ASME BOILER AND PRESSURE VESSEL CODE

1980 EDITION

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

SECTION II

AN AMERICAN NATIONAL STANDARD

ANSI / ASME BPV-IIB

Material Specifications Part B

Nonferrous Materials

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

SECTION II
Material Specifications
Part B — Nonferrous

1980 EDITION
JULY 1, 1980

ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON MATERIALS

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
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1980 ASME
BOILER AND PRESSURE VESSEL CODE

An American National Standard

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*Available in bound and loose-leaf versions. 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. Those Cases which have been adopted appear in one or both of the 1980 Code Cases books—(1) Boilers 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 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. 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.

GUIDELINE ON THE ADOPTION OF NEW BASE MATERIALS FOR THE ASME BOILER AND PRESSURE VESSEL CODE

The ASME Boiler and Pressure Vessel Committee considers requests for adoption of new materials desired by the owner/user or fabricator, manufacturer, installer, assembler of boilers, pressure vessels, or components constructed to the Code. That the material receive proper consideration by the appropriate subcommittees, information and data are required to properly categorize the material. In general, this information and data include, but are not necessarily limited to, the following information:

The proposed chemical composition should include those elements that establish the characteristics and behavior of the material.

The mechanical properties for the material should include tensile test data, ductility data, and other special mechanical test data which will assist the Committee in its review of the material and its application.

Tensile test data (per ASTM E 21), including both ultimate tensile strength and yield strength, should be at room temperature and at 100°F or 50°C intervals to a temperature at least 100°F higher than the intended use of the material. When creep properties may be expected to limit the allowable stress, creep and creep rupture data at temperature intervals of 100°F or 50°C are also required. Such data should be four or more time intervals, one of which should be longer than 2000 hr, but less than 6000 hr, and one of which should be longer than 6000 hr.

Toughness data on base and weld metal (including heat affected zone) may also be required. It is preferred that these data include temperature-toughness curves of material subjected to heat treatment(s) representative of the finished fabricated product. The toughness testing data should be obtained using methods and procedures outlined in the applicable sections of the Code under which the material is to be used.

If the material is to be used in welded construction, data from actual welding tests made in accordance with Section IX of the Code are recommended. This should also include the welding processes and weld filler metal(s) intended for the fabrication of the material, all-weld-metal tensile test data for temperatures representative of intended service, any special restrictions on the welding of the material, and with the appropriate postweld heat treatment, if any, which will be given the material. If postweld heat treatment results in embrittlement of the material, the significance of such treatments with substantiating data should be forwarded. Toughness data on weld metal and heat affected zone in the as-welded and postweld heat treated conditions, when appropriate, should be submitted.

Where the material is intended for special applications, requires special handling, requires special welding procedures, or has known limitations or susceptibility to failure in certain services, precautionary requirements and information should be included in the submittal of the necessary data for Committee review.

The forms[1] of materials which are needed for construction in accordance with the Code and the Sections of the Code[2] for which application is to be considered will be required.

The general data recommended should be submitted on a minimum of three heats of material, preferably commercial heats of material. Where the chemical range will have an effect on the mechanical properties, the heats selected must cover both the high and low range of the effective chemical elements to show the effect on the mechanical properties. Any special heat treatment, whether applied by the material suppliers

[1]Product forms, such as sheet, strip, plates, bars, shapes, seamless or welded pipe or tube, forging, casting, etc.
[2]Section I, III, IV, or VIII, Division 1 or 2.

or the fabricator, should be applied to these test pieces in preparation of the data. If the material is presently covered by an ASTM specification, please enclose the specification number(s) and grade(s) involved in your application. If the material is not in ASTM specifications covering the product forms required, it will be necessary to apply to ASTM for specification coverage of this material.

Should there be a need for Code use prior to the inclusion of the material in ASTM Specifications, the Committee will consider the issuance of a Code Case. In addition to the information and data noted above, the Committee should be provided with an indication of user need, the letter to ASTM requesting specification coverage, and sufficient information for the Committee to modify an appropriate existing ASME or ASTM Specification to establish the material specification requirements for the material product form.

The foregoing is a general outline of the data which the Committee may need for appropriate review of new material. The applicable Sections for construction should be reviewed for any additional guidance, such as fatigue data for the requirements of Section III or Section VIII, Division 2. If the intended use of the new material is in elevated temperature nuclear construction, the proposer should request a copy of the special publication titled "Guidelines for Required Data on New Materials for Elevated Temperature Nuclear Construction" (approved January 8, 1976).

When the new material is a minor modification of a Code approved material, the data required may be reduced with the concurrence of the Committee. When the data supplied is insufficient for an adequate elevation, the Committee will request additional data. Such requests will be forwarded to inquirers, indicating those areas in which additional information is required.

STATEMENT OF POLICY ON THE USE OF CODE SYMBOLS AND CODE AUTHORIZATION IN ADVERTISING

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

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

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

The ASME Symbol shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of a Code Symbol who may also use the facsimile in advertising to show that clearly specified items will carry the symbol. General usage is permitted only when all of a manufacturer's items are constructed under the Rules.

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

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

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

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

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PREFACE

The American Society of Mechanical Engineers (ASME) and the American Society for Testing and Materials (ASTM) have cooperated for more than fifty years in the preparation of material specifications adequate for safety in the field of pressure equipment for ferrous and nonferrous materials, contained in Section II (Part A—Ferrous and Part B—Nonferrous) of the ASME Boiler and Pressure Vessel Code.

The evolution of this cooperative effort is contained in Professor A. M. Greene's "History of the ASME Boiler Code," which was published as a series of articles in *Mechanical Engineering* from July 1952 through August 1953 and is now available from ASME in a special bound edition. The following quotations from this history, which was based upon the minutes of the ASME Boiler and Pressure Vessel Committee, will help focus on the cooperative nature of the specifications found in Section II, Material Specifications.

"General discussion of material specifications comprising Paragraphs 1 to 112 of Part 2 and the advisability of having them agree with ASTM specifications," (1914).

"ASME Subcommittee appointed to confer with ASTM," (1916).

"Because of this cooperation the specifications of the 1918 Edition of the ASME Boiler Code were more nearly in agreement with ASTM specifications. In the 1924 Edition of the Code, 10 specifications were in complete agreement with ASTM specifications, 4 in substantial agreement and 2 covered materials for which ASTM had no corresponding specifications."

"In Section II, Material Specifications, the paragraphs were given new numbers beginning with S-1 and extending to S-213," (1925).

"Section II was brought into agreement with changes made in the latest ASTM specifications since 1921," (1932).

"The Subcommittee on Material Specifications arranged for the introduction of the revisions of many of the specifications so that they would agree with the latest form of the earlier ASTM specifications. . .," (1935).

From the preceding, it is evident that many of the material specifications were prepared by the Boiler and Pressure Vessel Code Committees, then subsequently, by cooperative action, modified and identified as ASTM specifications. Section II, Parts A and B, currently contain many material specifications which are identical with the corresponding ASTM specifications and some which have been modified for Code usage.

In 1969, the American Welding Society began publication of specifications for welding rods, electrodes, and filler metals, hitherto issued by ASTM. The Boiler and Pressure Vessel Committee has recognized this new arrangement, and is now working with AWS on these specifications. Section II, Part C, contains the welding material specifications approved for Code use.

All identical specifications are indicated by the ASME/ASTM symbols or the ASME/AWS symbols. The ASME Boiler and Pressure Vessel Committee has given careful consideration to each new and revised ASTM or AWS specification, and has made such changes as they deemed necessary to make the specification adaptable for Code usage. In addition, ASME has furnished ASTM with the basic requirements that should govern many proposed new specifications. Joint action will continue an effort to make the ASTM, AWS, and ASME specifications identical.

To assure that there will be a clear understanding on the part of the users of Section II, ASME publishes both the identical specifications and those amended for Code usage in three parts every three years, in the same page size to match the other sections of the Code, and Addenda are issued every six months to provide the latest changes in Section II specifications.

The ASME Boiler and Pressure Vessel Code has been adopted into law by 45 states and many municipalities in the United States and by all of the Canadian Provinces.

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SPECIFICATION FOR COPPER PLATES FOR LOCOMOTIVE FIREBOXES

SB-11

(Identical with ASTM Specification B 11-78 for the alloys covered, Section 19 Certification has been added and editorial changes made. Minimum yield strength requirements are mandatory.)

1. Scope

1.1 This specification covers copper plates for locomotive fire boxes. The following coppers are covered:

Copper No.	Previously Used Designation	Type of Copper
110	ETP	Electrolytic tough pitch
122	DHP	Phosphorized, high residual phosphorus
125	FRTP	Fire-refined, tough pitch
142	DPA	Phosphorized, arsenical

NOTE 1—Tough pitch copper (nonarsenical) may be furnished at the option of the manufacturer as either Copper No. 110 or 125.

NOTE 2—The values stated in U.S. customary units are to be regarded as the standard.

2. Applicable Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.1.1 *ASTM Standards:*

E 8, Tension Testing of Metallic Materials

E 29, Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values

E 53, Chemical Analysis of Copper (Electrolytic Determination of Copper)

E 55, Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition

E 62, Chemical Analysis of Copper and Copper-Base Alloys

3. Definitions

3.1 The following definitions shall apply:

3.1.1 *plate*—a rolled flat product over 0.188 in. (4.78 mm) thick and over 12 in. (305 mm) wide, in straight lengths.

3.1.2 *lengths*—straight pieces of the product.

3.1.2.1 *ends*—straight pieces, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specific lengths. They are subject to minimum length and maximum weight requirements.

3.1.2.2 *mill*—straight lengths, including ends, that can be conveniently manufactured in the mills. Full length pieces are usually 8, 10, or 12 ft (2.44, 3.05, or 3.66 m) and subject to established length tolerances.

3.1.2.3 *specific*—straight lengths that are uniform in length, as specified, and subject to established length tolerances.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Copper No. (Section 1),

4.1.2 Dimensions: length, width, thickness (Section 9 and Table 2),

4.1.3 Weight: total weight of each size.

NOTE 3—When these plates are to be welded either Copper No. 122 or 142 should be specified.

5. Materials and Manufacture

5.1 The material shall be of such quality and purity that the finished product shall have the properties and characteristics prescribed in this specification.

5.2 The copper shall be hot rolled from suitable cakes which may be either fire refined or electrolytic.

6. Chemical Requirements

6.1 The copper shall conform to the requirements as to chemical composition prescribed in Table 1.

7. Tensile Requirements

7.1 The material shall conform to the requirements in Table 2 as to tensile properties.