

SECTION III
Rules for Construction of
Nuclear Facility Components

2023 ASME Boiler and
Pressure Vessel Code
An International Code

Division 1 — Subsection NF
Supports

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AN INTERNATIONAL CODE

2023 ASME Boiler & Pressure Vessel Code

2023 Edition

July 1, 2023



RULES FOR CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS

Division 1 - Subsection NF

Supports

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 In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees: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

* 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.

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.

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(23)

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January 1, 2023

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CORRESPONDENCE WITH THE COMMITTEE

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

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.

*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.

(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.

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 Subsection.

<i>Page</i>	<i>Location</i>	<i>Change</i>
viii	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”
xii	Personnel	Updated
xxxiv	Correspondence With the Committee	Added (replaces “Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees”)
xxxvi	Organization of Section III	In para. 1, Division 4 added
xlii	Cross-Referencing in the ASME BPVC	Updated
1	NF-1110	Subparagraph (e) revised
2	NF-1214	Subparagraph (g) added
8	Figure NF-1214-1	Last illustration added
10	NF-2130	In subpara. (a), cross-reference to NCA updated
14	NF-2321	Revised
24	NF-2432.2	In subpara. (c), cross-reference to NCA updated
25	NF-2530	Title and first line of paragraph revised
26	NF-2610	(1) Cross-references to NCA updated (2) Subparagraph (b) revised (3) Subparagraph (g) added
29	NF-3128	Title and first line of paragraph revised
30	Table NF-3131(a)-1	For Type “Standard,” Class 2 entries under “Linear” column corrected by errata
33	Table NF-3221.2-1	Note (2) revised
38	NF-3250	Paragraph below heading deleted
38	NF-3251	(1) Paragraph below main heading added (2) Titles of NF-3251.1, NF-3251.2, and NF-3251.3 revised
42	Table NF-3251.2-1	Note (2) revised
47	NF-3313.1	In nomenclature, entry for F_e added
48	Table NF-3312.1(b)-1	Note (2) revised
50	NF-3322.1	(1) Subparagraphs (c), (c)(1), (c)(2), and (e)(1) revised (2) Duplicate equation numbers deleted
56	NF-3322.2	(1) Revised (2) Duplicate equation numbers deleted
57	Table NF-3322.2(d)-1	Added
69	Figure NF-3322.8-2	Below General Note, the dimensional requirements for a , b , and b_e , combined and corrected by errata to “ $a \geq 1.33b_e$, where $b_e = 2t + \frac{5}{8}$ in. ($2t + 16$ mm) $\leq b$ ”
74	NF-3324.6	Subparagraphs (a)(1) through (a)(4) revised
78	Table NF-3332.3-1	In first column, for “General Condition — Groove welds” and “General Condition — Attachments,” cross-references revised
83	NF-3342.2	Duplicate equation numbers deleted
86	NF-3411.3	Subparagraphs (c) and (c)(2) revised
87	NF-3412.4	(1) In subpara. (a), last sentence added (2) Endnote 6 revised
88	NF-3412.5	Last sentence added
88	NF-3412.6	Added
93	NF-4121.1	First cross-reference updated

Page	Location	Change
93	NF-4125	Sentence below heading corrected by errata
98	NF-4335	Second sentence revised
98	NF-4335.1	In subpara. (a), last sentence revised
102	NF-4451	Revised
105	Table NF-4622.1-1	Column heads revised
104	NF-4622.3	Revised
106	NF-4622.7	Subparagraph (b) revised
107	Table NF-4622.7(b)-1	Revised
109	Table NF-4622.7(b)-2	Deleted
109	NF-4721	In subpara. (e), cross-reference to “(d)” corrected by errata to “(b)”
110	NF-4725.1	Revised
114	NF-5321	Subparagraph (d) revised
116	NF-5510	Cross-references updated
116	NF-5521	In endnote 9, cross-reference updated
117	NF-5523	Cross-reference updated
117	NF-5540	Added
192	NF-B-5200	Revised
196	Article NF-C-4000	(1) Revised (2) Former Table NF-C-4000 redesignated as Table NF-C-4000-1 (3) Table NF-C-4000-2 added
202	Table NF-D-1330-1	For Items <i>II</i> and <i>VI</i> in first column, text following “C)” revised

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 alphanumeric designator of that paragraph. The crossreferences 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).

ARTICLE NF-1000

INTRODUCTION

NF-1100 SCOPE AND GENERAL REQUIREMENTS

(23) NF-1110 ASPECTS OF CONSTRUCTION COVERED BY THESE RULES

(a) Subsection NF contains rules for the material, design, fabrication, examination, installation, and preparation of certification documents (Certificate of Compliance and NS-1 Certificate of Conformance) for supports for components and piping which are intended to conform to the requirements for Class 1, 2, 3, and MC construction as set forth in Subsections NB, NCD, and NE, respectively, of this Section.

(b) They *do not* cover deterioration that may occur in service as a result of corrosion, erosion, radiation effects, or metallurgical instability of the materials (see NCA-1130).

(c) Nuclear power plant supports (see NCA-9200 provides the definitions of "support" and other terms) for which the rules are specified in this Subsection are those metal elements which transmit loads between components (see NCA-1210), including piping systems, and intervening elements and the building structure. However, the term *supports* does not encompass a structural element the sole function of which is to carry dynamic loads caused by a postulated loss of pressure-retaining integrity.

(d) The Owner shall be responsible for assuring the adequacy of the building structure and all intervening elements in the support load path in accordance with the requirements of NCA-3211.18 and NCA-3211.19(b). To the extent necessary, the support designer shall consider the structural interaction with intervening elements and the building structure.

(e) Except for the requirements listed in (1) through (11), the requirements of Subsection NF do not apply to bearings, bushings, gaskets, hydraulic fluids, seals, shims, slide plates, retaining rings, wear shoes, springs, washers, wire rope, compression spring end plates, thread locking devices, cotter pins, sight glass assemblies, spring hanger travel and hydro stops, nameplates, nameplate attachment devices, padding between piping and supports, or for compression dynamic stops used as stops (stops do not include snubbers, dampers, and energy absorbers; see NF-3412.4, NF-3412.5, and

NF-3412.6) for seismic and other dynamic loads that are designed primarily for compressive loading and are not connected to the support or pressure boundary.

(1) The material of the exempt items shall be selected to tolerate the environmental conditions to which they will be exposed, such as temperature, fluids, humidity, and irradiation.

(2) The exempt item shall be designed for the loading conditions and other requirements identified in the Design Specification.

(3) Design Output Documents (see NCA-3211.40) shall indicate items that are exempt.

(4) Materials, fabrication, and installation of the exempt items shall comply with Design Output Documents.

(5) Class 1 springs shall be inspected in accordance with NF-2520.

(6) Washers shall comply with the requirements of NF-2128(b) and NF-4700.

(7) Wire rope shall comply with the requirements of NF-2530 and Article NF-3000.

(8) Compression spring end plates shall comply with the requirements of Articles NF-3000, NF-4000, NF-5000, and NF-8000.

(9) Compression dynamic stops shall comply with the requirements of Articles NF-3000, NF-4000, NF-5000, and NF-8000.

(10) Thread locking devices shall comply with the requirements of NF-4725.1.

(11) The means by which exempt items are attached to supports shall comply with the applicable requirements of this Subsection.

NF-1120 RULES FOR SUPPORTS AND THEIR CLASSIFICATION

NF-1121 Rules for Supports

The rules of Subsection NF provide requirements for new construction and include consideration of mechanical stresses and effects which result from the constraint of free-end displacements and anchor point motions defined in NF-3121.12 and NF-3121.13, but not thermal or peak stresses.

NF-1122 Classification of Supports

Supports shall be constructed to the requirements of this Subsection that are applicable to the class of the component, including piping system, they are intended to support. Supports may be optionally classified as permitted in NCA-2134. When the components are optionally classified to a higher class as permitted in NCA-2134 (d), the support need not be classified to the higher class.

NF-1123 ALTERNATIVE RULES

NF-1123.1 Linear Piping Supports. See Section III Appendices, Nonmandatory Appendix CC for the alternative rules to the requirements of Division 1 Subsections NCA and NF for Linear Piping Supports.

NF-1130 BOUNDARIES OF JURISDICTION

NF-1131 Boundary Between Components and Supports

The jurisdictional boundary between components, including piping systems, and supports shall meet the requirements of NB-1132, NCD-1132, or NE-1132 as applicable to the class of component.

NF-1132 Boundary Between Supports and the Building Structure

(a) Supports may bear on or may be welded, bolted, pinned, or clamped to the building structure. Typical examples of jurisdictional boundaries defined between supports and building structures are shown in [Figure NF-1132-1](#).

(b) The jurisdictional boundary between a support and the load carrying building structure is the surface of the building structure.

(c) For the purpose of defining the jurisdictional boundary between a support and the building structure, structural members shown on the civil/structural drawings of the plant and considered in the building structural analysis may be designated building structure even though located in the support load path. However, structural members, except as defined in (d), detailed on support drawings which are installed and used for the primary purpose of supporting piping or components shall be designated supports and be constructed to the rules of this Subsection.

(d) The Design Specification shall designate whether surface-mounted base plates intended to receive loads transmitted by supports are to be within the jurisdiction of Subsection NF or building structure. Fully or partially embedded steel elements intended to receive loads transmitted by supports; grout; concrete anchors; and hold-down bolts, nuts, and washers shall be designated building structure.

(e) If the means by which the support is connected to the building structure is a weld, the weld shall fall within the jurisdiction of this Subsection.

(f) If the means by which the support is connected to the building structure is a bolted joint to a building structural steel member, the bolts shall fall within the jurisdiction of this Subsection.

NF-1133 Boundary Between Supports and Intervening Elements

The jurisdictional boundary between supports and intervening elements in the support load path is the surface of the intervening elements. Supports may bear on or may be welded, bolted, pinned, or clamped to intervening elements. The means by which supports are connected to intervening elements shall fall within the jurisdiction of this Subsection.

NF-1200 TYPES OF SUPPORTS AND ATTACHMENTS

NF-1210 TYPES OF SUPPORTS

NF-1211 General Requirements

In this Subsection all supports are categorized into three separate types based on the general design procedure used for analysis of the support (see [NF-3140](#)). Requirements for materials, design, fabrication, and examination for each of the three types are provided in the following Articles of this Subsection. These support types are defined in [NF-1212](#) through [NF-1215](#).

NF-1212 Plate- and Shell-Type Supports

A *Plate- and Shell-Type Support* is a support such as a skirt or saddle which is fabricated from plate and shell elements and is normally subjected to a biaxial stress field.

NF-1213 Linear-Type Support

A *Linear-Type Support* is defined as acting under essentially a single component of direct stress. Such elements may also be subjected to shear stresses. Examples of such structural elements are tension and compression struts, beams and columns subjected to bending, trusses, frames, rings, arches, and cables. Energy-absorbing parts designed to dissipate energy by yielding and which are incorporated into a linear-type piping support shall be constructed in accordance with [Mandatory Appendix NF-III](#).

NF-1214 Standard Supports

Typical *Standard Supports* are described in MSS SP-58, *Pipe Hangers and Supports, Materials, Design, and Manufacture*, which was developed and approved by the Manufacturers Standardization Society of the Valve and Fittings

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