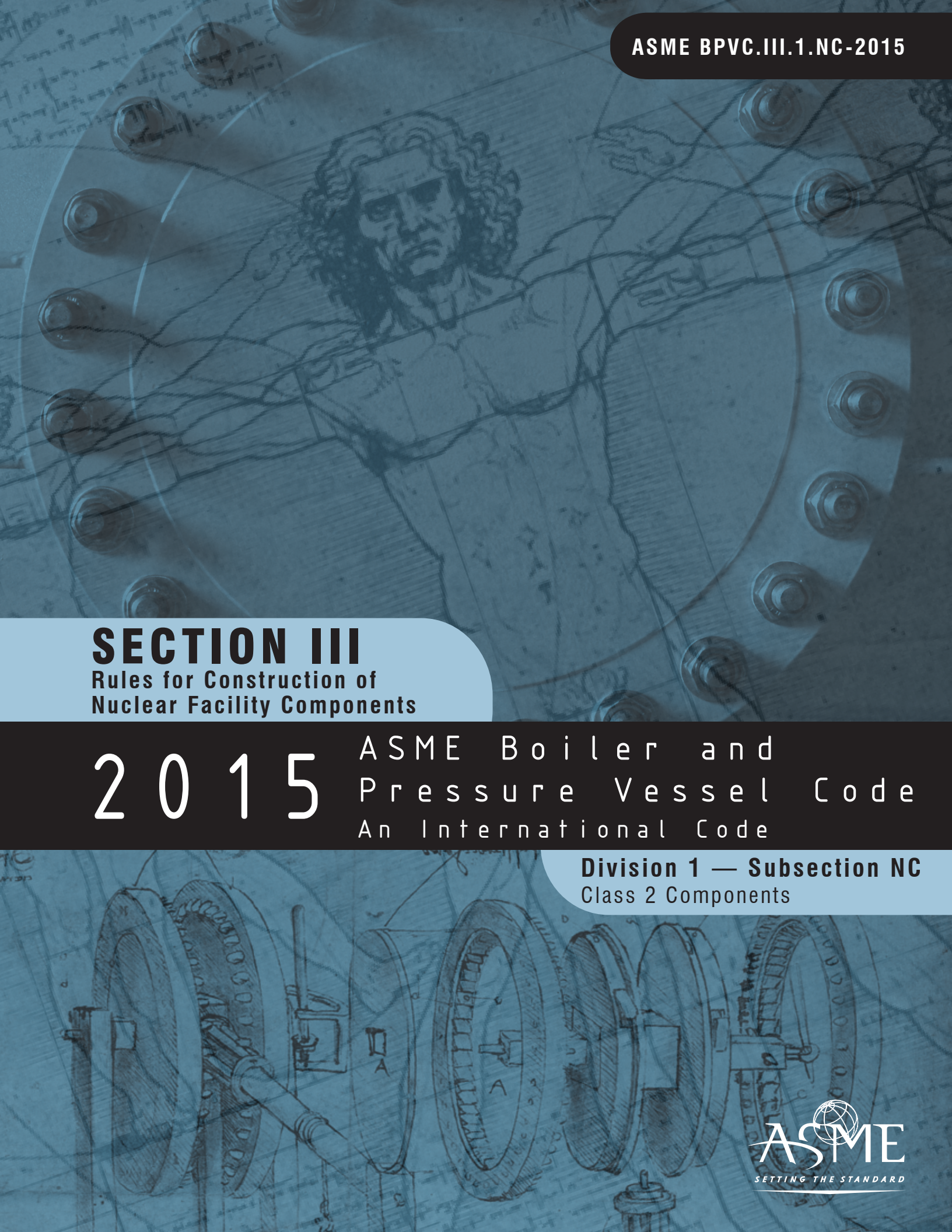

ASME BPVC.III.1.NC-2015

# SECTION III

## Rules for Construction of Nuclear Facility Components

# 2015 ASME Boiler and Pressure Vessel Code

An International Code

## Division 1 — Subsection NC

Class 2 Components

ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

# 2015 ASME Boiler & Pressure Vessel Code

2015 Edition July 1, 2015

# III

# RULES FOR CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS

## Division 1 - Subsection NC

## Class 2 Components

ASME Boiler and Pressure Vessel Committee
on Nuclear Power

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2015

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 is the last edition in which Section III, Division 1, Subsection NH, *Class 1 Components in Elevated Temperature Service*, will be published. The requirements located within Subsection NH have been moved to Section III, Division 5, Subsection HB, Subpart B for the elevated temperature construction of Class A components.

## INTERPRETATIONS

Interpretations of the Code have historically been posted in January and July at http://cstools.asme.org/interpretations.cfm. Interpretations issued during the previous two calendar years are included with the publication of the applicable Section of the Code in the 2015 Edition. Interpretations of Section III, Divisions 1 and 2 and Section III Appendices are included with Subsection NCA.

Following the 2015 Edition, interpretations will not be included in editions; they will be 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 2015 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 2017 Code.

(15)

# 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 judgement* 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.

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

## 1 INTRODUCTION

*(a)* The following information provides guidance to Code users for submitting technical inquiries to the committees. See Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code in Section II, Parts C and D for additional requirements for requests involving adding new materials to the Code. Technical inquiries include requests for revisions or additions to the Code rules, requests for Code Cases, and requests for Code Interpretations, as described below.

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

*(2) Code Cases.* Code Cases represent alternatives or additions to existing Code rules. 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 jurisdictions or owners automatically accept Code Cases. The most common applications for Code Cases are:

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

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

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

*(3) Code Interpretations.* Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an interpretation, an Intent Interpretation will be issued and the Code will be revised.

*(b)* The Code rules, Code Cases, and Code Interpretations established by the committees 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 rules.

*(c)* Inquiries that do not comply with these provisions or that do not provide sufficient information for a committee's full understanding may result in the request being returned to the inquirer with no action.

## 2 INQUIRY FORMAT

Submittals to a committee shall include:

*(a) Purpose.* Specify one of the following:

*(1)* revision of present Code rules

*(2)* new or additional Code rules

*(3)* Code Case

*(4)* Code Interpretation

*(b) Background.* 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, provide a copy of the specific referenced portions of the Code.

*(c) Presentations.* The inquirer may desire 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 committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the committee.

## 3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

*(a) Proposed Revisions or Additions.* For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

*(b) Statement of Need.* Provide a brief explanation of the need for the revision or addition.

*(c) Background Information.* 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 proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate. When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

## 4 CODE CASES

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined 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, etc.) must be defined and it must be confirmed 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 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 proposed Code Case applies.

## 5 CODE INTERPRETATIONS

*(a)* Requests for Code Interpretations shall provide the following:

*(1) Inquiry.* Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" *Reply,* with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

*(2) Reply.* Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the *Reply* should be "yes" or "no," with brief provisos if needed.

*(3) Background Information.* Provide any background information that will assist the committee in understanding the proposed *Inquiry* and *Reply.*

*(b)* Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The committee cannot 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

Submittals to and responses from the committees shall meet the following:

*(a) Submittal.* Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will also be considered. They shall include the name, address, telephone number, fax number, and e-mail address, if available, of the inquirer and be mailed to the following address:

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

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org or via our online tool at http://go.asme.org/InterpretationRequest.

*(b) Response.* The Secretary of the appropriate committee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the inquirer upon completion of the requested action by the committee.

(15)

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January 1, 2015

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(15)

# ORGANIZATION OF SECTION III

## 1 GENERAL

Section III consists of Division 1, Division 2, Division 3, 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, and by the letter "H" for Division 5. Each Subsection is published separately, with the exception of those listed for Divisions 2, 3, and 5.

- Subsection NCA — General Requirements for Division 1 and Division 2
- Appendices
- Division 1
  - Subsection NB — Class 1 Components
  - Subsection NC — Class 2 Components
  - Subsection ND — Class 3 Components
  - Subsection NE — Class MC Components
  - Subsection NF — Supports
  - Subsection NG — Core Support Structures
  - Subsection NH — Class 1 Components in Elevated Temperature Service[*]
- Division 2 — Code for Concrete Containments
  - Subsection CC — Concrete Containments
- Division 3 — Containments for Transportation and Storage of Spent Nuclear Fuel and High Level Radioactive Material and Waste
  - Subsection WA — General Requirements for Division 3
  - Subsection WB — Class TC Transportation Containments
  - Subsection WC — Class SC Storage Containments
- 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 A Metallic Core Support Structures
    - Subpart A — Low Temperature Service
    - Subpart B — Elevated Temperature Service
  - Subsection HH — Class A Nonmetallic Core Support Structures
    - Subpart A — Graphite Materials
    - Subpart B — Composite Materials

## 2 SUBSECTIONS

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

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

## 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 NB-3000 includes all material in Article NB-3000; reference to NB-3200 includes all material in subarticle NB-3200; reference to NB-3230 includes all paragraphs, NB-3231 through NB-3236.

*(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-89-2003.

*(4)* Specifications for welding and brazing materials are published by the American Welding Society (AWS), 8669 Doral Boulevard, Suite 130, Doral, 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-2131. 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.

[**] 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

After publication of the 2015 Edition, 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, **(15)**, 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 | Revised |
| xiv | Foreword | *(1)* Revised<br>*(2)* New footnote added by errata *(13-860)* |
| xvii | Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees | In last line of 6(a), URL revised |
| xix | Personnel | Updated |
| xxxvi | Organization of Section III | *(1)* New footnote added<br>*(2)* 9(d)(3) added *(13-1032)* |
| 7 | NC-2126.1 | In subpara. (e), last two sentences added *(14-1713)* |
| 15 | NC-2420 | In first paragraph, cross-reference to "Section IX, QW-492" corrected by errata to "Section IX, QG-109" *(14-2229)* |
| 18 | NC-2432.1 | In subpara. (d), last sentence corrected by errata *(14-2229)* |
| 25 | Table NC-2571-1 | In third column, ninth entry, cross-reference to "NC-2474" corrected by errata to "NC-2575" *(14-2229)* |
| 41 | NC-3218 | In subpara. (a), cross-reference to "NC-6231" corrected by errata to "NC-6321" *(15-225)* |
| 45 | NC-3224.6 | In last sentence, cross-reference to "Figure NC-3358-1" corrected by errata to "Figure NC-3358.1(a)-1" *(15-225, 15-1011)* |
| 45 | NC-3224.8 | In second paragraph, last sentence, cross-reference to "Figure NC-3358-1" corrected by errata to "Figure NC-3358.1(a)-1" *(15-225, 15-1011)* |
| 45 | NC-3224.9 | In last sentence, cross-reference to "Figure NC-3358-1" corrected by errata to "Figure NC-3358.1(a)-1" *(15-225, 15-1011)* |
| 47 | NC-3224.13 | In subparas. (b)(3) and (c)(3), cross-reference to "NC-3252.2(b)" deleted by errata *(15-225, 15-1011)* |
| 55 | NC-3232.2 | In subpara. (b), cross-reference to "NC-3234.1(c)" corrected by errata to "NC-3234.1(b)"*(15-225, 15-1011)* |
| 57 | NC-3235 | In subpara. (d), cross-reference to "NC-4237" corrected by errata to "NC-3237" *(15-225, 15-1011)* |

| *Page* | *Location* | *Change (Record Number)* |
|---|---|---|
| 59 | NC-3237 | In first sentence, cross-reference to "NC-3224.11(c)" corrected by errata to "NC-3224.13(d)" *(15-225, 15-1011)* |
| 64 | NC-3258.1 | In subparas. (a) and (b), cross-references to "Figure NC-3358-1" corrected by errata to "Figure NC-3358.1(a)-1" *(15-225, 15-1011)* |
| 66 | NC-3261 | In first paragraph and subpara. (b), cross-references to "Figure NC-3358-1" corrected by errata to "Figure NC-3358.1(a)-1" *(15-225, 15-1011)* |
| 88 | Figure NC-3335(b)-1 | Revised editorially |
| 90 | NC-3351.2 | Endnote reference corrected by errata *(14-1554)* |
| 90 | NC-3351.3 | First endnote reference corrected by errata *(14-1554)* |
| 90 | NC-3351.4 | Endnote reference corrected by errata *(14-1554)* |
| 91 | Figure NC-3352-1 | Revised editorially |
| 94 | Figure NC-3358.1(a)-1 | General Notes removed from the graphic by errata and redesignated as Notes (1) through (5) *(14-1224)* |
| 100 | NC-3432.1 | In subpara. (c), cross-reference to "NC-1150" revised to "NC-1130" *(14-2214)* |
| 110 | NC-3441.9 | In subpara. (a)(3), first sentence, the phrase "Except for flanged joints conforming to (5)" deleted by errata *(14-1561)* |
| 117 | NC-3512.2 | Revised *(12-503)* |
| 131 | NC-3642.1 | *(1)* Subparagraph (c) revised *(13-621)*<br>*(2)* Former endnote 28 deleted; subsequent endnotes renumbered *(13-621)* |
| 131 | Table NC-3642.1(c)-1 | Deleted *(13-621)* |
| 140 | NC-3647.2 | *(1)* Nomenclature re-ordered by errata *(14-1533)*<br>*(2)* In definition of $S$, "ksi" corrected by errata to "psi" *(13-1034)* |
| 147 | NC-3654.2 | Subparagraph (a) revised *(12-1975, 13-1280)* |
| 147 | NC-3655 | *(1)* Subparagraph (a)(2) revised *(12-1975, 13-1280)*<br>*(2)* In subparas. (b)(2) and (b)(4), definition of $S_h$ added *(13-1280)*<br>*(3)* In subpara. (b)(3), definition of $M_E$ revised *(13-832)* |
| 153 | Table NC-3673.2(b)-1 | *(1)* "Run legs" equations for "Branch connection or unreinforced fabricated tee" revised *(10-1819)*<br>*(2)* In General Note (a), definition of $d_i$ added, and in Note (9), last sentence added *(10-1819)* |
| 169 | Figure NC-3862(a)-1 | Revised editorially |
| 171 | Figure NC-3863-1 | Revised editorially |
| 167 | NC-3911.1 | In first sentence, endnote reference corrected by errata *(14-1554)* |
| 175 | Figure NC-3922.1-1 | *(1)* Revised *(12-887)*<br>*(2)* Callouts corrected by errata *(14-1551)*<br>*(3)* In General Note (a), cross-reference to "Figure ND-3822.1-2" corrected by errata to "Figure NC-3922.1-2" *(14-1551)* |
| 177 | NC-3922.3 | In subpara. (a), last two equations for $S_{cs}$ revised, and in subpara. (b), second, fourth, and fifth equations for $S_{ca}$ revised *(12-887)* |
| 179 | Table NC-3923.1-1 | Revised *(12-887)* |

| *Page* | *Location* | *Change (Record Number)* |
|---|---|---|
| 186 | NC-3933.4 | In subpara. (b), eq. (25) for SI units revised *(12-887)* |
| 187 | NC-3933.5(h) | Equation (26) for SI units revised *(12-887)* |
| 209 | NC-4223.1 | Revised *(13-621)* |
| 216 | Figure NC-4243.1-1 | Revised editorially |
| 222 | Figure NC-4244(e)-2 | Revised editorially |
| 228 | NC-4266 | In subpara. (c)(2)(-b), first sentence, cross-reference to "NC-3239.8" corrected by errata to "NC-3237" *(14-2229)* |
| 231 | Figure NC-4266(a)-1 | Revised editorially |
| 233 | Figure NC-4266(b)-1 | Revised editorially |
| 236 | Figure NC-4267-1 | Revised editorially |
| 237 | NC-4324 | Cross-references to Section IX, QW-201 and QW-300.20 deleted by errata *(14-2229)* |
| 242 | NC-4424 | In first paragraph, cross-reference to "Table NB-3683.2-1" corrected by errata to "Table NC-3673.2(b)-1" *(14-2229)* |
| 263 | NC-5521 | Subparagraphs (a), (a)(3), and (a)(4) revised *(12-454)* |
| 273 | NC-6922 | In numerator of eq. (3), $D$ corrected by errata to $B$ *(14-2353)* |
| 276 | NC-7111 | In subpara. (b), edition year for ASME PTC 25 deleted *(14-873)* |
| 290 | NC-7738 | In first sentence, edition year for ASME PTC 25 deleted *(14-873)* |
| 292 | NC-7746 | *(1)* In first sentence, edition year for ASME PTC 25 deleted *(14-873)*<br>*(2)* In last sentence, endnote reference corrected by errata *(14-1172)* |
| 294 | NC-7755 | *(1)* In first sentence, edition year for ASME PTC 25 deleted *(14-873)*<br>*(2)* In last sentence, endnote reference corrected by errata *(14-1172)* |
| 296 | NC-7764 | *(1)* In first sentence, edition year for ASME PTC 25 deleted *(14-873)*<br>*(2)* In last sentence, endnote reference corrected by errata *(14-1172)* |

**NOTE:** Volume 63 of the Interpretations to Section III, Divisions 1 and 2 of the ASME Boiler and Pressure Vessel Code follows the last page of Subsection NCA.

## LIST OF CHANGES IN RECORD NUMBER ORDER

| Record Number | Change |
|---|---|
| 10-1819 | In Table NC-3673.2(b)-1, revised stress indices and stress intensification factors for branch connections and unreinforced fabricated tees where $r/R \leq 0.5$. |
| 12-454 | Incorporated acceptance of the ASNT SNT-TC-1A 2011 standard into NC-5521 and clarified the requirement for the near-vision acuity examination. |
| 12-503 | Added standard design rules for socket-welded end and nonwelded end instrument, control, and sampling line valves, NPS 1 (DN 25) and smaller, to NC-3512.2. |
| 12-887 | Revised NC-3900. |
| 12-1046 | Editorial and stylistic revisions to correct changes made during the XML conversion. |
| 12-1975 | In NC-3654.2(a) and NC-3655(a)(2), changed "eqs. NC-3653.1(a)(9a) and NC-3653.1(b)(9b)" to "eq. NC-3653.1(a)(9a)" for appropriate application to Levels C and D Service Limits. Please see the proposal for further information. |
| 13-621 | Deleted Table NC-3642.1(c)-1 and replaced it with new Nonmandatory Appendix. Changed references to this Table in NC-3642 and NC-4223 to reference the new Appendix. Deleted NC-4223.1(b). |
| 13-832 | Made additions to the definition of $M_E$ in NC-3655(b)(3) to definitively state that it includes weight and inertial loading, which is implied by the initial discussion in these sections but not clearly stated in the definition. |
| 13-860 | In the Foreword, the subtitle has been deleted and replaced with an ANSI disclaimer as a footnote. |
| 13-1032 | Added a subparagraph to the Organization of Section III, Article 9(d), *References to Appendices* to add guidance on the use of Nonmandatory Appendices for Section III. |
| 13-1034 | Errata correction. See Summary of Changes for details. |
| 13-1280 | Changed NC-3654.2(a), NC-3655(a)(2), NC-3655(b)(2), and NC-3655(b)(4) to state that $S_h$ and $S_y$ are taken at a temperature consistent with the load being considered. |
| 13-1943 | Errata changes to NC-3358.3 and NC-3358.4. |
| 14-873 | In NC-7111(b), NC-7738, NC-7746, NC-7755, and NC-7764, deleted ASME PTC-25 edition year. |
| 14-1172 | Errata correction. See Summary of Changes for details. |
| 14-1224 | Errata correction. See Summary of Changes for details. |
| 14-1533 | Errata correction. See Summary of Changes for details. |
| 14-1551 | Errata correction. See Summary of Changes for details. |
| 14-1554 | Errata correction. See Summary of Changes for details. |
| 14-1561 | Errata correction. See Summary of Changes for details. |
| 14-1713 | Revised NC-2126(e). |
| 14-2214 | Changed cross-reference to "NC-1150" to "NC-1130" in NC-3432.1(c). |
| 14-2229 | Errata correction. See Summary of Changes for details. |
| 14-2353 | Errata correction. See Summary of Changes for details. |

# 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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# ARTICLE NC-1000
# INTRODUCTION

## NC-1100 SCOPE

*(a)* Subsection NC contains rules for the material, design, fabrication, examination, testing, overpressure relief, marking, stamping, and preparation of reports by the Certificate Holder for items which are intended to conform to the requirements for Class 2 construction.

*(b)* The rules of Subsection NC cover the strength and pressure integrity of items the failure of which would violate the pressure-retaining boundary. The rules cover load stresses but do not cover deterioration which may occur in service as a result of corrosion, radiation effects, or instability of materials. NCA-1130 further limits the rules of this Subsection.

*(c)* Subsection NC does not contain rules to cover all details of construction of Class 2 vessels and storage tanks. Where complete details are not provided in this Subsection, it is intended that the N Certificate Holder, subject to the approval of the Owner or his designee and acceptance by the Inspector, shall provide details of construction which will be consistent with those provided by the rules of this Subsection.

## NC-1120 TEMPERATURE LIMITS

Vessels are to be designed using the standard design method in NC-3300 or the alternative design rules of NC-3200, which allows the use of analysis with the higher design stress intensity values of Section II, Part D, Subpart 1, Tables 2A, 2B, and 4.

## NC-1130 BOUNDARIES OF JURISDICTION APPLICABLE TO THIS SUBSECTION

### NC-1131 Boundary of Components

The Design Specification shall define the boundary of a component to which piping or another component is attached. The boundary shall not be closer to a vessel, tank, pump, or valve than:

*(a)* the first circumferential joint in welded connections (the connecting weld shall be considered part of the piping);

*(b)* the face of the first flange in bolted connections (the bolts shall be considered part of the piping);

*(c)* the first threaded joint in screwed connections.

### NC-1132 Boundary Between Components and Attachments

**NC-1132.1 Attachments.**

*(a)* An *attachment* is an element in contact with or connected to the inside or outside of the pressure-retaining portion of a component.

*(b)* Attachments may have either a pressure-retaining function or a nonpressure-retaining function.

*(1)* Attachments with a pressure-retaining function include items such as:

*(-a)* pressure boundary stiffeners;

*(-b)* branch and vessel opening reinforcement.

*(2)* Attachments with a nonpressure-retaining function include items such as:

*(-a)* valve guides, thermal sleeves, and turning vanes;

*(-b)* vessel saddles, support and shear lugs, brackets, pipe clamps, trunnions, skirts, and other items within the component support load path.

*(c)* Attachments may also have either a structural or nonstructural function.

*(1)* Attachments with a structural function (structural attachments):

*(-a)* perform a pressure-retaining function;

*(-b)* are in the component support load path.

*(2)* Attachments with a nonstructural function (nonstructural attachments):

*(-a)* do not perform a pressure-retaining function;

*(-b)* are not in the component support load path;

*(-c)* may be permanent or temporary.

Nonstructural attachments include items such as nameplates, insulation supports, and locating and lifting lugs.

**NC-1132.2 Jurisdictional Boundary.** The jurisdictional boundary between a pressure-retaining component and an attachment defined in the Design Specification shall not be any closer to the pressure-retaining portion of the component than as defined in (a) through (g) below. Figures NC-1132.2-1 through NC-1132.2-3 are provided as an aid in defining the boundary and construction requirements of this Subsection.

*(a)* Attachments cast or forged with the component and weld buildup on the component surface shall be considered part of the component.

*(b)* Attachments, welds, and fasteners having a pressure-retaining function shall be considered part of the component.