittals to the Committee should include the following information:

(a) Purpose. Specify one of the following:

(1) request for revision of present Code requirements

(2) request for new or additional Code requirements

(3) request for Code Case

(4) request for Code Interpretation

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

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

3 CODE REVISIONS OR ADDITIONS

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

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

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

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

4 CODE CASES

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

5 CODE INTERPRETATIONS

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

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

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

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

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

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

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

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

(3) a request seeking the rationale for Code requirements

6 SUBMITTALS

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

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

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

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

(17)

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January 1, 2017

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

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

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

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

Page	*Location*	*Change (Record Number)*
xii	List of Sections	Updated
xvii	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Revised in its entirety *(13-2222)*
xx	Personnel	Updated
1	HG-100	*(1)* In subpara. (a), last sentence added *(11-1347)* *(2)* Subparagraph (b) revised *(15-215)*
3	HG-200.7	In second sentence, table references revised *(15-186)*
4	HG-301.1	In definition for *S*, table references revised *(15-186)*
4	HG-305.1	In definition for *S*, table references revised *(15-186)*
5	HG-307.1	In definition for *S*, table references revised *(15-186)*
6	Figure HG-307	In illustrations (a) and (c), callouts revised *(15-2276)*
7	HG-307.2	In subpara. (a), reference to B16.5 revised *(16-2677)*
9	HG-309	In definition for *S*, table references revised (inadvertently omitted from 15-186)
9	HG-309.1	*(1)* In subpara. (a)(3), reference to B16.5 revised *(16-2677)* *(2)* In subpara. (b) Note, reference to B16.5 revised *(16-2677)*
21	HG-330.6	Added *(16-2067)*
21	HG-340.1	In definition for *S*, table references revised *(15-186)*
23	HG-340.6	Revised *(16-1368)*
26	HG-346.1	In definition for *S*, table references revised *(15-186)*
27	Figure HG-345.1(a)	In General Note (a), table reference revised *(15-186)*
28	Figure HG-345.1(b)	In General Note (a), table reference revised *(15-186)*
31	HG-360.3	In subpara. (e)(6), table reference revised *(15-186)*
31	HG-370.2	In subparas. (a) and (b), reference to B16.5 revised *(16-2677)*
34	HG-401.3	Subparagraph (c)(4) revised *(14-653)*
35	HG-402.2	Subparagraphs (a)(1) and (a)(2) revised *(12-1931)*
35	HG-402.3	In subpara. (a), second paragraph revised *(13-729)*

Page	*Location*	*Change (Record Number)*
37	HG-402.8	Subparagraph (a) revised *(12-1931)*
41	HG-511	Subparagraph (j) revised *(15-2550)*
44	HG-530	*(1)* Revised *(11-1347, 14-2139, 15-2439)* *(2)* In HG-530.2, subparas. (b)(3) through (b)(5) added *(14-2139, 15-2439)* *(3)* HG-530.3 added *(16-2067)*
48	HG-531	Subparagraph (a)(1) revised *(14-2139)*
49	HG-540	*(1)* HG-540.2 through HG-540.8 revised *(12-1931)* *(2)* In HG-540.4(b), second reference to “Article 5” corrected by errata to “Part HA” *(15-2425)*
53	HG-607	Subparagraph (c) added *(16-2067)*
53	HG-613	Subparagraph (a) revised *(11-223)*
54	HG-615	Subparagraph (c) added *(16-2067)*
56	HG-701.1	Last sentence revised *(14-189)*
57	Figure HG-703.1(a)	Revised *(15-1679)*
58	Figure HG-703.1(b)	Revised *(15-1679)*
59	Figure HG-703.2	Revised *(15-1679)*
61	HG-710	New HG-710.4 added and former HG-710.4 renumbered as HG-710.5 *(16-2067)*
62	HG-716	*(1)* Subparagraph (a)(1) revised *(16-2067)* *(2)* Subparagraph (b)(4) added *(16-2067)*
63	HG-725.6	In last sentence, table reference revised *(15-186)*
66	HF-201	In subparas. (a) and (b), table references revised *(15-186)*
66	HF-202	Table references revised *(15-186)*
67	HF-204	In HF-204, HF-204.1, and HF-204.3, table references revised *(15-186)*
70	HF-302	In title, table references revised *(15-186)*
71	Table HF-300.1	*(1)* For Plate Steels Carbon Steels, SA/EN 10025-2 added by errata *(15-2425)* *(2)* For Pipes and Tubes Electric Resistance Welded Carbon Steel, SA/EN 10217-1 added by errata *(15-2425)* *(3)* For Plate Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(4)* For Plate Alloy Steel, SA/EN 10088-2 added by errata *(15-2425)* *(5)* For Tube Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(6)* For Tube Alloy Steel, Grade “S44735” changed to “S44700” *(16-2745)* *(7)* For Pipe Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(8)* Notes (25) and (26) added *(12-1703)* *(9)* Notes (27) through (29) added by errata *(15-2425)*

Page	*Location*	*Change (Record Number)*
78	Table HF-300.1M	*(1)* For Plate Steels Carbon Steels, SA/EN 10025-2 added by errata *(15-2425)* *(2)* For Pipes and Tubes Electric Resistance Welded Carbon Steel, SA/EN 10217-1 added by errata *(15-2425)* *(3)* For Plate Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(4)* References to Notes (15) and (16) deleted *(15-2433)* *(5)* For Plate Alloy Steel, SA/EN 10088-2 added by errata *(15-2425)* *(6)* For Tube Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(7)* For Tube Alloy Steel, Grade "S44735" changed to "S44700" *(16-2745)* *(8)* For Pipe Alloy Steel, S31803 and S32101 added *(12-1702, 12-1703)* *(9)* Notes (26) and (27) added *(12-1703)* *(10)* Notes (28) through (30) added by errata *(15-2425)*
86	Table HF-300.2	*(1)* For Aluminum, SB-221 A96061, Product Form corrected to "Extruded bar, rod and shapes" by errata *(15-2425)* *(2)* For Aluminum, SB-221 A96063 added *(12-631, 12-632)* *(3)* For Aluminum, SB-241 A91100 and A96063 added *(11-1744, 12-633)* *(4)* Subheading "Casting, Bronze, Brass, and Aluminum" changed to "Casting, Aluminum" *(12-1555)* *(5)* For Casting, Aluminum SB/EN 1706, Alloy Designation UNS No. changed to AC43000 and Maximum Allowable Stress Values revised *(15-1055)* *(6)* For Casting, Aluminum, EN AC-43000 line deleted *(14-1579)* *(7)* For Casting, Aluminum, SB/EN 1706 AC44300 line added *(12-1555)* *(8)* Note (11) added and following note renumbered *(12-1555)*
91	Table HF-300.2M	*(1)* For Aluminum, SB-221 A96061, Product Form editorially corrected to "Extruded bar, rod and shapes" *(2)* For Aluminum, SB-221 A96063 lines added *(12-631, 12-632)* *(3)* For Aluminum, SB-241 A91100 and A96063 line added *(11-1744, 12-633)* *(4)* Subheading "Casting, Bronze, Brass, and Aluminum" changed to "Casting, Aluminum" *(12-1555)* *(5)* For Casting, Aluminum SB/EN 1706, Alloy Designation UNS No. changed to AC43000 *(15-1055)* *(6)* For Casting, Aluminum, EN AC-43000 line deleted *(14-1579)* *(7)* For Casting, Aluminum, SB/EN 1706 AC44300 line added *(12-1555)* *(8)* Note (14) added and following note renumbered *(12-1555)*
97	HW-500	In first paragraph, table references revised *(15-186)*
100	HW-703	Table references revised *(15-186)*
100	HW-710	*(1)* Revised *(14-2219, 15-2436)* *(2)* HW-710.5 deleted *(15-2436)*
106	Figure HW-731	In illustration (w-3), callout revised *(15-25)*
108	HW-731.7	In subpara. (c), last sentence added *(15-25)*
118	HB-1100	Table references revised *(15-186)*

Page	*Location*	*Change (Record Number)*
130	HC-310.1	Reference to B16.1 revised *(16-2677)*
136	HC-501.1	First paragraph revised *(12-1931)*
137	HC-502.10	Revised *(15-2476)*
137	HC-502.12	*(1)* Revised *(12-1931, 15-2551)* *(2)* HC-502.12.1 revised *(12-1931, 15-2551)* *(3)* In HC-502.12.2, new subpara. (e) added and subsequent subparagraphs redesignated *(12-1931, 15-2551)*
137	HC-520	*(1)* New subpara. (c) added and subsequent subparagraphs redesignated *(15-2551)* *(2)* Former subparas. (c) and (d) revised *(15-2551)*
142	HA-300	In subpara. (a), table reference revised *(15-186)*
144	HA-407	Revised in its entirety *(15-2550)*
145	HA-501.1	First paragraph revised *(12-1931)*
146	HA-502.10	Revised; HA-502.10.1 and HA-502.10.2 added *(15-2476)*
146	HA-502.12	*(1)* HA-502.12.1 revised *(12-1931, 15-2551)* *(2)* In HA-502.12.2(a), reference to "HA-402" corrected by errata to "HA-404" *(15-2425)*
146	HA-504	*(1)* Subparagraph (c) added and subsequent subparagraphs redesignated *(15-2551*) *(2)* Former subparas. (d) and (e) revised *(15-2551)*
148	Introduction (Part HLW)	Second and fourth paragraphs revised *(15-223)*
150	HLW-100	In subpara. (a), last sentence revised *(15-223)*
150	HLW-101	Revised *(15-223)*
154	HLW-203	In subpara. (b), table reference revised *(15-186)*
154	HLW-204	In subparas. (a) through (g), reference to B16 standards revised *(16-2677)*
154	HLW-205	Table references revised *(15-186)*
155	HLW-300	In subpara. (b), table reference revised *(15-186)*
156	Table HLW-300	For "SA-285 Modified to Chem.," entries to the right editorially deleted
158	Table HLW-301	*(1)* For Plate Alloy Steel, SA-240 S31803 added *(12-1702)* *(2)* For Tube Alloy Steel, SA-789 S31803 added *(12-1702)* *(3)* For Pipe Alloy Steel, SA-790 S31803 added *(12-1702)* *(4)* Last column heading revised *(16-2745)* *(5)* For Plate Alloy Steel, Tube Alloy Steel, and Bar Alloy Steel, Grade S44400 reference to "Note (1)" deleted *(16-2745)* *(6)* For Tube Alloy Steel SA-268, Grade S44735 changed to Grade S44700 *(16-2745)*
159	HLW-303	In definition for *S*, table references revised *(15-186)*
159	HLW-305.1	In definition for *S*, table references revised *(15-186)*
160	HLW-310.1	Last sentence added *(15-2822)*
162	HLW-401	HLW-401.3 and HLW-401.4 added *(14-1449)*
187	Table 2-100	Entry for CA-1 added *(12-1931)*

Page	*Location*	*Change (Record Number)*
192	Table 4-1	*(1)* Second line of table title editorially moved below table as General Note *(2)* Instructions for Reference (36) revised *(16-1107)*
195	Form H-2	Back of form revised *(16-1107)*
197	Form H-3	Revised *(11-1347, 16-1107)*
199	Form H-4	Revised *(16-1107, 16-2629)*
205	Form H-6	Revised *(16-1107)*
208	Form HC-3	Added *(15-2551)*
210	Form HA-2	Revised and title corrected by errata *(15-2425, 15-2550)*
211	Form HA-3	Added *(15-2551)*
212	Form HLW-6	Back of form revised *(16-1107)*
214	Form HLW-7	Back of form revised *(16-1107)*
216	Form HLW-8	Revised *(16-1107, 16-251)*
217	5-400	In subpara. (a), first sentence, "(Σ = 1)" corrected by errata to "(E = 1)" *(15-2425)*
220	Mandatory Appendix 7	All instances of "boiler(s)" replaced with "boiler(s) with the Certification Mark with the H designator" *(15-2441)*
227	Mandatory Appendix 10	Added *(11-1347)*
236	E-100	Definition of *boiler, modular* revised *(16-2067)*
237	E-101	In definition for *joint efficiency*, table references revised *(15-186)*
243	Nonmandatory Appendix K	Table editorially revised
245	Figure K-1	Updated by ASME Conformity Assessment

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
11-223	Revised HG-613(a).
11-1347	Added new Mandatory Appendix for the Requirements for Feedwater Economizers; revised HG-100 scope to include economizers; and revised the H3 Data Report to include economizers.
11-1744	Incorporated the material requirements of Code Case 2501-1 for 6063-O aluminum into Tables HF-300.2 and HF-300.2M.
12-631	Incorporated Code Case 2502 by adding the alloy 6063-T5 into Tables HF-300.2 and HF-300.2M.
12-632	Incorporated Code Case 2573 by adding alloy A96063-T6 to Tables HF-300.2 and HF-300.2M.
12-633	Added A91100-O to Tables HF-300.2 and HF-300.2M.
12-1555	Added Aluminum Alloy EN AC-AlSi12(Fe), AC44300, to Tables HF-300.2 and HF-300.2M.
12-1702	Revised Table HF-300.1 and HF-300.1M to add various product forms of UNS S31803.
12-1703	Incorporated allowable stress values for UNS S32101 into Tables HF-300.1 and HF-300.1M.
12-1931	The ASME CA-1 Standard is adopted to establish uniform requirements for conformity assessment. As part of this revision, the latest edition of CA-1 is referenced in Mandatory Appendix 2.
13-729	Added the requirement of the maximum coefficient of 0.878 (0.9 × 0.975) to HG-402.3(a).
13-2222	Revised the front guidance on interpretations in its entirety.
14-189	Updated HG-701.1 to change text from “inlet area of the valve” to “nominal inside area of a Schedule 80 pipe (as defined by ASME B36.10M) of the same nominal pipe size as the inlet of the valve.”
14-653	The proposal file contains an update to HG-401.3(c)(4) to clarify actions that need to be taken within the 60-day period following a failure of replacement valves.
14-1449	Added new paragraphs, HLW-401.3 (Alignment Tolerance) and HLW-401.4 (Distortion), to address alignment of butt-weld joints and out-of-roundness conditions in potable water heaters and storage tanks.
14-1579	Revised the alloy designation, for Tables HF-300.2 and HF-300.2M, to AC43000 and removed the alloy designation AC-43000 from the Spec No. column.
14-2139	Revised titles of HG-530 and HG-530.1; added surface condition requirements to HG-530.1(b); and added quality control and surface condition requirements to HG-530.1(a) and HG-530.1(b).
14-2219	Revised HW-710.2 to clarify limit of projection on welded stays.
15-25	Revised external fillet weld size in Figure HW-731 sketch (w-3) to t_c and added that size requirement to HW-731.7(c).
15-186	Revised all the location references for S as the maximum allowable stress to be found in Table HF-300.1 (HF-300.1M) or HF-300.2 (HF-300.2M).
15-215	Per issue intent interpretation, revised HG-100(b) to permit the Manufacturer to use alternative design details when the Code does not contain rules that address a particular construction feature.
15-223	Revised HLW-101 into subparas. (a) and (b) to clarify which vessels are covered and which are exempt from the rules of Part HLW.
15-1055	Corrected allowable stress values in Table HF-300.2.
15-1679	Figure HG-703.1(a): replaced wording “F&T trap high level spill” with wording “Steam trap (Optional).” Figure HG-703.1(b): deleted “F&T trap.” Figure HG-703.2: inserted the word “Temperature” between the words “High” and “Limit” in two places where the limit controls are shown. Replaced wording “Maximum temperature limit control” with “Operating Temperature Limit Control” in two places on the second limit.
15-2276	Revised nomenclature in Figure HG-307.1 by correcting the symbol by replacing “*L*” with “*l*” lowercase to avoid confusion with other variables; revised Figure HG-307(c) by replacing “Center of weld” with “Center of lap.”
15-2425	Errata correction. See Summary of Changes for details.

Record Number	Change
15-2433	Revised Table HF-300.1.M as follows: *(a)* deleted all references to notes (15) and (16) *(b)* deleted text from notes (15) and (16) and replaced with "Deleted"
15-2436	Rewrote HW-710.1 through HW-710.4 and deleted HW-710.5.
15-2439	Added aluminum; replaced "stamping" with "annealing" in HG-530; added laser annealing in HG-530.1(b) and HG-530.1(b)(1); added HG-530.1(b)(3) stating that laser annealing is allowed only on stainless steels in HG-530.1. Note: HG-530.1(b) already requires that the mark is permanent and legible; added HG-530.1(b)(4) stating that no coating that obscures the marking shall be allowed.
15-2441	Added the wording "with the Certification Mark with the H designator" to 7-100 through 7-500.
15-2476	Revised HC-502.10 and HA-502.10 to provide for methods, other than written signatures, to indicate certification, authorization, or approval of documents.
15-2550	Added coverage for pneumatic testing in HA-407; removed reference to HG-511 in HA-407; removed reference to HA-407 in HG-511(j); and revised Form HA-2 so it covers both hydrostatic and pneumatic testing.
15-2551	Added new subpara. (e) to HC-502.12.2 and HA-502.12.2, which covers the ASME nameplate application oversight duties of the Certified Individual. The existing subpara. (e) becomes subpara. (f). Added new subpara. (c) to HC-520 and HA-407, which covers filling out the Certificate of Conformance that documents the application of the ASME nameplate. Added Forms HC-3 and HA-3 to document the application of the ASME nameplates. Expanded the text to make it clear that a shop assembler is required to have a CI if they are applying for the ASME nameplate.
15-2822	Added additional material requirement to the end of HLW-310.1.
16-251	Revised line 8 of Form HLW-8 by replacing (81) with (61).
16-1107	Revised MDRs shown on proposal file to reflect change of "National Board Commission Number and Endorsement" to "National Board Authorized Inspector Commission Number."
16-1368	Revised HG-340.6 by deleting "in inches" from first sentence.
16-2067	In order to clarify the rules for certification of modular boilers in a single data report and under one code nameplate covering the entire assembly, as well as clarify the related requirements for inspection openings and accessibility to nameplate stamping, revised the definition of modular boiler and incorporated new requirements under new paras. HG-330.6; HG-530.3; HG-607(c); HG-615(c); HG-710.4; and HG-716(b)(4). In addition, the current limit of 400,000 Btu/hr limit per module was deleted from HG-716.
16-2629	Revised Form H-4 by replacing all the incorrect referenced circled numbers.
16-2677	Revised HG-307.2 by replacing "ANSI B16.5" with "ASME B16.5"; revised HG-309.1(a)(3) by replacing "ANSI B16.5" with "ASME B16.5"; revised the Note following HG-309.1(b)(2)(-b) by replacing "ANSI B16.5" with "ASME B16.5"; revised HG-370.2(a) and (b) by replacing "ANSI B16.5" with "ASME B16.5"; revised HC-310.1 by replacing "ANSI B16.1" with "ASME B16.1"; and revised HLW-204 by replacing "ANSI" with "ASME" for B16.5, B16.9, B16.11, B16.15, B16.24, B16.28, and B16.42.
16-2745	Corrected errors in Tables HF-300.1, HF-300.1M, and HLW-301. In all three tables, the Grade UNS number S44735 was corrected to S44700. In Table HLW-301, paragraph reference in the last column heading was corrected from HLW-303 to HLW-301.

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

(17)

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 whichever is 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 pressure relief. 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.