

**SECTION III**  
Rules for Construction of  
Nuclear Facility Components

2023 ASME Boiler and  
Pressure Vessel Code  
An International Code

**Division 5**  
High Temperature Reactors

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AN INTERNATIONAL CODE

# 2023 ASME Boiler & Pressure Vessel Code

2023 Edition

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## RULES FOR CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS

### Division 5

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## High Temperature Reactors

ASME Boiler and Pressure Vessel Committee  
on Construction of Nuclear Facility Components



The American Society of  
Mechanical Engineers

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# 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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees: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. For nuclear items other than pressure-retaining components, the Committee also establishes rules of safety related to structural integrity. 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 and, for nuclear items other than pressure-retaining components, structural 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 components addressed by the Code. 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

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\* 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.

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 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.

# PERSONNEL

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January 1, 2023

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D. Cheetham, *Contributing Member*  
A. J. Spencer, *Honorary Member*

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M. Wilson, *Alternate*  
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# CORRESPONDENCE WITH THE COMMITTEE

(23)

## General

ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Section of the ASME Boiler and Pressure Vessel Code (BPVC) should be sent to the staff secretary noted on the Section's committee web page, accessible at <https://go.asme.org/CSCcommittees>.

NOTE: See ASME BPVC Section II, Part D for guidelines on requesting approval of new materials. See Section II, Part C for guidelines on requesting approval of new welding and brazing materials ("consumables").

## Revisions and Errata

The committee processes revisions to this Code on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Code. Approved revisions will be published in the next edition of the Code.

In addition, the committee may post errata and Special Notices at <http://go.asme.org/BPVCerrata>. Errata and Special Notices become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata and Special Notices.

This Code is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

## Cases

(a) The most common applications for cases are

(1) to permit early implementation of a revision based on an urgent need

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Code

(4) to permit use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases 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.

(c) The committee will consider proposed cases concerning the following topics only:

(1) equipment to be marked with the ASME Single Certification Mark, or

(2) equipment to be constructed as a repair/replacement activity under the requirements of Section XI

(d) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Code Section and the paragraph, figure, or table number(s) to which the proposed case applies

(4) the edition(s) of the Code to which the proposed case applies

(e) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Cases that have been approved will appear in the next edition or supplement of the Code Cases books, "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 until the next edition of the 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. The status of any case is available at <http://go.asme.org/BPVCCDatabase>. An index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases is available at <http://go.asme.org/BPVCC>.

## **Interpretations**

*(a)* Interpretations clarify existing Code requirements and are written as a question and reply. Interpretations do not introduce new requirements. If a revision to resolve conflicting or incorrect wording is required to support the interpretation, the committee will issue an intent interpretation in parallel with a revision to the Code.

*(b)* Upon request, the committee will render an interpretation of any requirement of the Code. An interpretation can be rendered only in response to a request submitted through the online Interpretation Submittal Form at <http://go.asme.org/InterpretationRequest>. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

*(c)* ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers may track the status of their requests at <http://go.asme.org/Interpretations>.

*(d)* ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee or subcommittee. ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

*(e)* Interpretations are published in the ASME Interpretations Database at <http://go.asme.org/Interpretations> as they are issued.

## **Committee Meetings**

The ASME BPVC committees regularly hold meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the applicable committee. Information on future committee meetings can be found at <http://go.asme.org/BCW>.

# ORGANIZATION OF SECTION III

(23)

## 1 GENERAL

Section III consists of Division 1, Division 2, Division 3, Division 4, and Division 5. These Divisions are broken down into Subsections and are designated by capital letters preceded by the letter “N” for Division 1, by the letter “C” for Division 2, by the letter “W” for Division 3, by the letter “F” for Division 4, and by the letter “H” for Division 5. Each Subsection is published separately, with the exception of those listed for Divisions 2, 3, 4, and 5.

- Subsection NCA — General Requirements for Division 1 and Division 2
- Appendices
- Division 1
  - Subsection NB — Class 1 Components
  - Subsection NCD — Class 2 and Class 3 Components
  - Subsection NE — Class MC Components
  - Subsection NF — Supports
  - Subsection NG — Core Support Structures
- Division 2 — Code for Concrete Containments
  - Subsection CC — Concrete Containments
- Division 3 — Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
  - Subsection WA — General Requirements for Division 3
  - Subsection WB — Class TC Transportation Containments
  - Subsection WC — Class SC Storage Containments
  - Subsection WD — Class ISS Internal Support Structures
- Division 4 — Fusion Energy Devices
  - Subsection FA — Fusion Energy Device Facilities
  - Subsection FB — Pressure Boundary Components
- Division 5 — High Temperature Reactors
  - Subsection HA — General Requirements
    - Subpart A — Metallic Materials
    - Subpart B — Graphite Materials
    - Subpart C — Composite Materials
  - Subsection HB — Class A Metallic Pressure Boundary Components
    - Subpart A — Low Temperature Service
    - Subpart B — Elevated Temperature Service
  - Subsection HC — Class B Metallic Pressure Boundary Components
    - Subpart A — Low Temperature Service
    - Subpart B — Elevated Temperature Service
  - Subsection HF — Class A and B Metallic Supports
    - Subpart A — Low Temperature Service
  - Subsection HG — Class SM Metallic Core Support Structures
    - Subpart A — Low Temperature Service
    - Subpart B — Elevated Temperature Service
  - Subsection HH — Class SN Nonmetallic Core Components
    - Subpart A — Graphite Materials
    - Subpart B — Composite Materials

## 2 SUBSECTIONS

Subsections are divided into Articles, subarticles, paragraphs, and, where necessary, subparagraphs and subsubparagraphs.

### 3 ARTICLES

Articles are designated by the applicable letters indicated above for the Subsections followed by Arabic numbers, such as NB-1000. Where possible, Articles dealing with the same topics are given the same number in each Subsection, except NCA, in accordance with the following general scheme:

Article Number	Title
1000	Introduction or Scope
2000	Material
3000	Design
4000	Fabrication and Installation
5000	Examination
6000	Testing
7000	Overpressure Protection
8000	Nameplates, Stamping With Certification Mark, and Reports

The numbering of Articles and the material contained in the Articles may not, however, be consecutive. Due to the fact that the complete outline may cover phases not applicable to a particular Subsection or Article, the rules have been prepared with some gaps in the numbering.

### 4 SUBARTICLES

Subarticles are numbered in units of 100, such as NB-1100.

### 5 SUBSUBARTICLES

Subsubarticles are numbered in units of 10, such as NB-2130, and generally have no text. When a number such as NB-1110 is followed by text, it is considered a paragraph.

### 6 PARAGRAPHS

Paragraphs are numbered in units of 1, such as NB-2121.

### 7 SUBPARAGRAPHS

Subparagraphs, when they are *major* subdivisions of a paragraph, are designated by adding a decimal followed by one or more digits to the paragraph number, such as NB-1132.1. When they are *minor* subdivisions of a paragraph, subparagraphs may be designated by lowercase letters in parentheses, such as NB-2121(a).

### 8 SUBSUBPARAGRAPHS

Subsubparagraphs are designated by adding lowercase letters in parentheses to the *major* subparagraph numbers, such as NB-1132.1(a). When further subdivisions of *minor* subparagraphs are necessary, subsubparagraphs are designated by adding Arabic numerals in parentheses to the subparagraph designation, such as NB-2121(a)(1).

### 9 REFERENCES

References used within Section III generally fall into one of the following four categories:

(a) *References to Other Portions of Section III.* When a reference is made to another Article, subarticle, or paragraph, all numbers subsidiary to that reference shall be included. For example, reference to Article NB-3000 includes all material in Article NB-3000; reference to NB-3100 includes all material in subarticle NB-3100; reference to NB-3110 includes all paragraphs, NB-3111 through NB-3113.

(b) *References to Other Sections.* Other Sections referred to in Section III are the following:

(1) *Section II, Materials.* When a requirement for a material, or for the examination or testing of a material, is to be in accordance with a specification such as SA-105, SA-370, or SB-160, the reference is to material specifications in Section II. These references begin with the letter "S."

(2) *Section V, Nondestructive Examination.* Section V references begin with the letter “T” and relate to the nondestructive examination of material or welds.

(3) *Section IX, Welding and Brazing Qualifications.* Section IX references begin with the letter “Q” and relate to welding and brazing requirements.

(4) *Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components.* When a reference is made to inservice inspection, the rules of Section XI shall apply.

(c) *Reference to Specifications and Standards Other Than Published in Code Sections*

(1) Specifications for examination methods and acceptance standards to be used in connection with them are published by the American Society for Testing and Materials (ASTM). At the time of publication of Section III, some such specifications were not included in Section II of this Code. A reference to ASTM E94 refers to the specification so designated by and published by ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

(2) Dimensional standards covering products such as valves, flanges, and fittings are sponsored and published by The American Society of Mechanical Engineers and approved by the American National Standards Institute.\* When a product is to conform to such a standard, for example ASME B16.5, the standard is approved by the American National Standards Institute. The applicable year of issue is that suffixed to its numerical designation in Table NCA-7100-1, for example ASME B16.5-2003. Standards published by The American Society of Mechanical Engineers are available from ASME (<https://www.asme.org/>).

(3) Dimensional and other types of standards covering products such as valves, flanges, and fittings are also published by the Manufacturers Standardization Society of the Valve and Fittings Industry and are known as Standard Practices. When a product is required by these rules to conform to a Standard Practice, for example MSS SP-100, the Standard Practice referred to is published by the Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, NE, Vienna, VA 22180. The applicable year of issue of such a Standard Practice is that suffixed to its numerical designation in Table NCA-7100-1, for example MSS SP-58-2009.

(4) Specifications for welding and brazing materials are published by the American Welding Society (AWS), 8669 NW 36 Street, No. 130, Miami, FL 33166. Specifications of this type are incorporated in Section II and are identified by the AWS designation with the prefix “SF,” for example SFA-5.1.

(5) Standards applicable to the design and construction of tanks and flanges are published by the American Petroleum Institute and have designations such as API-605. When documents so designated are referred to in Section III, for example API-605-1988, they are standards published by the American Petroleum Institute and are listed in Table NCA-7100-1.

(d) *References to Appendices.* Section III uses two types of appendices that are designated as either Section III Appendices or Subsection Appendices. Either of these appendices is further designated as either Mandatory or Nonmandatory for use. Mandatory Appendices are referred to in the Section III rules and contain requirements that must be followed in construction. Nonmandatory Appendices provide additional information or guidance when using Section III.

(1) Section III Appendices are contained in a separate book titled “Appendices.” These appendices have the potential for multiple subsection applicability. Mandatory Appendices are designated by a Roman numeral followed, when appropriate, by Arabic numerals to indicate various articles, subarticles, and paragraphs of the appendix, such as II-1500 or XIII-1210. Nonmandatory Appendices are designated by a capital letter followed, when appropriate, by Arabic numerals to indicate various articles, subarticles, and paragraphs of the appendix, such as D-1200 or Y-1440.

(2) Subsection Appendices are specifically applicable to just one subsection and are contained within that subsection. Subsection-specific mandatory and nonmandatory appendices are numbered in the same manner as Section III Appendices, but with a subsection identifier (e.g., NF, NH, D2, etc.) preceding either the Roman numeral or the capital letter for a unique designation. For example, NF-II-1100 or NF-A-1200 would be part of a Subsection NF mandatory or nonmandatory appendix, respectively. For Subsection CC, D2-IV-1120 or D2-D-1330 would be part of a Subsection CC mandatory or nonmandatory appendix, respectively.

(3) It is the intent of this Section that the information provided in both Mandatory and Nonmandatory Appendices may be used to meet the rules of any Division or Subsection. In case of conflict between Appendix rules and Division/Subsection rules, the requirements contained in the Division/Subsection shall govern. Additional guidance on Appendix usage is provided in the front matter of Section III Appendices.

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\* The American National Standards Institute (ANSI) was formerly known as the American Standards Association. Standards approved by the Association were designated by the prefix “ASA” followed by the number of the standard and the year of publication. More recently, the American National Standards Institute was known as the United States of America Standards Institute. Standards were designated by the prefix “USAS” followed by the number of the standard and the year of publication. While the letters of the prefix have changed with the name of the organization, the numbers of the standards have remained unchanged.

## SUMMARY OF CHANGES

Changes listed below are identified on the pages by a margin note, **(23)**, placed next to the affected area. In addition, gender pronouns have been eliminated throughout this Division.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xxv	List of Sections	(1) Under Section III, Division 4 added (2) Title of Section XI and subtitle of Section XI, Division 2 revised (3) Information on interpretations and Code cases moved to “Correspondence With the Committee”
xxix	Personnel	Updated
li	Correspondence With the Committee	Added (replaces “Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees”)
liii	Organization of Section III	In para. 1, Division 4 added
lx	Cross-Referencing in the ASME BPVC	Updated
4	HAA-3300	Added
5	Table HAA-7100-1	Revised
11	HAB-1110	Subparagraph (b) revised
38	Table HAB-7100-1	Edition year for ISO/IEC 17025 revised
42	HAB-9200	(1) Definition of <i>EDN</i> deleted (2) Definition of <i>fluence</i> revised
46	Article HBA-2000	Added
53	HBB-2600	Added
73	Table HBB-3225-2	Last entry and Note (2) revised
75	Table HBB-3225-4A	Added
76	Table HBB-3225-4B	Former Table HBB-3225-4 redesignated
103	Table HBB-I-14.1(a)	(1) For “2 <sup>1</sup> / <sub>4</sub> Cr-1Mo,” SA-234, entry under “Types, Grades, or Classes” revised (2) For 9Cr-1Mo-V, all entries under “Types, Grades, or Classes” revised (3) Notes (1) and (6)(c) revised
104	Table HBB-I-14.1(b)	For 9Cr-1Mo-V, entries under “Class” revised
144	Table HBB-I-14.10E-1	Revised in its entirety
151	Figure HBB-II-3000-1	Editorially revised
152	Figure HBB-II-3000-2	Editorially revised
153	Figure HBB-II-3000-3	Editorially revised
161	Figure HBB-II-3000-11	Editorially revised
163	Figure HBB-II-3000-13	Editorially revised
164	Figure HBB-II-3000-14	Editorially revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
177	HBB-T-1410	(1) In HBB-T-1411, definition of $(n)_j$ revised (2) In HBB-T-1413, first paragraph and Step 2 revised (3) In HBB-T-1414, Step 4 revised
180	HBB-T-1420	In subpara. (a), paragraph added below equation
188	Figure HBB-T-1420-1E	(1) In Note (2), third equation, variables to the left of the equal sign corrected by errata to $N_{2S}$ (2) In Note (2) nomenclature, $N_{S2}$ corrected by errata to $N_{2S}$
205	Table HBB-T-1820-1	(1) In second column head, "Maximum" corrected by errata to "Minimum" (2) Under "Maximum Time," last entry revised
205	HBB-T-1831	In subpara. (c), nomenclature corrected by errata
226	HBB-T-1832	In subpara. (c), nomenclature corrected by errata
228	Table HBB-T-1832-3	Under D, second entry " $-4.499 \times 10^{-17}$ " corrected by errata to " $-4.499 \times 10^{17}$ "
236	Figure HBB-T-1832-6	Revised
263	HBB-T-1834	(1) In subpara. (c), equation for $\varepsilon_3, p_1$ corrected by errata to $p_2$ (2) In subpara. (c), equation for $a$ , operators corrected by errata
277	HBB-T-1835	In subpara. (c), $TT$ corrected by errata to $T$ in definition of $Q_0$
278	Table HBB-T-1835-2	Under $Y$ , ninth entry, "410" corrected by errata to "376"
279	Figure HBB-T-1835-1	Revised
280	Figure HBB-T-1835-2	Revised
281	Figure HBB-T-1835-3	Revised
282	Figure HBB-T-1835-4	Revised
283	Figure HBB-T-1835-5	Revised
284	Figure HBB-T-1835-6	Revised
285	Figure HBB-T-1835-7	Revised
286	Figure HBB-T-1835-8	Revised
287	Figure HBB-T-1835-9	Revised
288	Figure HBB-T-1835-10	Revised
289	Figure HBB-T-1835-11	Revised
299	Nonmandatory Appendix HBB-Z	Added
363	HGB-2121	In subpara. (a), cross-reference to Section II, Part D tables corrected by errata
367	HGB-3213	Endnote 40 revised
372	Table HGB-3217-1	Note (6) revised
389	Article HGB-I-1000	Subparagraph (d) revised
391	HGB-II-2121	In subpara. (a), cross-reference to Section II, Part D tables corrected by errata
401	HGB-II-3220	Revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
402	HGB-II-3222.4	(1) Endnote 46 revised (2) Cross-references to Subsection NG replaced by cross-references to Section III Appendices
404	HGB-II-3224	Revised
404	HGB-II-3224.1	Subparagraphs (a)(1), (a)(2), (b)(1), (b)(2), (b)(3), and (d) revised
405	HGB-II-3228.3	Revised
405	HGB-II-3229	First paragraph revised
405	HGB-II-3231	Subparagraph (b) revised
431	HHA-2230	First paragraph revised
434	HHA-3130	Revised
435	HHA-3140	Revised
435	HHA-3141	(1) Revised (2) Figure HHA-3141-1 moved to Article HHA-B-3000 and redesignated (3) Figure HHA-3141-2 deleted
436	HHA-3142	HHA-3142.1 and HHA-3142.2 revised
439	HHA-3215.2	Last line revised
439	HHA-3217	Subparagraphs (g)(2) and (g)(3) revised
444	HHA-3237	Revised
448	HHA-4110	Revised
449	HHA-4231	Revised
450	HHA-4241	Revised
450	HHA-4243	First line revised
450	HHA-4250	First paragraph revised
452	HHA-5110	Revised
452	HHA-5210	Subparagraph (f) revised
453	HHA-5400	Revised
453	HHA-5500	First paragraph revised
457	Article HHA-II-2000	(1) First paragraph revised (2) Forms MDS-1 and MDS-2 and Table HHA-II-2000-1 revised
462	Article HHA-II-3000	Revised in its entirety
470	HHA-III-3200	Revised
478	Article HHA-B-3000	Revised in its entirety
485	HHB-2111	In second paragraph, last line revised
486	HHB-2130	(1) Subparagraph (b) revised (2) Subparagraphs (c) and (d) added
486	HHB-2131	Subparagraphs (b) and (c) revised
487	HHB-2220	Subparagraph (c) revised
491	HHB-3130	Definition of $R_{tc}$ deleted

<i>Page</i>	<i>Location</i>	<i>Change</i>
491	HHB-3142.1	Revised
494	HHB-3215.2	Last line revised
494	HHB-3220	Third paragraph revised
494	HHB-3221	Revised
495	Figure HHB-3221-1	Revised
496	HHB-3226.1	Revised
496	HHB-3227	Title and first line revised
499	HHB-4310	First paragraph revised
500	HHB-4360	Revised
502	HHB-5310	Revised
504	HHB-6200	Revised
506	HHB-I-1111	Subparagraph (d) revised
508	Table HHB-I-1120-1	Items (13), (14), and (23) revised
512	Form MDS-3	On seventh page of form, entries below “Design Strength and Material Reliability Curve Values” revised
527	Form MDS-4	On seventh page of form, entries below “Design Strength and Material Reliability Curve Values” revised
542	Table HHB-II-2000-1	(1) Items (13), (14), and (23) revised (2) Item (27) deleted
545	HHB-II-3100	First sentence revised
545	HHB-II-3200	Third paragraph revised
546	HHB-II-3400	In eq. (4), “= $-m \cdot \ln(x) + m \cdot \ln(S_c)$ ” corrected by errata to “= $m \cdot \ln(x) - m \cdot \ln(S_c)$ ”
548	HHB-II-3600	In subpara. (a), first sentence revised
561	HHB-B-1200	Definition of <i>ceramic matrix composite (CMC)</i> revised
576	HHB-C-1100	Third sentence revised
579	HHB-C-1320	Fifth paragraph revised
587	Nonmandatory Appendix HBB-D	Added
594	Nonmandatory Appendix HHB-E	Added

## CROSS-REFERENCING IN THE ASME BPVC

Paragraphs within the ASME BPVC may include subparagraph breakdowns, i.e., nested lists. The following is a guide to the designation and cross-referencing of subparagraph breakdowns:

*(a) Hierarchy of Subparagraph Breakdowns*

- (1) First-level breakdowns are designated as (a), (b), (c), etc.
- (2) Second-level breakdowns are designated as (1), (2), (3), etc.
- (3) Third-level breakdowns are designated as (-a), (-b), (-c), etc.
- (4) Fourth-level breakdowns are designated as (-1), (-2), (-3), etc.
- (5) Fifth-level breakdowns are designated as (+a), (+b), (+c), etc.
- (6) Sixth-level breakdowns are designated as (+1), (+2), etc.

*(b) Cross-References to Subparagraph Breakdowns.* Cross-references within an alphanumerically designated paragraph (e.g., PG-1, UIG-56.1, NCD-3223) do not include the alphanumerical designator of that paragraph. The cross-references to subparagraph breakdowns follow the hierarchy of the designators under which the breakdown appears. The following examples show the format:

- (1) If X.1(c)(1)(-a) is referenced in X.1(c)(1), it will be referenced as (-a).
- (2) If X.1(c)(1)(-a) is referenced in X.1(c)(2), it will be referenced as (1)(-a).
- (3) If X.1(c)(1)(-a) is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
- (4) If X.1(c)(1)(-a) is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).

# SUBSECTION HA GENERAL REQUIREMENTS

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## SUBPART A METALLIC MATERIALS

### ARTICLE HAA-1000 INTRODUCTION

#### HAA-1100 GENERAL

##### HAA-1110 SCOPE

The rules of this [Subsection HA, Subpart A](#) constitute the general requirements associated with metallic components used in the construction of high temperature reactor systems and their supporting systems.

(a) The rules of [Subsection HA, Subpart A](#) are contained in Divisions 1 and 2, Subsection NCA, except for those paragraphs or subparagraphs (with numbered headers) replaced by corresponding numbered HAA paragraphs or subparagraphs in this Subpart or new numbered HAA paragraphs or subparagraphs added to this Subpart.

(b) Division 1 rules may use different terminology than Division 5 (e.g., Class 1 and Class 2 versus Class A and Class B, etc.) but the application and use of these rules is identical for Division 5 construction.

(c) Division 1, Class 1 requirements are applicable to Division 5 construction but shall be referred to as Division 5, Class A.

(d) Division 1, Class CS requirements are applicable to Division 5 construction but shall be referred to as Division 5, Class SM.

(e) Division 1, Class 2 requirements are applicable to Division 5 construction but shall be referred to as Division 5, Class B.

(f) Division 1, Class 3 and Class MC requirements are not applicable to Division 5 construction.

(g) References to Appendices are to the Section III Appendices, unless otherwise identified.

#### HAA-1120 DEFINITIONS

Definitions of key terms used in this Division for metallic components are included in [Article HAA-9000](#). The definitions in [Article HAA-9000](#) shall prevail should a conflict exist with definitions found in Division 1 or in other documents referenced in this Division. Unless defined in [Article HAA-9000](#), the definitions of Divisions 1 and 2, Article NCA-9000 shall apply.

#### HAA-1130 LIMITS OF THESE RULES

(a) The rules of this Division for metallic materials provide requirements for new construction and include consideration of mechanical and thermal stresses due to cyclic operation and high temperature creep. They do not cover deterioration that may occur in service as a result of radiation effects, corrosion, erosion, thermal embrittlement, or instability of the material. These effects shall be taken into account with a view to realizing the design or the specified life of the components and supports. The changes in properties of materials subjected to neutron radiation may be checked periodically by means of material surveillance programs.

(b) The rules are not intended to be applicable to valve operators, controllers, position indicators, pump impellers, pump drivers, or other accessories and devices, unless they are pressure-retaining parts or act as core support structures or supports. If such items are in a support load path, the provisions of [HFA-1100](#) apply.