ASME BOILER AND PRESSURE VESSEL CODE
AN AMERICAN NATIONAL STANDARD

SECTION VII

Recommended Rules for Care of Power Boilers

1983 EDITION

JULY 1, 1983

ASME BOILER AND PRESSURE VESSEL COMMITTEE
SUBCOMMITTEE ON POWER BOILERS
SUBGROUP ON CARE OF POWER BOILERS

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

An American National Standard

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ADDENDA

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

Interpretations

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

CODE CASES

The Boiler and Pressure Vessel Committee meets regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases which have been adopted appear in one or both of the 1983 Code Cases books: (1) Boilers and Pressure Vessels and (2) Nuclear Components. Supplements will be sent automatically to the purchasers of one or both the Code Cases books up to the publication of the 1986 Edition. The Code Cases books are not available in a separate SI Edition.

FOREWORD

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

The Committee's function is to establish rules of safety governing the design, fabrication, and inspection during construction of boilers and pressure vessels, and to interpret these rules when questions arise regarding their intent. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property and to provide a margin for deterioration in service so as to give a reasonably long safe period of usefulness. Advancements in design and material and the evidence of experience have been recognized.

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

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

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

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

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

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.

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.

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

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

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

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

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

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

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

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

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

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

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PREAMBLE

The purpose of these rules is to promote safety in the use of power boilers.

With respect to the application of these rules, a power boiler is a pressure vessel constructed in compliance with Section I and in which steam is generated, for use external to the boiler, at a pressure exceeding 15 psig the application of heat. This heat may be derived from the combustion of fuel (solids, liquids, or gases), from the hot waste gases of other chemical reactions, or from the application of electrical energy.

The term "power boiler" in this Code Section includes stationary, portable, and traction types, but does not include locomotive and high temperature water boilers (Section I), nuclear power plant (Section III), heating boilers (Section IV), miniature boilers (Section I), pressure vessels (Section VIII), or marine boilers.

These rules apply to the boiler proper and to pipe connections up to and including the valve or valves as required by the Code. Superheaters, reheaters, economizers, or other pressure parts connected directly to the boiler without intervening valves shall be considered as part of the boiler. Rules are also given covering auxiliary equipment in so far as safety is involved.

Since these rules have been compiled to assist operators of power boilers in maintaining their plants in as safe a condition as possible, the subject of economy has received only incidental consideration.

The difficulty in formulating a set of rules that may be applied to all sites and types of plants is recognized; therefore, it may be allowable or advisable to depart from them in specific cases. Such departure should be made only when approved by specifically authorized parties. The use of Manufacturers' operating instructions and other recommended procedures (such as National Fire Protection Association's codes covering prevention of furnace explosions) is suggested for guidance in cases not covered in detail herein and when not in violation of the intent of these rules.

DESCRIPTION OF RULES

1. *Rules for Routine Operation.* These rules are basic and govern the proper procedure in performing the ordinary duties of operating and maintaining steam boilers.
2. *Rules for Operating and Maintaining Boiler Appliances.* These rules are also basic in character and are classified to give collectively the rules pertaining to any one boiler appliance.
3. *Rules for Inspection.* These rules apply only to those who are responsible for the inspection and operation of boiler plants and must not be considered as applying to the state, municipal, or insurance companies' inspectors. Consideration should be given to the importance of continual inspection as compared with periodic inspection.
4. *Rules for the Prevention of Direct Causes of Boiler Failures.* These rules are intended as a guide and assistance to those who desire to make a more comprehensive study of the care of steam boilers in service. Their scope, including the entire boiler plant, is wider than that of the Rules for Routine Operation and the Rules for Operation of Boiler Auxiliaries. These rules are divided into three major subdivisions: Overpressure, Weakening of Structure, and Operation of Combustion Equipment. The rules on Overpressure deal with conditions which may cause boiler failure by subjecting the boiler to stresses greater than those for which it was designed. The rules on Weakening of Structure deal with conditions which may cause boiler failure by weakening the boiler structure to such an extent that it cannot withstand the stresses for which it was designed. The rules on Operation of Combustion Equipment point out rules and precautions to be taken to prevent failures due to misoperation of combustion equipment.
5. *Partial Rules for Design of Installation.* These rules are not complete. They treat with some conditions which are not encountered in Section I.
6. *Rules for Operation of Boiler Auxiliaries.* These rules relate to the operation and maintenance of Power Boiler Auxiliaries used in stationary service, in order to provide safe operation conditions for the boilers being served. Also included are rules for safe operation of the auxiliaries themselves.
7. *Rules for Control of Internal Chemical Conditions.* These rules relate to the internal cleaning of boilers; the laying-up of boilers; deposits of solid material on internal surfaces; corrosion of internal surfaces; cracking and embrittlement of boiler steel; contamination of steam; and sampling, testing, and reporting of analyses of water and steam.

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RULES FOR ROUTINE OPERATION

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SUBSECTION C1
RULES FOR ROUTINE OPERATION

C1.100 HANDLING FUEL-BURNING EQUIPMENT

C1.101 Safe and reliable operation is dependent to a large extent upon the skill and attentiveness of the operator and the maintenance personnel. Operating skill implies the following:

(a) knowledge of fundamentals

(b) familiarity with equipment

(c) suitable background of training and experience

Full and effective use should be made of manufacturer's instruction books on operation and maintenance. Of special importance are written procedures prepared expressly for each installation as established by the manufacturers' service engineers and qualified operating organization before and during the commissioning period. These procedures are based on actual experience and often include invaluable information on what the equipment is expected to do, what it is not expected to do, and, in addition, what limitations are critical to reliable and safe operation such as thermal shock, overheating, fuel combustion safety, etc.

Specific attention is called to other published rules such as National Fire Protection Association's publications, No. 85-1973, "Standards for Prevention of Furnace Explosions in Fuel Oil and Gas Fired Water Tube Boilers with Single Burners"; 85B-1973, "Standards for Prevention of Furnace Explosions in Multiple Burner Gas Fired Boilers"; 85D-1973, "Standards for Prevention of Furnace Explosions in Multiple Burner Fuel Oil Fired Boilers"; and 85E-1973, "Standards for Prevention of Furnace Explosions in Pulverized Fuel Fired Boilers." It is recommended that those in charge of boiler and plant design and operation take advantage of such information in these publications as does not contravene the safety requirements stated or implied herein.

Control systems now in widespread use vary in complexity from computer control to manual operation. Regardless of the type of system used, the operators should be thoroughly trained so that they can maintain safe and continuous operation during changeover from "automatic" to remote manual as well as to continue operation with any or all of the modulating systems out of service. The operator should have sufficient intelligent information at the point of manual operation to be aware of operating conditions at all times. Regularly scheduled changeover, manual-operation, and emergency drills to prevent loss of this skill are recommended.

C1.102 Before lighting a fire or before initial application of heat from other sources, all pertinent instrumentation should be checked out to assure that it has been calibrated and made ready for service. Control devices should be given a "dry run" wherever feasible to check their operability, including travel limits and freedom of motion of dampers, valves, and other mechanisms. Interlocks should be tested by simulating failure of, or shutdown of, interlocked equipment. For example, fan failure should be simulated to check tripping action of solenoid-actuated fuel shutoff devices. In like manner, the simulated failure of coal pulverizers should shut down related coal feeders. For pumped-circulation steam generators, simulated circulating-pump failure should cause tripping of fuel shutoff devices. For once-through steam generators, the loss of water flow or reduction of water flow below safe minimum rate should cause tripping of fuel shutoff devices.

C1.103 The boiler furnace, generating bank, economizer, air heater, and ducts should be adequately purged before any source of ignition (igniter, pilot flame) is introduced into the furnace to insure that no fuel has accumulated in the unit. The purge, usually air, should be at a sufficient rate to provide adequate velocity to clear dead spots or inactive pockets and should be sufficient to sweep the entire unit. Purge-air flow rates of 25% to 75% and purge time of 3 to 5 min or 8 air changes are considered adequate. This precaution should also be always observed after an