

ASME BOILER AND PRESSURE VESSEL CODE
AN AMERICAN NATIONAL STANDARD

SECTION XI

Rules for Inservice Inspection of Nuclear Power Plant Components

1983 EDITION

JULY 1, 1983



ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON NUCLEAR INSERVICE INSPECTION

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 Ameri-

can 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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PREFACE TO SECTION XI

INTRODUCTION

Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, of the ASME Boiler and Pressure Vessel Code provides rules for the examination, testing, and inspection of components and systems in a nuclear power plant. Application of this Section of the Code begins when the requirements of the Construction Code have been satisfied.

GENERAL

The rules of the Section constitute requirements to maintain the nuclear power plant and to return the plant to service, following plant outages, in a safe and expeditious manner. The rules require a mandatory program of examinations, testing, and inspections to evidence adequate safety. The rules also stipulate duties of the Authorized Nuclear Inservice Inspector to verify that the mandatory program has been completed, permitting the plant to return to service in an expeditious manner.

OWNER RESPONSIBILITIES

The Owner of the nuclear power plant is assigned the responsibilities to develop a program which will demonstrate conformance to the requirements of this Section of the Code. These responsibilities include:

(a) provision of access in the design and arrangement of the plant to conduct the examination and tests;

(b) development of plans and schedules, including detailed examination and testing procedures for filing with the enforcement and regulatory authorities having jurisdiction at the plant site;

(c) conduct of the program of examination and tests, system leakage and hydrostatic pressure tests, as well as inservice tests of pumps and valves;

(d) recording of the results of the examinations and tests, including corrective actions required and the actions taken.

DUTIES OF THE AUTHORIZED NUCLEAR INSERVICE INSPECTOR

Section XI differs from Section VI, Care and Operation of Heating Boilers, and Section VII, Care of Power Boilers, in that the rules for Inservice Inspection of Nuclear Power Plants are mandatory, while the other two Sections are Recommended Practices. Duties of the Authorized Nuclear Inservice Inspector are assigned by Section XI to verify that the responsibilities of the Owner and the mandatory requirements of this Section are met. Duties of the Authorized Nuclear Inservice Inspector include:

(a) witnessing the pressure testing;

(b) reviewing nondestructive examination procedures and repair programs;

(c) verifying that the visual examinations and tests on pumps and valves have been completed and the results recorded.

Listed as one of the duties is the prerogative of the Inspector to require requalification of any operator or procedure when he has reason to believe the requirements are not being met.

ORGANIZATION OF SECTION XI

1. DIVISIONS

Section XI consists of three Divisions, as follows:

Division 1—Rules for Inspection and Testing of Components of Light-Water Cooled Plants

Division 2—Rules for Inspection and Testing of Components of Gas-Cooled Plants

Division 3—Rules for Inspection and Testing of Components of Liquid-Metal Cooled Plants

2. SUBSECTIONS

The Divisions are broken down into Subsections which are designated by capital letters, preceded by the letters IW in Division 1, by the letters IG in Division 2, and by the letters IM in Division 3.

Division 1 consists of Subsections covering the following aspects of the rules:

Subsection	Title
IWA	General Requirements
IWB	Class 1 Components
IWC	Class 2 Components
IWD	Class 3 Components
IWE	Class MC Components
IWF	Class 1, 2, 3, and MC Component Supports
IWG	Core Internal Structures (In course of preparation)
IWP	Pumps
IWV	Valves

Division 2 consists of Subsections covering the following aspects of the rules:

Subsection	Title
IGA	General Requirements
IGB	Class 1 Components
IGC	Class 2 Components
IGD	Class 3 Components
IGG	Reactor Internals
IGH	Elevated Temperature Material
IGI	Graphite and Thermal Insulation Materials
IGK	Concrete Reactor Vessels
IGP	Pumps
IGQ	Compressors
IGV	Valves

Division 3 consists of Subsections covering the following aspects of the rules:

Subsection	Title
IMA	General Requirements
IMB	Class 1 Components
IMC	Class 2 Components
IMD	Class 3 Components
IMF	Class 1, 2, and 3 Component Sup- ports

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

3. ARTICLES

Articles are designated by the applicable letters indicated above for the Subsections, followed by Arabic numbers, such as IWA-1000 or IWB-2000. Where possible, Articles dealing with the same general topics are given the same number in each Subsection, in accordance with the following scheme:

Article Number	Title
1000	Scope and Responsibility
2000	Examination and Inspection
3000	Acceptance Standards for Flaw Indications
4000	Repair Procedures
5000	System Pressure Tests
6000	Records and Reports
7000	Replacements

The numbering of Articles and 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 IWA-1100 or IWA-1200.

5. SUBSUBARTICLES

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

6. PARAGRAPHS

Paragraphs are numbered in units of 1, such as IWA-2131 or IWA-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 IWA-1111.1 or IWA-1111.2. When they are *minor* subdivisions of a paragraph, subparagraphs may be designated by lowercase letters in parentheses, such as IWA-1111(a) or IWA-1111(b).

8. REFERENCES

References used within this Section generally fall into one of six categories, as explained below.

(a) *References to Other Portions of This Section.* When a reference is made to another Article, Subarticle, or paragraph number, all numbers subsidiary to that reference shall be included. For example, reference to IWA-2000 includes all materials in Article IWA-2000; reference to IWA-2200 includes all material in Subarticle IWA-2200; reference to IWA-2220 includes all paragraphs in IWA-2220 through IWA-2222.

(b) *References to Other Sections.* Other Sections referred to in Section XI are as follows:

(1) *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." Materials conforming to ASTM specifications may be used in accordance with the provisions of the last paragraph of the Foreword to the Boiler Code.

(2) *Section III, Nuclear Power Plant Components.* Section III references begin with the letter "N" and relate to nuclear power plant design or construction requirements.

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

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

(c) *References 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. For example, reference to ASTM E 71-64 refers to the specification so designated and published by ASTM, 1916 Race Street, Philadelphia, Pa. 19103.

(2) Recommended practices for qualifying and certifying nondestructive testing personnel are published by the

American Society for Nondestructive Testing. These documents are designated SNT-TC-1A. A reference to SNT-TC-1A shall be understood to mean the practice and its supplements, so designated and published by the American Society for Nondestructive Testing, 3200 Riverside Drive, Columbus, Ohio 43221.

(3) Specifications and standards for materials, processes examination and test procedures, qualifications of personnel, and other requirements of the Code approved by the American National Standards Institute are designated by the letters ANSI followed by the serialization for the particular specification or standard. ANSI-approved standards published by ASME are available from ASME, 345 East 47th Street, 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.

(d) *References to Government Regulations.* U.S. Federal regulations issued by executive departments and agencies, as published in the Federal Register, are codified in the Code of Federal Regulations. The Code of Federal Regulations is published by the Office of the Federal Register, National Archives and Records Service, General Service Administration, and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Title 10 of the Code of Federal Regulations contains the regulations for atomic energy. The abbreviated reference "10 CFR 50" is used to mean "Title 10, Code of Federal Regulations, Part 50."

(e) *References to Appendices.* Two types of Appendices are used in Section XI 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. A reference to III-1100, for example, refers to a Mandatory Appendix.

(2) Nonmandatory Appendices provide information or guidance for the use of Section XI; such references are designated by a capital letter followed by Arabic numerals. A reference to A-3300, for example, refers to a Nonmandatory Appendix.

(f) *References to Technical Reports.* The following reports prepared at the request of the American Society of Mechanical Engineers and published by Electric Power Research Institute are relevant to Code-related articles of Section XI. Requests for copies should be directed to EPRI Research Reports Center, Box 50490, Palo Alto, Ca. 94303.

(1) NP-1406-SR — Nondestructive Examination Acceptance Standards Technical Basis and Development for Boiler and Pressure Vessel Code, ASME Section XI, Division 1, Special Report, May 1980.

(2) NP-719-SR — Flaw Evaluation Procedures — Background and Application of ASME Section XI Appendix A — Special Report, August 1978.

DIVISION 1

**RULES FOR INSPECTION AND
TESTING OF COMPONENTS OF
LIGHT-WATER COOLED PLANTS**

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ARTICLE IWA-1000

SCOPE AND RESPONSIBILITY

IWA-1100 SCOPE

(a) This Division provides the rules and requirements for inservice inspection and inservice testing of light-water cooled nuclear power plants. The rules and requirements identify as a minimum the areas subject to inspection, responsibilities, provisions for accessibility and inspectability, examination methods and procedures, personnel qualifications, frequency of inspection, record keeping and report requirements, procedures for evaluation of inspection results and subsequent disposition of results of evaluations, and repair requirements.

(b) This Division provides for the design, fabrication, installation, and inspection of replacements.

IWA-1200 JURISDICTION

The jurisdiction of this Division covers individual components and complete power plants that have met all the requirements of the Construction Code, commencing at that time when the Construction Code requirements have been met, irrespective of physical location. When portions of systems or plants are completed at different times, jurisdiction of this Division shall cover only those portions on which all of the construction requirements have been met.

IWA-1300 APPLICATION

IWA-1310 COMPONENTS SUBJECT TO INSPECTION AND TESTING

Components identified in this Division for inspection and testing shall be included in the inservice inspection plan. These components include nuclear power plant items such as vessels, containments, piping systems, pumps, valves, core support structures, and storage tanks, including their respective supports. The selection of components for the inservice inspection plan is subject to review by the

regulatory and enforcement authorities having jurisdiction at the plant site.

IWA-1320 CLASSIFICATIONS

(a) Application of the rules of this Division shall be governed by the group classification criteria of the regulatory authority having jurisdiction at the plant site as follows.

(1) The rules of IWB shall be applied to those systems whose components are classified ASME Class 1 (Quality Group A).

(2) The rules of IWC shall be applied to those systems whose components are classified ASME Class 2 (Quality Group B).

(3) The rules of IWD shall be applied to those systems whose components are classified ASME Class 3 (Quality Group C).

(b) Optional construction of a component within a system boundary to a classification higher than the minimum class established in the component Design Specification (either upgrading from Class 2 to Class 1 or from Class 3 to Class 2) shall not affect the overall system classification by which the applicable rules of this Division are determined.

(c) Where all components within the system boundary or isolable portions of the system boundary are classified to a higher class than required by the group classification criteria, the rules of (a) above may be applied to the higher classification, provided the rules of the applicable Subsection are applied in their entirety.

(d) The portion of piping that penetrates a containment vessel, which is required by Section III to be constructed to Class 1 or 2 rules for piping and which may differ from the classification of the balance of the piping system, need not affect the overall system classification that determines the applicable rules of this Division.

(e) If systems safety criteria permit a system to be nonnuclear safety Class and an Owner optionally