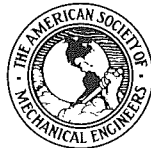


ASME BOILER AND PRESSURE VESSEL CODE
AN AMERICAN NATIONAL STANDARD
ANSI/ASME BPV-I

SECTION I
Rules for Construction of
Power Boilers

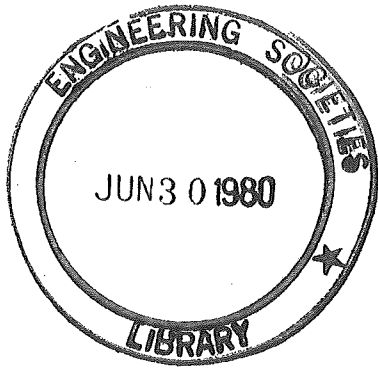
1980 EDITION

JULY 1, 1980



ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON POWER BOILERS

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
United Engineering Center 345 East 47th Street New York, N.Y. 10017



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1980 ASME BOILER AND PRESSURE VESSEL CODE

An American National Standard

Sections*

- I Power Boilers
- II Material Specifications
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 - Part B — Nonferrous Materials
 - Part C — Welding Rods, Electrodes and Filler Metals
- III Subsection NCA — General Requirements for Division 1 and Division 2
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- XI Rules for Inservice Inspection of Nuclear Power Plant Components — Division 1

*Available in bound and loose-leaf editions. Either version may be used for ASME Certification.

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. The cases which have been adopted appear in one or both of the 1980 Code Cases books—(1) Boiler and Pressure Vessels and (2) Nuclear Components. Supplements will be sent automatically to the purchasers of one or both of the Code Cases books up to the publication of the 1983 Edition.

Interpretations

Each issue of the Interpretations includes all of the written replies issued during successive 6-month intervals by the Secretarial Staff, speaking on behalf of the ASME Boiler and Pressure Vessel Committee, to inquiries concerning interpretations of technical aspects of the Code. The inquiries and replies are presented chronologically in groupings determined by the Code Sections to which they apply. Issues are published twice a year. Purchasers of the Interpretations will receive the six issues (Nos. 6-11) that will be published up to the publication of the 1983 Code.

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 1983 Code. Purchasers of the bound versions of the Sections will receive bound Addenda. Purchasers of the loose-leaf versions of the Sections will receive replacement pages.

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 approved 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.

After Code revisions are approved by Council they may be used beginning with the date of issuance shown on the Addenda. Revisions become mandatory as minimum requirements six months after such date of issuance except for boilers or pressure vessels contracted for prior to the end of the six-month period.

Manufacturers and users of components are cautioned against making use of revisions and Cases that are less restrictive than former requirements without having assurance that they have been accepted by the proper authorities in the jurisdiction where the component is to be installed.

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, methods of fabrication, inspection, and safety devices. Permission may be granted to regulatory bodies and organizations pub-

lishing 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. Its function is clearly recognized and, as a result, inquiries received which bear on the administration or application of the rules are referred directly to the National Board. Such handling of this type of inquiry not only simplifies the work of the Boiler and Pressure Vessel Committee, but action on the problem for the inquirer is thereby expedited. Where an inquiry is neither clearly an interpretation of the rules nor a problem of application or administration, it may be considered both by the Boiler and Pressure Vessel Committee and the National Board.

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 base 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 one or more Sections of the Boiler and Pressure Vessel Code. All materials allowed by these various Sections and used for construction within the scope of their rules shall be furnished in accordance with ASME Material Specifications contained in Section II except where otherwise provided in Code Cases or in the applicable Section of the Code. Materials covered by these Specifications are acceptable for use in items covered by the Code Sections only to the degree indicated in the applicable Section. Materials for Code use should preferably be ordered, produced, and documented on this basis; however, material produced under an ASTM Specification may be used in lieu of the corresponding ASME Specification, provided that the requirements of the ASTM Specification are identical (excluding editorial differences) or more stringent than the ASME Specification for the Grade, Class, or Type produced and provided that the material is confirmed as complying with the ASTM Specification. Material produced to an ASTM specification with requirements different from the requirements of the corresponding ASME Specification may also be used in accordance with the above, provided the material manufacturer or vessel manufacturer certifies with evidence acceptable to the Authorized Inspector or Authorized Nuclear Inspector that the corresponding ASME Specification requirements have been met. Material produced to an ASME or ASTM Material Specification is not limited as to country of origin.

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, construction, or activities "are built (produced or performed) as 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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W. M. Beyerly	W. A. Polvie
B. G. Carlton	J. L. Perkins
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PREAMBLE

This Code covers rules for construction of power boilers,¹ electric boilers,² miniature boilers³ and high-temperature water boilers⁴ to be used in stationary service and includes those power boilers used in locomotive, portable, and traction service. Reference to a paragraph includes all the subparagraphs and subdivisions under that paragraph.

The Code does not contain rules to cover all details of design and construction. Where complete details are not given, it is intended that the manufacturer, subject to the approval of the Authorized Inspector, shall provide details of design and construction which will be as safe as otherwise provided by the rules in the Code.

The scope of jurisdiction of Section I applies to the boiler proper and to the boiler external piping.

Superheaters, economizers, and other pressure parts connected directly to the boiler without intervening valves shall be considered as parts of the boiler proper, and their construction shall conform to Section I rules.

Boiler external piping shall be considered as that piping which begins where the boiler proper terminates at:

- (a) the first circumferential joint for welding end connections; or
- (b) the face of the first flange in bolted flanged connections; or
- (c) the first threaded joint in that type of connection; and which extends up to and including the valve or valves required by this Code.

ASME Code Certification (including Data Forms and Code Symbol Stamping), and/or inspection by the Authorized Inspector, when required by this Code, is required for the boiler proper and the boiler external piping.

Construction rules for materials, design, fabrication, installation, and testing of the boiler external piping are contained in ANSI B31.1—Power Piping. Piping beyond the

valve or valves required by Section I is not within the scope of Section I, and it is not the intent that the Code Symbol Stamp be applied to such piping or any other piping.

The material for forced-circulation boilers, boilers with no fixed steam and water line, and high-temperature water boilers shall conform to the requirements of the Code. All other requirements shall also be met except where they relate to special features of construction made necessary in boilers of these types, and to accessories that are manifestly not needed or used in connection with such boilers, such as water gages, water columns, and gage cocks.

Reheaters receiving steam which has passed through part of a turbine or other prime mover and separately fired steam superheaters which are not integral with the boiler are considered fired pressure vessels and their construction shall comply with Code requirements for superheaters, including safety devices. Piping between the reheater connections and the turbine or other prime mover is not within the scope of the Code.

A pressure vessel in which steam is generated by the application of heat resulting from the combustion of fuel (solid, liquid, or gaseous) shall be classed as a fired steam boiler.

Unfired pressure vessels in which steam is generated shall be classed as unfired steam boilers with the following exceptions:

- (a) Vessels known as evaporators or heat exchangers.
- (b) Vessels in which steam is generated by the use of heat resulting from operation of a processing system containing a number of pressure vessels such as used in the manufacture of chemical and petroleum products.

Unfired steam boilers shall be constructed under the provisions of Section I or Section VIII.

Expansion tanks required in connection with high-temperature water boilers shall be constructed to the requirements of Section I or Section VIII.

A pressure vessel in which an organic fluid is vaporized by the application of heat resulting from the combustion of fuel (solid, liquid, or gaseous) shall be constructed under the provisions of Section I. Vessels in which vapor is generated incidental to the operation of a processing system, containing a number of pressure vessels such as used in chemical and petroleum manufacture, are not covered by the rules of Section I.

¹Power boiler—a boiler in which steam or other vapor is generated at a pressure of more than 15 psi (100 kPa).

²Electric boiler—a power boiler or a high-temperature water boiler in which the source of heat is electricity.

³Miniature boiler—a power boiler or a high-temperature water boiler in which the limits specified in PMB-2 are not exceeded.

⁴High-temperature water boiler—a water boiler intended for operation at pressures in excess of 160 psi (1100 kPa) and/or temperatures in excess of 250°F (121°C).

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PART PG

GENERAL REQUIREMENTS FOR ALL METHODS OF CONSTRUCTION

GENERAL

PG-1 SCOPE

The requirements of Part PG apply to power boilers and high pressure, high-temperature water boilers and to parts and appurtenances thereto and shall be used in conjunction with the specific requirements in the applicable parts of this Section that pertain to the methods of construction used.

PG-2 SERVICE LIMITATIONS

2.1 The rules of this Section are applicable to the following services:

- (a) boilers in which steam or other vapor is generated at a pressure of more than 15 psig (103 kPa gage);
- (b) high-temperature water boilers intended for operation at pressures exceeding 160 psig (1100 kPa gage) and/or temperatures exceeding 250°F (121°C).

2.2 For services below those specified in PG-2.1 it is intended that rules of Section IV apply; however, boilers for such services may be constructed and stamped in accordance with this Section provided all applicable requirements are met.

2.3 It is not the intent of these rules to cover coil-type hot water boilers without any steam space where water flashes into steam when released through a manually operated nozzle for cleaning machinery, equipment, buildings, etc., unless one of the following limitations is exceeded:

- (a) $\frac{3}{4}$ in. (19 mm) diameter tubing or pipe size with no drums or headers attached;
- (b) nominal water containing capacity not exceeding 6 gal (23 l);
- (c) water temperature not exceeding 350°F (177°C);
- (d) steam not generated within the coil.

Steam cleaners exempt by this classification shall be provided with adequate safety relief valves and controls.

MATERIALS

PG-5 GENERAL

5.1 Material subject to stress due to pressure shall conform to one of the specifications given in Section II and shall be limited to those that are listed in Tables PG-23.1 and PG-23.2 except as otherwise permitted in PG-8.2, PG-8.3, PG-10, and PG-11. Materials shall not be used at temperatures above those for which stress values are given in Tables PG-23.1 and PG-23.2. Specific additional requirements¹ described in PG-5 through PG-13 shall be met as applicable.

5.2 Material covered by specifications in Section II is not restricted as to the method of production unless so stated in the specification, and as long as the product complies with the requirements of the specification.

5.3 If, in the development of the art of boiler construction, it is desired to use materials other than those herein described, data should be submitted to the Boiler and Pressure Vessel Committee in accordance with A-75 to A-80. Material not completely identified with any approved Code specifications may be used in the construction of boilers under the conditions outlined in PG-10.

5.4 Materials outside the limits of size or thickness given in the title or scope clause of any specification in

¹For example, PG-9.1 does not allow the use of austenitic stainless steel for boiler pressure parts which are water wetted in normal operation, but PG-9.2 includes austenitic stainless steels in the acceptable materials for normally steam-touched service such as superheaters and reheaters.