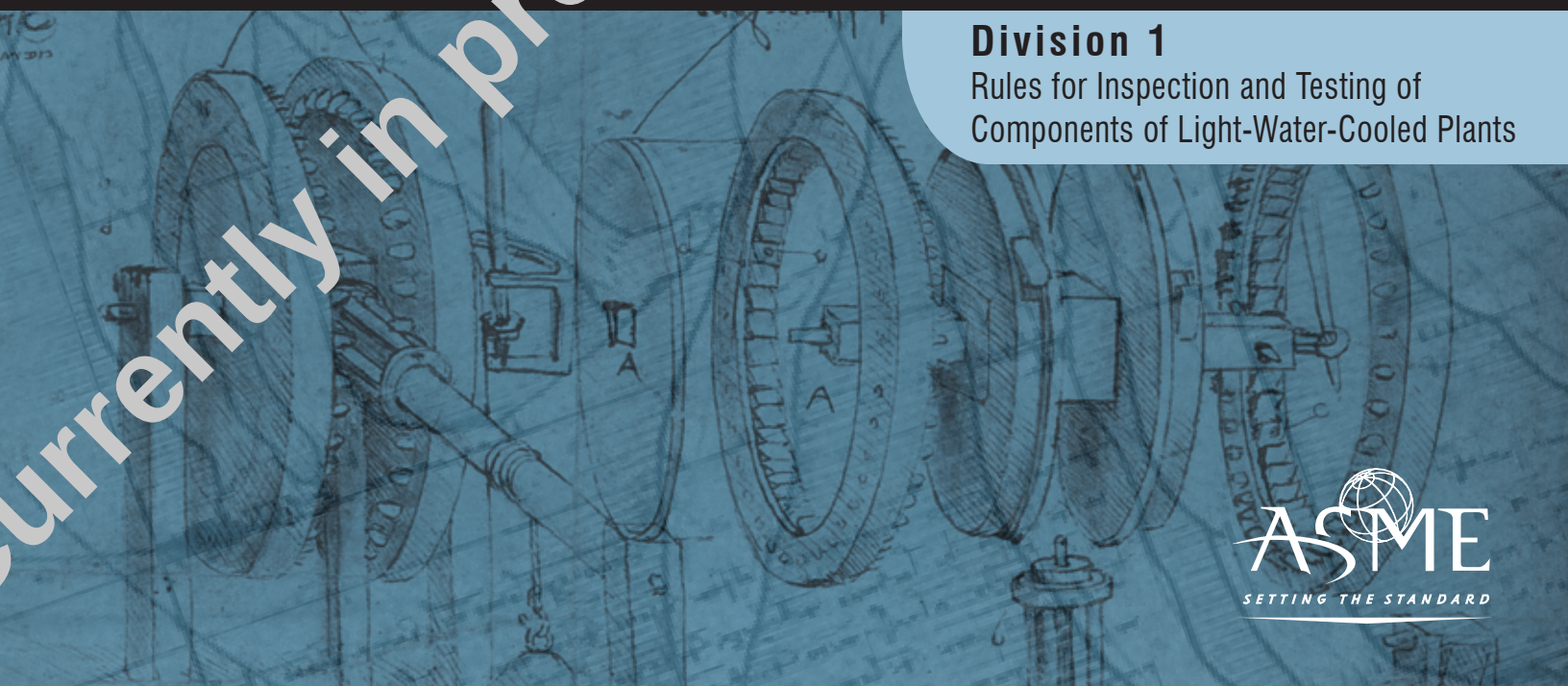
ASME BPVC.XI.1-2021

SECTION XI

Rules for Inservice Inspection of Nuclear Power Plant Components

2021 ASME Boiler and Pressure Vessel Code

An International Code



Division 1

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

ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

2021 ASME Boiler & Pressure Vessel Code

2021 Edition July 1, 2021

XI

RULES FOR INSERVICE INSPECTION OF NUCLEAR POWER PLANT COMPONENTS

Division 1

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

ASME Boiler and Pressure Vessel Committee
on Nuclear Inservice Inspection

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2021

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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ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

The endnotes and preamble in this document (if any) are part of this American National Standard.

ASME Collective Membership Mark

ASME Single Certification Mark

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INTERPRETATIONS

Interpretations are 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 2021 Code Cases book: "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements. Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2023 Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. Code Case users can check the current status of any Code Case at http://go.asme.org/BPVCCDatabase. Code Case users can also view an index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases at http://go.asme.org/BPVCC.

FOREWORD[*]

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In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

(a) Committee on Power Boilers (I)
(b) Committee on Materials (II)
(c) Committee on Construction of Nuclear Facility Components (III)
(d) Committee on Heating Boilers (IV)
(e) Committee on Nondestructive Examination (V)
(f) Committee on Pressure Vessels (VIII)
(g) Committee on Welding, Brazing, and Fusing (IX)
(h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)
(i) Committee on Nuclear Inservice Inspection (XI)
(j) Committee on Transport Tanks (XII)
(k) Committee on Overpressure Protection (XIII)
(l) Technical Oversight Management Committee (TOMC)

Where reference is made to "the Committee" in this Foreword, each of these committees is included individually and collectively.

The Committee's function is to establish rules of safety relating to pressure integrity, which govern the construction[**] of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. For nuclear items other than pressure-retaining components, the Committee also establishes rules of safety related to structural integrity. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity and, for nuclear items other than pressure-retaining components, structural integrity. Except for Sections XI and XII, and with a few other exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of components addressed by the Code. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgment* refers to technical judgments made by knowledgeable engineers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code

[*] The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

[**] *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection.

neither requires nor prohibits the use of computers for the design or analysis of components constructed to the requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at http://go.asme.org/BPVCPublicReview to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the Committee. ASME is to be notified should questions arise concerning improper use of the ASME Single Certification Mark.

When required by context in this Section, the singular shall be interpreted as the plural, and vice versa, and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

The words "shall," "should," and "may" are used in this Standard as follows:

- *Shall* is used to denote a requirement.
- *Should* is used to denote a recommendation.
- *May* is used to denote permission, neither a requirement nor a recommendation.

STATEMENT OF POLICY ON THE USE OF THE ASME SINGLE CERTIFICATION MARK AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use the ASME Single Certification Mark for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the ASME Single Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the ASME Single Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the ASME Single Certification Mark, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not "approve," "certify," "rate," or "endorse" any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding the ASME Single Certification Mark and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities "are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code," or "meet the requirements of the ASME Boiler and Pressure Vessel Code." An ASME corporate logo shall not be used by any organization other than ASME.

The ASME Single Certification Mark shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of the ASME Single Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the ASME Single Certification Mark.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the ASME Single Certification Mark described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the ASME Single Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

(21)

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 applicable Boiler and Pressure Vessel (BPV) Standards Committee (hereinafter referred to as the Committee). See the guidelines on approval of new materials under the ASME Boiler and Pressure Vessel Code in Section II, Part D for requirements for requests that involve adding new materials to the Code. See the guidelines on approval of new welding and brazing materials in Section II, Part C for requirements for requests that involve adding new welding and brazing materials ("consumables") to the Code.

Technical inquiries can include requests for revisions or additions to the Code requirements, requests for Code Cases, or requests for Code Interpretations, as described below:

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

(2) Code Cases. Code Cases represent alternatives or additions to existing Code requirements. 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 regulators, jurisdictions, or Owners automatically accept Code Cases. The most common applications for Code Cases are as follows:

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

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

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

(3) Code Interpretations

(-a) Code Interpretations provide clarification of the meaning of existing requirements in the Code and are presented in Inquiry and Reply format. Interpretations do not introduce new requirements.

(-b) Interpretations will be issued only if existing Code text is ambiguous or conveys conflicting requirements. If a revision of the requirements is required to support the Interpretation, an Intent Interpretation will be issued in parallel with a revision to the Code.

(b) Code requirements, Code Cases, and Code Interpretations established by the Committee 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 requirements.

(c) Inquiries that do not comply with the following guidance or that do not provide sufficient information for the Committee's full understanding may result in the request being returned to the Inquirer with no action.

2 INQUIRY FORMAT

Submittals to the Committee should include the following information:

(a) Purpose. Specify one of the following:

(1) request for revision of present Code requirements

(2) request for new or additional Code requirements

(3) request for Code Case

(4) request for Code Interpretation

(b) Background. The Inquirer should 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. This information should include a statement indicating why the included paragraphs, figures, or tables are ambiguous or convey conflicting requirements. Preferably, the Inquirer should provide a copy of, or relevant extracts from, the specific referenced portions of the Code.

(c) Presentations. The Inquirer may desire to attend 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 BPV Standards Committee meeting shall be at the expense of the Inquirer. The Inquirer's attendance or lack of attendance at a meeting will not be used by the Committee as a basis for acceptance or rejection of the Inquiry by the Committee. However, if the Inquirer's request is unclear, attendance by the Inquirer or a representative may be necessary for the Committee to understand the request sufficiently to be able to provide an Interpretation. If the Inquirer desires to make a presentation at a Committee meeting, the Inquirer should provide advance notice to the Committee Secretary, to ensure time will be allotted for the presentation in the meeting agenda. The Inquirer should consider the need for additional audiovisual equipment that might not otherwise be provided by the Committee. With sufficient advance notice to the Committee Secretary, such equipment may be made available.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions should include the following information:

(a) Requested Revisions or Additions. For requested revisions, the Inquirer should identify those requirements of the Code that they believe should be revised, and should submit a copy of, or relevant extracts from, the appropriate requirements as they appear in the Code, marked up with the requested revision. For requested additions to the Code, the Inquirer should provide the recommended wording and should clearly indicate where they believe the additions should be located in the Code requirements.

(b) Statement of Need. The Inquirer should provide a brief explanation of the need for the revision or addition.

(c) Background Information. The Inquirer should 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 requested revision or addition. Sketches, tables, figures, and graphs should be submitted, as appropriate. The Inquirer should identify any pertinent portions of the Code that would be affected by the revision or addition and any portions of the Code that reference the requested revised or added paragraphs.

4 CODE CASES

Requests for Code Cases should be accompanied by a statement of need and background information similar to that described 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) should be described. In addition, it is important that the request is in connection with equipment that will bear the ASME Single Certification Mark, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and should 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 requested Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations should be accompanied by the following information:

(1) Inquiry. The Inquirer should propose a condensed and precise Inquiry, omitting superfluous background information and, when possible, composing the Inquiry in such a way that a "yes" or a "no" Reply, with brief limitations or conditions, if needed, can be provided by the Committee. The proposed question should be technically and editorially correct.

(2) Reply. The Inquirer should propose a Reply that clearly and concisely answers the proposed Inquiry question. Preferably, the Reply should be "yes" or "no," with brief limitations or conditions, if needed.

(3) Background Information. The Inquirer should include a statement indicating why the included paragraphs, figures, or tables are ambiguous or convey conflicting requirements. The Inquirer should provide any need or background information, such as described in 3(b) and 3(c), respectively, for Code revisions or additions, that will assist the Committee in understanding the proposed Inquiry and Reply.

If the Inquirer believes a revision of the Code requirements would be helpful to support the Interpretation, the Inquirer may propose such a revision for consideration by the Committee. In most cases, such a proposal is not necessary.

(b) Requests for Code Interpretations should be limited to an Interpretation of a particular requirement in the Code or in a Code Case. Except with regard to interpreting a specific Code requirement, the Committee is not permitted to 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

(a) Submittal. Requests for Code Interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt. If the Inquirer is unable to use the online form, the Inquirer may mail the request to the following address:

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

All other Inquiries should be mailed to the Secretary of the BPV Committee at the address above. Inquiries are unlikely to receive a response if they are not written in clear, legible English. They must also include the name of the Inquirer and the company they represent or are employed by, if applicable, and the Inquirer's address, telephone number, fax number, and e-mail address, if available.

(b) Response. The Secretary of the appropriate Committee will provide a written response, via letter or e-mail, as appropriate, to the Inquirer, upon completion of the requested action by the Committee. Inquirers may track the status of their Interpretation Request at http://go.asme.org/Interpretations.

PERSONNEL
ASME Boiler and Pressure Vessel Standards Committees, Subgroups, and Working Groups

(21)

January 1, 2021

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M. Moenssens
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S. F. Harrison, Jr., *Contributing Member*

PREFACE TO SECTION XI

INTRODUCTION

Section XI, Division 1, Rules for Inspection and Testing of Components of Light-Water-Cooled Plants, of the ASME Boiler and Pressure Vessel Code provides requirements for examination, testing, and inspection of components and systems, and repair/replacement activities in a nuclear power plant. Application of Division 1 begins when the requirements of the Construction Code have been satisfied.

Section XI, Division 2, Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Power Plants, is a technology-neutral standard of the ASME Boiler and Pressure Vessel Code. It provides requirements for protecting pressure integrity of structures, systems, and components (SSCs) that affect reliability. Application of Division 2 begins when the requirements of the Construction Code have been satisfied. It is applicable regardless of the Construction Code classification used for an SSC if the SSC is designated as important to the safety and reliability of an operating plant.

GENERAL

The rules of this 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.

Division 1 rules require a mandatory program of examinations, testing, and inspections to evidence adequate safety and to manage deterioration and aging effects. 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.

Division 2 rules require the development of a Reliability and Integrity Management (RIM) Program that considers the combination of design, fabrication, degradation mechanisms, inspection, examination, monitoring, operation, and maintenance of SSCs to ensure they will meet their required reliability target values. The rules also stipulate duties of the Authorized Nuclear Inservice Inspector to verify that the program has been completed, implemented, and updated in accordance with the requirements of Division 2.

INSERVICE TESTING OF PUMP AND VALVES

With the 1998 Edition with the 2000 Addenda, all requirements for testing pumps and valves have been removed from Section XI, Division 1. These requirements are now located in the ASME Code for Operation and Maintenance of Nuclear Power Plants.

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;

(c) conduct of the program of examination and tests, system leakage and hydrostatic pressure tests; and

(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, Recommended Rules for the Care and Operation of Heating Boilers, and Section VII, Recommended Guidelines for the Care of Power Boilers, in that the requirements 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 the following:

(a) verifying system pressure tests;

(b) reviewing nondestructive examination procedures and Repair/Replacement Programs and Plans; and

(c) verifying that the visual examinations and tests 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 two Divisions, as follows:

Division 1 = Rules for Inspection and Testing of Components of Light-Water-Cooled Plants
Division 2 = Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Power Plants

2 ORGANIZATION OF DIVISION 1

2.1 SUBSECTIONS

Division 1 is broken down into Subsections that are designated by capital letters, preceded by the letters IW. 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 and CC Components
IWF	Class 1, 2, 3, and MC Component Supports
IWG	Core Internal Structures (In course of preparation)
IWL	Class CC Concrete Components

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

2.2 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
4000	Repair/Replacement Activities
5000	System Pressure Tests
6000	Records and Reports

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 requirements have been prepared with some gaps in the numbering.

2.3 SUBARTICLES

Subarticles are numbered in units of 100, such as IWA-1100 or IWA-1200.

2.4 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.

2.5 PARAGRAPHS

Paragraphs are numbered in units of 1, such as IWA-2131 or IWA-2132.

2.6 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).

3 ORGANIZATION OF DIVISION 2

Division 2 is broken down into Articles that are designated by the capital letters RIM, followed by the Article number. Division 2 Articles consist of the following:

Article	Title
RIM-1	Scope and Responsibility
RIM-2	Reliability and Integrity Management (RIM) Program
RIM-3	Acceptance Standards
RIM-4	Repair/Replacement Activities
RIM-5	System Leak Monitoring and Periodic Tests
RIM-6	Records and Reports
RIM-7	Glossary

Division 2 also maintains Mandatory Appendices that are required for the development and implementation of the RIM Program. Mandatory Appendices consist of the following:

Appendix	Title
I	RIM Decision Flowcharts for Use With the RIM Program
II	Derivation of Component Reliability Targets From Plant Safety Requirements
III	Owner's Record and Report for RIM Program Activities
IV	Monitoring and NDE Qualification
V	Catalog of NDE Requirements and Areas of Interest
VI	Reliability and Integrity Management Expert Panel (RIMEP)
VII	Supplements for Types of Nuclear Plants

Articles are divided into paragraphs and subparagraphs. Appendices are divided into Articles, paragraphs, and subparagraphs.

4 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, IWA-2221, and 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 E71-64 refers to the specification so designated and published by American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428.

(2) Recommended practices for qualifying and certifying nondestructive examination personnel are published by the American Society for Nondestructive Testing (ASNT). These documents are designated SNT-TC-1A and CP-189. A reference to SNT-TC-1A or CP-189 shall be understood to mean the practice and its supplements, so designated and published by the American Society for Nondestructive Testing (ASNT), 1711 Arlingate Lane, P. O. Box 28518, Columbus, OH 43228-0518.

(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. Standards published by ASME are available from ASME (https://www.asme.org/).

(4) Specifications and standards for materials, processes, examination and test procedures, and other requirements of the Code relating to concrete are listed in Table IWA-1600-1, designated by the letters ACI, and are approved and published by the American Concrete Institute. Standards published by the American Concrete Institute can be obtained by writing ACI, Box 19150, 22400 West Seven Mile Road, Detroit, MI 48219.

(5) Specifications and standards for determining water chemistry as identified in Table IWA-1600-1 by the letter designation APHA are approved and published by the American Public Health Association. Standards published by the American Public Health Association can be obtained by writing APHA, 1015 15th Street, NW, Washington, D.C. 20005.

(6) Specifications and standards for welding are listed in Table IWA-1600-1 and are approved and published by the American Welding Society. Standards published by the American Welding Society can be obtained by writing AWS, 8669 NW 36 Street, No. 130, Miami, FL 33166.

(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 Section XI activities; 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.

SUMMARY OF CHANGES

Errata to the BPV Code may be posted on the ASME website 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, **(21)**, placed next to the affected area.

Page	*Location*	*Change*
xxv	List of Sections	*(1)* Listing for Section III updated *(2)* Section XIII added *(3)* Code Case information updated
xxvii	Foreword	*(1)* Subparagraph (k) added and subsequent subparagraph redesignated *(2)* Second footnote revised *(3)* Last paragraph added
xxx	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	Paragraphs 1(a)(3)(-b), 2(b), and 5(a)(3) revised
xxxiii	Personnel	Updated
3	Table IWA-1600-1	AWWA C105 added
5	IWA-2110	*(1)* Title revised *(2)* Subparagraphs (a) and (b) added, and subsequent subparagraphs redesignated
5	IWA-2120	Revised in its entirety
5	IWA-2200	Subparagraph (a) revised
6	IWA-2212	Subparagraph (c) revised
15	IWA-3300	In subpara. (b), last sentence revised
28	IWA-4134	Revised in its entirety
29	IWA-4142.1	Revised in its entirety
30	IWA-4143	Revised
30	IWA-4150	Subparagraphs (b), (c)(1), and (c)(6) revised
31	IWA-4190	Subparagraph (a) revised
31	IWA-4222	Subparagraph (a)(2) revised
32	IWA-4226.2	Subparagraph (c) added
40	IWA-4540	Subparagraph (a) revised, and subpara. (e) added
41	IWA-4610	*(1)* Subparagraph (b)(1) revised and restructured *(2)* Subparagraphs (d) and (e) added
50	IWA-4672	In subpara. (b), last sentence revised
50	IWA-4673	In subpara. (b), last sentence revised

Page	*Location*	*Change*
51	IWA-4683	In subpara. (b), last sentence revised
61	IWA-5241	Subparagraph (c) revised, and subparas. (i) and (j) added
62	IWA-5244	Revised in its entirety
65	IWA-6230	Subparagraph (b)(3) added, and subsequent subparagraphs redesignated
66	IWA-6340	Subparagraph (k) added
68	Article IWA-9000	*(1)* Definitions of *appurtenance, buried component or support, Certificate of Authorization*, and *enforcement authority* revised *(2)* Definitions of *audit, part, piping subassembly, qualified source material*, and *unqualified source material* added
75	IWB-2411	Subparagraphs (a)(2) and (a)(3) revised
76	IWB-2420	*(1)* Subparagraph (b) revised and restructured *(2)* Subparagraphs (g)(1) and (g)(2) deleted
77	Table IWB-2420-1	Added
77	Figure IWB-2420-1	Added
78	IWB-2500	Subparagraph (g) revised
82	Table IWB-2500-1 (B-B)	Under “Extent and Frequency of Examination,” figure citations editorially revised
84	Table IWB-2500-1 (B-D)	*(1)* Under “Examination Requirements/Figure No.,” figure citations editorially revised *(2)* Note (7) revised, and Note (8) added
86	Table IWB-2500-1 (B-F)	Item No. B5.160 and Note (3) added
88	Table IWB-2500-1 (B-G-1)	Under “Examination Requirements/Figure No.,” figure citations revised
92	Table IWB-2500-1 (B-J)	Item No. B9.50 and Note (8) added
97	Table IWB-2500-1 (B-N-1, B-N-2, B-N-3)	Under “Parts Examined,” subheadings editorially revised
98	Table IWB-2500-1 (B-O)	Under “Parts Examined,” subheadings revised; Note (1) revised
117	Figure IWB-2500-12(a)	Top of figure revised
126	IWB-3131	In subpara. (c), last sentence revised
126	IWB-3134	Deleted
129	Table IWB-3510-1	Note (4) revised
131	Table IWB-3512-1	Note (4) revised
133	Table IWB-3514-1	Note (4) revised
132	IWB-3515.2	Subparagraph (a) revised
134	IWB-3515.3	Revised
137	Table IWB-3519.2-1	Note (4) revised
138	Table IWB-3519.2-2	Note (4) revised

Page	*Location*	*Change*
139	IWB-3600	*(1)* Former IWB-3610(b) and IWB-3610(c) revised and redesignated as IWB-3600 *(2)* IWB-3610(a) revised, and former IWB-3610(d) redesignated as IWB-3610(b)
140	Figure IWB-3600-1	*(1)* Former Figure IWB-3610-1 redesignated as Figure IWB-3600-1 *(2)* Title and Note (1) revised
141	IWB-3640	Revised
143	IWB-3700	Paragraph added
145	IWB-5221	Subparagraph (d)(3) added
149	IWC-2200	Subparagraphs (a) and (b)(3) revised
149	IWC-2411	In subpara. (a), first sentence revised
149	IWC-2420	*(1)* Subparagraph (b) revised and restructured *(2)* Subparagraphs (f)(1) and (f)(2) deleted
151	IWC-2500	Subparagraphs (a) and (b) revised, and subpara. (f) added
156	Table IWC-2500-1 (C-D)	Under “Examination Requirements/Figure No.,” figure citations revised
157	Table IWC-2500-1 (C-F-1)	Item No. C5.50 and Note (7) added
161	Table IWC-2500-1 (C-H)	*(1)* For Item No. C7.10, “Acceptance Standard” citation revised *(2)* Item No. C7.20 and Note (2) added
162	Table IWC-2500-1 (C-J)	Added
171	Figure IWC-2500-6(a)	Left side of figure revised
181	IWC-3112	Subparagraph (a)(1) revised
181	IWC-3121	Subparagraph (b) revised
182	IWC-3125	Deleted
183	Table IWC-3410-1	Examination Category C-J added
184	Table IWC-3510-1	Note (4) revised
185	IWC-3510.5	Subparagraphs (a) and (c) revised
186	Table IWC-3511-1	Note (4) revised
186	IWC-3513.1	Subparagraph (a) revised
187	Table IWC-3513-1	Title revised
188	Table IWC-3514-1	Note (4) revised
189	IWC-3516	IWC-3516.1(f) revised, and IWC-3516.2 added
189	IWC-3517	Added
189	IWC-3610	Revised
194	IWD-2200	Revised
194	IWD-2411	In subpara. (a), first sentence revised
194	IWD-2420	Subparagraphs (e)(1) and (e)(2) deleted
195	IWD-2500	Subparagraphs (a) and (b) revised, and subpara. (c) added
198	Table IWD-2500-1 (D-B)	Revised in its entirety

Page	*Location*	*Change*
199	Table IWD-2500-1 (D-C)	Added
202	Table IWD-3410-1	Examination Category D-C added
202	IWD-3511	IWD-3511.1(f) revised, and IWD-3511.2 added
202	IWD-3512	Added
204	IWD-5222	In subpara. (a), “safety-related” corrected by errata to “safety”
207	IWE-1241	Subparagraphs (a) and (b) revised
214	Table IWE-2500-1 (E-G)	Note (2) revised
216	IWE-3122.2	Last sentence added
217	IWE-3200	Revised
217	IWE-3511	Revised and restructured
222	Figure IWF-1300-1	Note (1) added
235	Table IWL-2500-1 (L-B)	In title, “Unbound” corrected by errata to “Unbonded”
236	IWL-2512	Subparagraphs (b) and (b)(6) revised
254	Mandatory Appendix I, Supplement 7	Revised
257	Form NIS-2	“Remarks” line added
258	Table II-1	Item (12) added
259	Form OAR-1	“Remarks” line added
261	Table II-2	Item (28) added
266	III-3310	Revised
296	VII-3130	The word “training” replaced with “practice”
306	VIII-3110	Subparagraph (b) revised, and subpara. (e) added
306	Table VIII-3110-1	*(1)* Under “Piping Welds,” penultimate row revised *(2)* Under “Piping Welds” and “Vessels,” last row added
306	VIII-3120	In subpara. (b), last sentence revised
331	Mandatory Appendix VIII, Supplement 15	Added
346	Figure A-3210-2	In illustration (a), missing arrowhead added for “*d*”
364	Table A-3541-1	Y_1 value for coefficient m_2 corrected by errata to “6.9286 E−02”
381	A-3561	In equation for a_1, “288” corrected by errata to “228”
393	Table A-3610-1	Entries for d/t values 0.01 and 0.1 added
396	Table A-3610-2	Entries for d/t values 0.01 and 0.1 added
399	Table A-3610-3	Entries for d/t values 0.01 and 0.1 added
402	Table A-3610-4	Entries for d/t values 0.01 and 0.1 added
405	Table A-3610-5	Entries for d/t values 0.01 and 0.1 added
408	Table A-3610-6	Entries for d/t values 0.01 and 0.1 added
419	Table A-3630-4	Under aspect ratio 0.03125, first value of G_4 corrected by errata to “0.000 E−00”

Page	*Location*	*Change*
445	Table A-3660-6	Under aspect ratio 0.50, third value of G_2 corrected by errata to "8.899 E−02"
449	A-4300	*(1)* Subparagraph (a)(2) editorially restructured *(2)* In subparas. (b)(2)(-a) and (b)(2)(-b), third definition of S corrected by errata
466	C-2200	Revised in its entirety
485	Figure C-4310-3	Placement of $2a$ and R_2 dimensions corrected by errata
514	C-8410	Subparagraph (a) added, and subsequent subparagraphs redesignated
517	C-8512	In definition of C_1 in subpara. (a), "K_1" corrected by errata to "K_I"
520	Table C-8321-2	Column headings editorially revised
521	Figure C-8410-1	Revised
522	Figure C-8410-1M	Revised
593	Table L-3210-1	*(1)* "% Membrane" column and Notes (2) and (3) added *(2)* In last row, nominal wall thickness values revised
594	Table L-3210-2	*(1)* "% Membrane" column and Notes (2) and (3) added *(2)* In last two columns and last row, nominal wall thickness values revised
593	L-3312	Subparagraph (a) revised
613	Article Q-2000	Subparagraph (d) revised
614	Article Q-3000	Subparagraphs (a) and (b)(2) revised
615	Q-4100	Subparagraphs (b) and (c) revised
615	Figure Q-4100-1	Revised
616	Q-4400	Revised
654	Form RRA-1	First page editorially revised
686	Nonmandatory Appendix Y	Added
707	Nonmandatory Appendix Z	Added

LIST OF CHANGES IN RECORD NUMBER ORDER

DELETED

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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DIVISION 1
RULES FOR INSPECTION AND TESTING OF COMPONENTS OF LIGHT-WATER-COOLED PLANTS

SUBSECTION IWA
GENERAL REQUIREMENTS

ARTICLE IWA-1000
SCOPE AND RESPONSIBILITY

IWA-1100 SCOPE

This Division provides requirements for inservice inspection and testing of light-water-cooled nuclear power plants. The requirements identify 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/replacement activity requirements, including procurement, design, welding, brazing, defect removal, fabrication, installation, examination, and pressure testing.

IWA-1200 JURISDICTION

The jurisdiction of this Division covers individual components and complete plants that have met all the requirements of the Construction Code, commencing 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 for which all of the construction requirements have been met. Prior to installation, an item that has met all requirements of the Construction Code may be corrected using the rules of either the Construction Code or this Division, as determined by the Owner.

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.

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 Subsection IWB shall be applied to those systems whose components are classified ASME Class 1.

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