ASME BOILER AND PRESSURE VESSEL CODE
AN AMERICAN NATIONAL STANDARD

SECTION III

Rules for Construction of Nuclear Power Plant Components

DIVISION 1 — SUBSECTION NG

Core Support Structures

1983 EDITION

JULY 1, 1983

ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON NUCLEAR POWER

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
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1983 ASME
BOILER AND PRESSURE VESSEL CODE

An American National Standard

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ADDENDA

Colored-sheet Addenda, which include additions and revisions to individual Sections of the Code, are published twice a year and will be sent automatically to purchasers of the applicable Sections up to the publication of the 1986 Code. Both Editions of the 1983 Code are available only in the loose-leaf format; accordingly, the Addenda will be issued only in the loose-leaf, replacement-page format.

Interpretations

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. With the 1983 Edition, the Interpretations for each individual Section will be published separately and will be included with the Addenda service to that Section. Interpretations of Section III, Divisions 1 and 2, will be included with the Addenda service to Subsection NCA. Interpretations are not part of the Addenda to the Code.

CODE CASES

The Boiler and Pressure Vessel Committee meets 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 which have been adopted appear in one or both of the 1983 Code Cases books: (1) Boilers and Pressure Vessels and (2) Nuclear Components. Supplements will be sent automatically to the purchasers of one or both the Code Cases books up to the publication of the 1986 Edition. The Code Cases books are not available in a separate SI Edition.

FOREWORD

The American Society of Mechanical Engineers set up a committee in 1911 for the purpose of formulating standard rules for the construction of steam boilers and other pressure vessels. This committee is now called the Boiler and Pressure Vessel Committee.

The Committee's function is to establish rules of safety governing the design, fabrication, and inspection during construction of boilers and pressure vessels, and to interpret these rules when questions arise regarding their intent. 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 so as to give a reasonably long safe period of usefulness. Advancements in design and material and the evidence of experience have been recognized.

The Boiler and Pressure Vessel Committee deals with the care and inspection of boilers and pressure vessels in service only to the extent of providing suggested rules of good practice as an aid to owners and their inspectors.

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 Boiler and Pressure Vessel Committee meets regularly to consider requests for interpretations and revisions of the rules, and to develop new rules as dictated by technological development. Inquiries must be addressed to the Secretary in writing and must give full particulars in order to receive consideration and a written interpretation. Proposed revisions to the Code resulting from inquiries will be presented to the Main Committee for appropriate action. The action of the Main Committee becomes effective only after confirmation by letter ballot of the Committee and approval by the Council of the Society.

Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute and published in *Mechanical Engineering* to invite comments from all interested persons. After the allotted time for public review and final approval by ASME Council, revisions are published semiannually in Addenda to the Code.

Code Cases may be used in the construction of components to be stamped with the ASME Code symbol beginning with the date of their approval by the ASME Council.

Code Editions may be used on or after the date of issue shown in the Edition. After Code revisions are approved by Council they may be used beginning with the date of issue shown on the Addenda.

Owners of nuclear power plants are cautioned that Code Editions, Addenda, and Cases to be used in construction shall be acceptable to the regulatory and enforcement authorities having jurisdiction at the nuclear power plant site.

Each state and municipality in the United States and each province in the Dominion of Canada that adopts or accepts one or more Sections of the Boiler and Pressure Vessel Code is invited to appoint a representative to act on the Conference Committee to the Boiler and Pressure Vessel Committee. Since the members of the Conference Committee are in active contact with the administration and enforcement of the rules, the requirements for inspection in this Code correspond with those in effect in their respective jurisdictions. The required qualifications for an Authorized Inspector or an Authorized Nuclear Inspector under these rules may be obtained from the administrative authority of any state, municipality, or province which has adopted these rules.

The Boiler and Pressure Vessel Committee in the formulation of its rules and in the establishment of maximum design and operating pressures considers materials, construction, method of fabrication, inspection, and safety devices. Permission may be granted to regulatory bodies and organizations publishing safety standards to use a complete Section of the Code by reference. If usage of a Section, such as Section IX, involves exceptions, omissions, or changes in provisions, the intent of the Code might not be attained.

Where a state or other regulatory body, in the printing of any Section of the Boiler and Pressure Vessel Code, makes additions or omissions, it is recommended that such changes be clearly indicated.

The National Board of Boiler and Pressure Vessel Inspectors is composed of chief inspectors of states and municipalities in the United States and of provinces in the Dominion of Canada that have adopted the Boiler and Pressure Vessel Code. This Board, since its organization in 1919, has functioned to uniformly administer and enforce the rules of the Boiler and Pressure Vessel Code. The cooperation of that organization with the Boiler and Pressure Vessel Committee has been extremely helpful.

It should be pointed out that the state or municipality where the Boiler and Pressure Vessel Code has been made effective has definite jurisdiction over any particular installation. Inquiries dealing with problems of local character should be directed to the proper authority of such state or municipality. Such authority may, if there is any question or doubt as to the proper interpretation, refer the question to the Boiler and Pressure Vessel Committee.

The Specifications for materials given in Section II, Parts A and B, are identical with or similar to those of The American Society for Testing and Materials. The Specifications for welding materials given in Section II, Part C, are identical with or similar to those of the American Welding Society. Use of the materials described in these Specifications is covered by the rules in this Section of the Boiler and Pressure Vessel Code. All materials allowed by this Section and used for construction within the scope of these rules shall be furnished in accordance with the Material Specifications contained in Section II except where otherwise provided in Code Cases or in this Section of the Code. Material produced to an ASME or ASTM Material Specification is not limited as to country of origin.

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 CODE SYMBOLS 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 Code Symbols for marking items or constructions which 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 Code Symbols for the benefit of the users, the enforcement jurisdictions, and the holders of the symbols who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the symbols, 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 which might so indicate. An organization holding a Code Symbol 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."

The ASME Symbol 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 a Code Symbol who may also use the facsimile in advertising to show that clearly specified items will carry the symbol. 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 Code Symbol Stamp described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the various Code Symbols shall not be used on any item which 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 which 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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CONTENTS

A Detailed Contents Precedes Each Article

ORGANIZATION OF SECTION III

1. GENERAL

Section III consists of Division 1 and Division 2. Both Divisions are broken down into Subsections which are designated by capital letters preceded by the letter "N" for Division 1 and by the letter "C" for Division 2. The following nine books make up the two Divisions.

Subsection NCA — General Requirements for Division 1 and Division 2

Division 1
- Subsection NB — Class 1 Components
- Subsection NC — Class 2 Components
- Subsection ND — Class 3 Components
- Subsection NE — Class MC Components
- Subsection NF — Component Supports
- Subsection NG — Core Support Structures
- Appendices

Division 2 — Code for Concrete Reactor Vessels and Containments

The Division 2 book includes Subsection CB — Concrete Reactor Vessels, Subsection CC — Concrete Containments, and Division 2 Appendices.

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 or CB-2000. Where possible, Articles dealing with the same topics are given the same number in each Subsection 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, 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 or CB-1200.

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-2131 or CB-2132.

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-1111.1 or CB-1111.2. When they are *minor* subdivisions of a paragraph, subparagraphs may be designated by lowercase letters in parentheses, such as NB-1111(a) or CB-1111(b).

8. SUBSUBPARAGRAPHS

Subsubparagraphs are designated by adding lowercase letters in parentheses to the *major* subparagraph numbers, such as NB-1111.1(a) or CB-1111.1(b). When further subdivisions of *minor* subparagraphs are necessary, subsubparagraphs are designated by adding Arabic numerals in parentheses to the subparagraph designation, such as NB-1111(a)(1) or CB-1111(a)(2).

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.

Wherever the term NX appears, it is intended to describe all the Subsections of Section III (NB, NC, ND, NE, NF, NG) where the referenced paragraph, Subarticle, or Article appears.

B. References to Other Sections

Other Sections referred to in Section III are:

Section II, Material Specifications. 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".

Section V, Nondestructive Examination. Section V references begin with the letter "T" and relate to the nondestructive examination of material or welds.

Section IX, Welding and Brazing Qualifications. Section IX references begin with the letter "Q" and relate to welding and brazing requirements.

Section XI, 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. At the time of publication of Section III, some such specifications were not included in Section II of this Code. A reference to ASTM E 71-64 refers to the specification so designated by and published by ASTM, 1916 Race St., Philadelphia, Pa. 19103.

(2) Dimensional standards covering products such as valves, flanges, and fittings are approved by the American National Standards Institute[1] and published by the American Society of Mechanical Engineers. When a product is to conform to such a standard, for example ANSI 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 NB-3132-1, for example ANSI B16.5-1977. ANSI-approved standards published by the American Society of Mechanical Engineers are available from ASME, 345 East 47th St., New York, N.Y. 10017. Other ANSI-approved standards are available from their publishers or the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

(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-6, the Standard Practice referred to is published by the Manufacturers Standardization Society of the Valve and Fittings Industry, 1815 North Ft. Meyer Drive, Arlington, Va. 22209. The applicable year of issue of such a Standard Practice is that suffixed to its numerical designation in Table NB-3132-1, for example MSS SP-6-1963.

(4) Specifications for welding and brazing materials are published by the American Welding Society, 2501 Northwest 7th St., Miami, Fla. 33125. 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-620 and API-2000. When documents so designated are referred to in Section III, they are standards published by the American Petroleum Institute.

D. References to Appendices

Two types of Appendices are used in Section III and are designated Mandatory and Nonmandatory.

(1) Mandatory Appendices contain requirements which must be followed in construction: such references are designated by a Roman numeral followed by Arabic numerals. References to Table I-1.2 or II-1100, for example, relate to the Mandatory Appendices.

(2) Nonmandatory Appendices provide information or guidance for the use of Section III: such references are designated by a capital letter followed by Arabic numerals. A reference to D-1100, for example, relates to a Nonmandatory Appendix.

[1]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.

ARTICLE NG-1000

ARTICLE NG-1000
INTRODUCTION

NG-1100 SCOPE

NG-1110 ASPECTS OF CONSTRUCTION COVERED BY THESE RULES

Subsection NG establishes rules for materials, design, fabrication, examination, and preparation of reports required in the manufacture and installation of core support structures.[1,2]

NG-1120 DEFINITION OF STRUCTURES AND APPLICATION OF THESE RULES TO THEM

NG-1121 Core Support Structures

Core support structures shall be constructed to the rules of this Subsection. Core support structures are those structures or parts of structures which are designed to provide direct support or restraint of the core (fuel and blanket assemblies) within the reactor pressure vessel. Structures which support or restrain the core only after the postulated failure of core support structures are considered to be internal structures (NG-1122).

NG-1122 Internal Structures

(a) Internal structures are *all* structures within the reactor pressure vessel other than core support structures, fuel[3] and blanket assemblies, control assemblies, and instrumentation.

(b) The rules of this Subsection apply to internal structures as defined in (a) above, only when so stipulated by the Certificate Holder manufacturing core supports, hereafter referred to in this Subsection as Certificate Holder.

(c) The Certificate Holder shall certify[2] that the construction of all internal structures is such as not to affect adversely the integrity of the core support structure.

NG-1130 BOUNDARY OF CORE SUPPORT STRUCTURES

The boundary of core support structures shall be taken as the welds or mechanical joints which connect such structures to the reactor vessel and to any internal structures. Such welds or mechanical joints shall be included in the core support structure boundary unless specifically included in the Design Specification for the reactor vessel.

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[1]*(a)* The rules of Subsection NG are not directed to sealing against coolant leakage. Further, gross hydrostatic loading may not be typical of the loads experienced by core support structures. Thus, hydrostatic testing of the structures is not required.

(b) The most severe loads on which design must be predicated usually result from abnormal, rather than normal, load conditions. Core support structures need not remain leak tight to perform their function. However, if leak tightness is required for a structure, the rules for pressure boundary construction may be appropriate.

[2]In Subsection NG it is recognized that the design functions are frequently handled separately from the fabrication functions of the Certificate Holder manufacturing core supports. The separation of these functions is necessary because the design of core support structures cannot be performed completely independent of the nuclear or hydraulic design of the coolant system. Furthermore, portions of a set of structures may be fabricated by a specialist and assembled at the site without any one fabricator having a controlling position for fabrication of the complete structure. Therefore, provisions are made herein for separate organizations to perform the design and fabricating functions of the Certificate Holder. This Section (NCA-3510), however, requires that one organization have overall responsibility for compliance with the requirements of this Subsection NG. The use of the term *Certificate Holder* therefore must be understood to mean the design or fabricating organization assuming the overall responsibility for compliance with this Section. The term *Certificate Holder*, as used in this Subsection, applies to the Certificate Holder manufacturing core supports who shall be responsible for certifying that all core support structures and internal structures, as defined in NG-1120, comply with the requirements of this Subsection.

[3]Note that some fuel and blanket positions in the core matrix may be filled with structures related to reflector or shielding functions. These structures also fall into the *fuel and blanket* category described above.