

1996 Addenda

Date of Issue: December 31, 1996

ASME BOILER AND PRESSURE VESSEL CODE An Internationally Recognized Code

SECTION I Power Boilers

1995 Edition

Addenda to the 1995 Edition of the Code are issued in the form of replacement pages. Revisions, additions, or deletions are incorporated directly into the affected pages. It is advisable, however, that these title sheets and all replaced pages be retained for reference.

SUMMARY OF CHANGES

This is the second Addenda to be published to the 1995 Edition of Section I. A previous Addenda was published in 1995.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **A96**, placed next to the affected area. Previous Addenda changes are indicated by **A95**. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	Location	Change
iii	List of Sections	Updated to include new Division 3 under Section VIII
v	Foreword	Fourth paragraph revised
xi-xx	Personnel	Updated to reflect A96
xxi	I Contents	Updated to reflect A96
6	PG-6.1	SA-442 entry deleted
11, 12	PG-16.3	NPS entry revised
32	Table PG-39	Under Pressures above 300 psi, NPS entries corrected to inches by Errata
48, 48.1	PG-60.1.1	(1) Second paragraph revised (2) Final paragraph added
50	PG-60.6.1	NPS entry revised
	PG-60.6.3	NPS entry revised
51	PG-61.3	NPS entries revised
55	PG-67.6	NPS entry revised
58	PG-71.3	NPS entries revised
60	PG-73.1.5	NPS entries revised

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Page	Location	Change
64	PG-91	Revised
	PG-99	Corrected by Errata
	Footnote 21	Added
69	PG-106.7	Revised in its entirety
	PG-106.8	Revised in its entirety
70	PG-109.2	NPS entries revised
71	PG-112.1	Revised
72, 72.1	PG-112.2.2	Revised in its entirety
	PG-112.2.4	Revised in its entirety
	PG-112.2.8	Added
	PG-112.3	Revised in its entirety
96	PW-40.2(2)	Revised
108	PW-54.1	Revised
110.1–110.9	Part PB	Added
124, 125	PFT-19.2	First line corrected by Errata
132, 132.1	PFT-31	(1) PFT-31.1 and PFT-31.2 revised in their entirety (2) PFT 31.3 and PFT-31.4 added
163, 164	Appendix Contents	Updated to reflect A96
177–180	A-30	New designator added
	A-33–A-40	Deleted
	A-44	Revised
	Table A-44	Title revised
	A-45	First paragraph deleted
	A-49–A-63.1	Deleted
	A-64	Title added
185	A-68	NPS entries revised
209	Data Report Forms and Guides Contents	Updated to reflect A96
211	A-350	Revised in its entirety
227	A-352	Items 4 and 8 revised
233, 234	Form P-4	Revised
235, 236	A-354	Revised
246.1, 246.2	Form P-7	Added
246.3, 246.4	A-356	New A-356 added
247	A-357	Original A-356 redesignated as A-357
250	Table A-360	B31.1 entry revised
263–270	Index	Updated to reflect A96

NOTE:

Volume 39 of the Interpretations to Section I of the ASME Boiler and Pressure Vessel Code follows the last page of the Addenda. The interpretations are not part of the Code or the Addenda and are included for information only.

1995 ASME BOILER AND PRESSURE VESSEL CODE

A95
A96

SECTIONS

- I Rules for Construction of Power Boilers
- II Materials
 - Part A — Ferrous Material Specifications
 - Part B — Nonferrous Material Specifications
 - Part C — Specifications for Welding Rods, Electrodes, and Filler Metals
 - Part D — Properties
- III Subsection NCA — General Requirements for Division 1 and Division 2
- III Division 1
 - Subsection NB — Class 1 Components
 - Subsection NC — Class 2 Components
 - Subsection ND — Class 3 Components
 - Subsection NE — Class MC Components
 - Subsection NF — Supports
 - Subsection NG — Core Support Structures
 - Subsection NH — Class 1 Components in Elevated Temperature Service
 - Appendices
- III Division 2 — Code for Concrete Reactor Vessels and Containments
- IV Rules for Construction of Heating Boilers
- V Nondestructive Examination
- VI Recommended Rules for the Care and Operation of Heating Boilers
- VII Recommended Guidelines for the Care of Power Boilers
- VIII Rules for Construction of Pressure Vessels
 - Division 1
 - Division 2 — Alternative Rules
 - Division 3 — Alternative Rules for Construction of High Pressure Vessels*
- IX Welding and Brazing Qualifications
- X Fiber-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Power Plant Components

ADDENDA

Colored-sheet Addenda, which include additions and revisions to individual Sections of the Code, are published annually and will be sent automatically to purchasers of the applicable Sections up to the publication of the 1998 Code. The 1995 Code is available only in the loose-leaf format; accordingly, the Addenda will be issued in the loose-leaf, replacement-page format.

INTERPRETATIONS

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. The Interpretations for each individual Section will be published separately and will be included as part of the update service to that Section. They will be issued semiannually (July and December) up to the publication of the 1998 Code. Interpretations of Section III, Divisions 1 and 2, will be included with the update service to Subsection NCA. Interpretations are not part of the Code or the Addenda.

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 will appear in the appropriate 1995 Code Cases book: (1) Boilers and Pressure Vessels and (2) Nuclear Components. Supplements will be sent automatically to the purchasers of the Code Cases books up to the publication of the 1998 Code.

* Projected publication in 1997.

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.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction¹ activities. The Code does not address all aspects of these activities and those aspects which 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 designers 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 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 they are responsible for the application of these programs to their design.

The Code does not fully address tolerances. When dimensions, sizes, or other parameters are not specified with tolerances, the values of these parameters are considered nominal and allowable tolerances or local variances may be considered acceptable when based on engineering judgment and standard practices as determined by the designer.

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 revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Boiler and Pressure Vessel 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 Mandatory Appendix covering preparation of technical inquiries). 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 ASME.

Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute and published in *Mechanical Engi-*

¹ *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

A95
A96

neering to invite comments from all interested persons. After the allotted time for public review and final approval by ASME, revisions are published annually 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 ASME.

A95

After Code revisions are approved by ASME, they may be used beginning with the date of issuance shown on the Addenda. Revisions, except for revisions to material specifications in Section II, Parts A and B, become mandatory 6 months after such date of issuance, except for boilers or pressure vessels contracted for prior to the end of the 6 month period. Revisions to material specifications are originated by the American Society for Testing and Materials (ASTM) and other recognized national or international organizations, and are usually adopted by ASME. However, those revisions may or may not have any effect on the suitability of material, produced to earlier editions of specifications, for use in ASME construction. ASME material specifications approved for use in each construction Code are listed in the Appendices of Section II, Parts A and B. These Appendices list, for each specification, the latest edition adopted by ASME, and earlier and later editions considered by ASME to be identical for ASME construction.

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 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 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 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.

The Code 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. Laws or regulations issued by municipality, state, provincial, federal, or other enforcement or regulatory bodies having jurisdiction at the location of an installation establish the mandatory applicability of the Code rules, in whole or in part, within their jurisdiction. Those laws or regulations may require the use of this Code for vessels or components not considered to be within its Scope or may establish additions or deletions in that Scope. Accordingly, inquiries regarding such laws or regulations are to be directed to the issuing enforcement or regulatory body.

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 ASME Boiler and Pressure Vessel Committee. ASME is to be notified should questions arise concerning improper use of an ASME Code symbol.

The specifications for materials given in Section II are identical with or similar to those of specifications published by ASTM, AWS, and other recognized national or international organizations. When reference is made in an ASME material specification to a non-ASME specification for which a companion ASME specification exists, the reference shall be interpreted as applying to the ASME material specification. Not all materials included in the material specifications in Section II have been adopted for Code use. Usage is limited to those materials and grades adopted by at least one of the other Sections of the Code for application under rules of that Section. All materials allowed

A95

by these various Sections and used for construction within the scope of their rules shall be furnished in accordance with material specifications contained in Section II or referenced in Appendices A of Section II, Parts A and B 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; Appendix A to Section II, Part A and Appendix A to Section II, Part B list editions of ASME and year dates of specifications that meet ASME requirements and which may be used in Code construction. Material produced to an acceptable specification with requirements different from the requirements of the corresponding specifications listed in*

Appendix A of Part A or Part B may also be used in accordance with the above, provided the material manufacturer or vessel manufacturer certifies with evidence acceptable to the Authorized Inspector that the corresponding requirements of specifications listed in Appendix A of Part A or Part B have been met. *Material produced to an acceptable 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.

Publication of the SI (Metric) Edition of the ASME Boiler and Pressure Vessel Code was discontinued with the 1986 Edition. Effective October 1, 1986, the SI Edition was withdrawn as an ASME Boiler and Pressure Vessel Code document.

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.

The ASME logo, which is the cloverleaf with the letters ASME within, shall not be used by any organization other than ASME.

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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As of July 1, 1996

A95
A96

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J. R. Barbee	M. J. Meyer
C. G. Beckham	L. C. Oakes
B. H. Berg	R. F. Perrin
G. Deily	U. Potapovs
K. Ennis	D. E. Tanner
G. S. Korin	G. M. Tolson

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B. H. Berg	R. F. Perrin
G. Deily	B. B. Scott
K. Ennis	G. M. Tolson

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C. W. Bruny	J. R. Santangelo
J. R. Cole	G. C. Slagis
R. P. Deubler	J. D. Stevenson
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H. D. Hanrath	R. Wray
R. W. Haupt	

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Y. Asada	

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R. D. Blevins	R. F. Perry
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P.-Y. Chen	

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N. W. Edwards	W. Z. Novak
H. D. Hanrath	E. Pelling
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R. E. Nickell	S. Yukawa

Working Group on General Requirements (SG-NUPACK) (SC III)

K. Goldmann, <i>Chair</i>	C. R. Witt
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Working Group on Material (SG-NUPACK) (SC III)

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H. W. Lee	K. B. Sorenson
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A. C. Eberhardt	R. E. Shewmaker
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R. C. Biel	D. P. Kendall
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R. H. Hansen, *Chair*

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PREAMBLE

This Code covers rules for construction of power boilers,¹ electric boilers,² miniature boilers,³ 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 acceptance 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, installa-

tion, and testing of the boiler external piping are contained in ASME 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 and water columns.

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 for use external to itself.

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 and/or temperatures in excess of 250°F.

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1

A Detailed Contents Precedes Each Part, the Appendix, and the Forms

Foreword	v
Statements of Policy.....	ix
Personnel	xi
Preamble.....	xxiii
Part PG General Requirements for All Methods of Construction	1
Part PW Requirements for Boilers Fabricated by Welding.....	75
Part PR Requirements for Boilers Fabricated by Riveting.....	109
Part PB Requirements for Boilers Fabricated by Brazing	110.1
Part PWT Requirements for Watertube Boilers.....	111
Part PFT Requirements for Firetube Boilers	117
Part PFH Optional Requirements for Feedwater Heater (When Located Within Scope of Section I Rules)	141
Part PMB Requirements for Miniature Boilers	143
Part PEB Requirements for Electric Boilers	149
Part PVG Requirements for Organic Fluid Vaporizers	155
Appendix I Mandatory — Preparation of Technical Inquiries to the Boiler and Pressure Vessel Committee	161
Appendix Explanation of the Code Containing Matter Not Mandatory Unless Specifically Referred to in the Rules of the Code	165
Data Report Forms and Guides.....	209
SI Units	259
Index	263

PART PG

General

PG-1	Scope.....	5
PG-2	Service Limitations.....	5
PG-3	Referenced Standards.....	5

Materials

PG-5	General.....	5
PG-6	Plate.....	6
PG-7	Forgings.....	6
PG-8	Castings.....	6
PG-9	Pipes, Tubes, and Pressure Containing Parts.....	7
PG-10	Material Identified With or Produced to a Specification Not Permitted by This Section, and Material Not Fully Identified.....	8
PG-11	Miscellaneous Pressure Parts.....	10
PG-12	Gage Glass Body and Connector Materials.....	11
PG-13	Stays.....	11

Design

PG-16	General.....	11
PG-17	Fabrication by a Combination of Methods.....	12
PG-18	Hydrostatic Deformation Test.....	12
PG-21	Maximum Allowable Working Pressure.....	12
PG-22	Loadings.....	12
PG-23	Stress Values for Calculation Formulas.....	12
PG-25	Quality Factors for Steel Castings.....	13
PG-27	Cylindrical Components Under Internal Pressure.....	14
PG-29	Dished Heads.....	17
PG-30	Stayed Dished Heads.....	18
PG-31	Unstayed Flat Heads and Covers.....	18

Openings and Compensation

PG-32	Openings in Shells, Headers, and Heads.....	22
PG-33	Compensation Required for Openings in Shells and Formed Heads.....	26
PG-34	Flanged-in Openings in Formed Heads.....	27
PG-35	Compensation Required for Openings in Flat Heads.....	27
PG-36	Limits of Metal Available for Compensation.....	27
PG-37	Strength of Compensation.....	29
PG-38	Compensation for Multiple Openings.....	31
PG-39	Methods of Attachment of Pipe and Nozzle Necks to Vessel Walls.....	31
PG-42	General Requirements for Fittings, Flanges, and Valves.....	32

PG-43	Nozzle Neck Thickness	36
PG-44	Inspection Openings	36
PG-46	Stayed Surfaces	36
PG-47	Staybolts	37
PG-48	Location of Staybolts	38
PG-49	Dimensions of Staybolts	38
PG-52	Ligaments	38
PG-53	Ligaments	41
PG-55	Supports and Attachment Lugs	41
 Boiler External Piping and Boiler Proper Connections		
PG-58	Outlets and External Piping	41
PG-59	Application Requirements for the Boiler Proper	46
 Design and Application		
PG-60	Requirements for Miscellaneous Pipe, Valves, and Fittings	48
PG-61	Feedwater Supply	50
 Safety Valves and Safety Relief Valves		
PG-67	Boiler Safety Valve Requirements	51
PG-68	Superheater Safety Valve Requirements	55
PG-69	Certification of Capacity of Safety and Safety Relief Valves	55
PG-70	Capacity of Safety Valves	58
PG-71	Mounting	58
PG-72	Operation	59
PG-73	Minimum Requirements for Safety and Safety Relief Valves	59
 Fabrication		
PG-75	General	61
PG-76	Cutting Plates and Other Stock	61
PG-77	Plate Identification	61
PG-78	Repairs of Defects in Materials	62
PG-79	Tube Holes and Ends	62
PG-80	Permissible Out-of-Roundness of Cylindrical Shells	62
PG-81	Tolerance for Formed Heads	62
PG-82	Holes for Stays	63
 Inspection and Tests		
PG-90	General	63
PG-91	Qualification of Inspectors	64
PG-99	Hydrostatic Test	64
PG-100	Hydrostatic Deformation Test	65
 Certification by Stamping and Data Reports		
PG-101	Heating Surface Computation	65
PG-104	General	65
PG-105	Code Symbol Stamps	65
PG-106	Stamping of Boilers	68
PG-107	Field Assembly	69

PG-108	Stamping for Field Assembled Boilers	70
PG-109	Stamping of Pressure Piping	70
PG-110	Stamping of Safety Valves	70
PG-111	Location of Stampings	71
PG-112	Manufacturers' Data Report Forms	71
PG-113	Master Data Report Form	72
Figures		
PG-31	Some Acceptable Types of Unstayed Flat Heads and Covers	21
PG-32	Chart Showing Limits of Sizes of Openings With Inherent Compensation in Cylindrical Shells	23
PG-33	Chart for Determining Value of F	26
PG-36	Limits of Reinforcement for Typical Openings	28
PG-36.4	Some Representative Configurations Describing the t_r Reinforcement Dimension	30
PG-38	Illustrations of the Rule Given in PG-38.4	31
PG-42.1	Welding End Transitions Maximum Envelope	34
PG-42.2	Typical Acceptable Weld Grooves for Attachment of Flanges Larger Than 4 in. Nominal Pipe Size	36
PG-46.2	Acceptable Proportions for Ends of Through-Stays	37
PG-52.1	Diagram for Determining the Efficiency of Longitudinal and Diagonal Ligaments Between Openings in Cylindrical Shells	39
PG-52.2	Example of Tube Spacing With Pitch of Holes Equal in Every Row	40
PG-52.3	Example of Tube Spacing With Pitch of Holes Unequal in Every Second Row	40
PG-52.4	Example of Tube Spacing With Pitch of Holes Varying in Every Second and Third Row	40
PG-52.5	Example of Tube Spacing With Tube Holes on Diagonal Lines	40
PG-52.6	Diagram for Determining Equivalent Longitudinal Efficiency of Diagonal Ligaments Between Openings in Cylindrical Shells	42
PG-58.3.1	Code Jurisdictional Limits for Piping — Drum Type Boilers	44
PG-58.3.2	Code Jurisdictional Limits for Piping — Forced-Flow Steam Generator With No Fixed Steam or Waterline	45
PG-59.1	Typical Boiler Bushings	47
PG-60	Typical Arrangement of Steam and Water Connections for a Water Column	50
PG-67.4	Requirements for Pressure Relief Forced-Flow Steam Generator	53
PG-80	Maximum Permissible Deviation From a Circular Form e for Cylindrical Parts Under External Pressure	63
PG-105.1	Official Symbols for Stamps to Denote The American Society of Mechanical Engineers' Standard for Boilers	66
PG-105.2	Official Symbol for Stamp to Denote The American Society of Mechanical Engineers' Standard for Assembly	66
PG-105.3	Official Symbol for Stamp to Denote The American Society of Mechanical Engineers' Standard for Welded Piping	66
PG-105.4	Official Symbol for Stamp to Denote The American Society of Mechanical Engineers' Standard for Safety Valves	66
PG-106	Form of Stamping	68
Table		
PG-39	Minimum Number of Threads per Connection	32

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

PG-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;
- (b) high-temperature water boilers intended for operation at pressures exceeding 160 psig and/or temperatures exceeding 250°F.

PG-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.

PG-2.3 Coil-type hot water boilers where the water can flash into steam when released directly to the atmosphere through a manually operated nozzle may be exempted from the rules of this Section provided the following conditions are met.

- (a) There is no drum, header, or other steam space.
- (b) No steam is generated within the coil.
- (c) Tubing outside diameter does not exceed 1 in.
- (d) Pipe size does not exceed NPS $\frac{3}{4}$.
- (e) Nominal water capacity does not exceed 6 gal.
- (f) Water temperature does not exceed 350°F.
- (g) Adequate safety relief valves and controls are provided.

PG-3 REFERENCED STANDARDS

Specific editions of standards referenced in this Section are shown in Appendix A-360.

MATERIALS

PG-5 GENERAL

PG-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 the Tables of Section II, Part D, 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 limited, for Section I construction, in the Tables of Section II, Part D. Specific additional requirements¹ described in PG-5 through PG-13 shall be met as applicable.

PG-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.

PG-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.

¹ For 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.

PG-5.4 Materials outside the limits of size or thickness given in the title or scope clause of any specification in Section II may be used if the material is in compliance with the other requirements of the specification, and no similar limitation is given in the rules for construction.

PG-6 PLATE

A96 PG-6.1 Steel plates for any part of a boiler subject to pressure, whether or not exposed to the fire or products of combustion, shall be of pressure vessel quality in accordance with one of the following specifications:

- SA-202 Pressure Vessel Plates, Alloy Steel, Chromium-Manganese-Silicon
- SA-203 Pressure Vessel Plates, Alloy Steel, Nickel
- SA-204 Pressure Vessel Plates, Alloy Steel, Molybdenum
- SA-240 (Type 405 only) Pressure Vessel Plates, Alloy Steel (Ferritic Stainless), Chromium
- SA-285 Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
- SA-299 Pressure Vessel Plates, Carbon Steel, Manganese-Silicon
- SA-302 Pressure Vessel Plates, Alloy Steel, Manganese-Molybdenum and Manganese-Molybdenum-Nickel
- SA-387 Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum
- SA-515 Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
- SA-516 Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

PG-7 FORGINGS

PG-7.1 Seamless steel drum forgings made in accordance with SA-266 for Carbon-Steel and SA-336 for Alloy Steel may be used for any part of a boiler for which pressure vessel quality is specified or permitted.

PG-7.2 Forged flanges, fittings, nozzles, valves, and other pressure parts of the boiler shall be of material that conforms to one of the forging specifications as listed in PG-9.

PG-7.3 Drums, shells, or domes may be of seamless drawn construction, with or without integral heads, provided the material conforms to the requirements of the Code for shell material.

PG-8 CASTINGS

PG-8.1 Except for the limited usage permitted by PG-8.2 and PG-8.3, cast material used in the construction of vessels and vessel parts shall conform to one of the specifications listed in PG-9 for which maximum allowable stress values are given in Tables 1A and 1B of Section II, Part D. The allowable stress values shall be multiplied by the applicable casting quality factor given in PG-25 for all cast materials except cast iron.

When cast iron is used as allowed in PG-11.1 for standard pressure parts, it shall conform to one of these standards:

ANSI B16.1-1967, Cast Iron Pipe Flanges and Flanged Fittings 25, 125, 250, and 800 lb²

ANSI B16.4-1971, Cast Iron Threaded Fittings, 125 and 250 lb

Material conforming to ASTM A 126-73 may be used subject to all requirements of the particular standard. Such usage is subject also to all the requirements for the use of cast iron given in PG-8.2 and other paragraphs of this Section.

PG-8.2 Cast Iron

PG-8.2.1 Cast iron shall not be used for nozzles or flanges attached directly to the boiler for any pressure or temperature.

PG-8.2.2 Cast iron as designated in SA-278, Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F may be used for boiler and superheater connections under pressure, such as pipe fittings, water columns, valves and their bonnets, for pressures up to 250 psi, provided the steam temperature does not exceed 450°F.

PG-8.3 Cast Nodular Iron. Cast nodular iron as designated in SA-395 may be used for boiler and superheater connections under pressure, such as pipe fittings, water columns, and valves and their bonnets, for pressures not to exceed 350 psi, provided the steam temperature does not exceed 450°F.

PG-8.4 Nonferrous. Bronze castings shall conform to SB-61 and SB-62 and may be used only for the following:

PG-8.4.1 For flanges and flanged or screwed fittings complying with the pressure and temperature requirements of ANSI B16.15-1971 or B16.24-1971, except that such fittings shall not be used where steel or other material is specifically required. Screwed fittings shall not be used where flanged types are specified.

² Classes 25 and 800 are not applicable to Section I.

PG-8.4.2.1 For valves at allowable stress values not to exceed those given in Table 1B of Section II, Part D, with maximum allowable temperatures of 550°F for SB-61 and 406°F for SB-62.

PG-8.4.2.2 For parts of safety valves or safety relief valves subject to limitations of PG-67.7.

PG-9 PIPES, TUBES, AND PRESSURE CONTAINING PARTS

Pipes, tubes, and pressure containing parts used in boilers shall conform to one of the specifications listed in this paragraph for which maximum allowable stresses are given in Tables 1A and 1B of Section II, Part D. The stress values given in these tables include the applicable joint efficiency factor for welded pipes and tubes.

Open-hearth, electric furnace, or basic oxygen steel shall be used for boiler pressure parts exposed to the fire or products of combustion. When used for internal pressure, the material stress and dimensions shall meet the appropriate requirements of PG-27 and Part PW and be in accordance with the following:

PG-9.1 Boiler parts shall be of the following specifications only:

- SA-53 Welded and Seamless Steel Pipe (excluding galvanized)
- SA-105 Forgings, Carbon Steel, for Piping Components
- SA-106 Seamless Carbon Steel Pipe for High-Temperature Service
- SA-178 Electric-Resistance-Welded Carbon Steel Boiler Tubes
- SA-181 Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for General Service
- SA-182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service (ferritic only)
- SA-192 Seamless Carbon Steel Boiler Tubes for High Pressure Service
- SA-209 Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes
- SA-210 Seamless Medium Carbon Steel Boiler and Superheater Tubes
- SA-213 Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater and Heat Exchanger Tubes (ferritic only)
- SA-216 Carbon Steel Castings Suitable for Fusion Welding for High-Temperature Service
- SA-217 Alloy-Steel Castings for Pressure-Containing Parts Suitable for High-Temperature Service

SA-226 Electric-Resistance-Welded Carbon Steel Boiler and Superheater Tubes for High-Pressure Service

SA-234 Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

SA-250 Electric-Resistance-Welded Carbon-Molybdenum Alloy Steel Boiler and Superheater Tubes

SA-266 Carbon Steel Seamless Drum Forgings

SA-268 Seamless and Welded Ferritic Stainless Steel Tubing for General Service

SA-335 Seamless Ferritic Alloy Steel Pipe for High-Temperature Service

SA-336 Alloy Steel Seamless Drum Forgings (ferritic only)

SA-423 Seamless and Electric Welded Low Alloy Steel Tubes

SA-660 Centrifugally Cast Carbon Steel Pipe for High-Temperature Service

PG-9.2 Superheater parts shall be of any one of the above specifications or one of the following:

SA-182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Plates for High-Temperature Service

SA-213 Seamless Ferritic and Austenitic Alloy Steel Boiler, Superheater and Heat Exchanger Tubes

SA-240 Stainless and Heat-Resisting Chromium and Chromium-Nickel Steel Plates, Sheet and Strip for Fusion-Welded Unfired Pressure Vessels

SA-249 Welded Austenitic Steel Boiler, Superheater, Heat Exchanger, and Condenser Tubes

SA-268 Seamless and Welded Ferritic Stainless Steel Tubing for General Service

SA-312 Seamless and Welded Austenitic Stainless Steel Pipe

SA-336 Alloy Steel Seamless Drum Forgings

SA-351 Ferritic and Austenitic Steel Castings for High-Temperature Service

SA-369 Ferritic Alloy Steel Forged and Bored Pipe for High-Temperature Service

SA-376 Seamless Austenitic Steel Pipe for High-Temperature Central-Station Service

SB-407 Nickel-Iron-Chromium Alloy Seamless Pipe and Tube

SB-408 Nickel-Iron-Chromium Alloy Rod and Bar

SB-409 Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip

SB-423 Nickel-Iron-Chromium-Molybdenum Seamless Pipe and Tube

SB-424 Nickel-Iron-Chromium-Molybdenum-Copper Alloy Plate, Sheet, and Strip

SB-425 Nickel-Iron-Chromium-Molybdenum-Copper Alloy Rod and Bar

SA-430 Austenitic Steel Forged and Bored Pipe for High-Temperature Service
 SA-479 Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
 SB-515 Welded Nickel-Iron-Chromium Alloy Tubes

PG-9.3 Except for the nonferrous materials listed in PG-9.2, nonferrous pipe or tubes shall not be used in the boiler proper for any service where the temperature exceeds 406°F. Where permitted, copper and copper alloys shall be seamless, having a thickness not less than ANSI Schedule 40 standard pipe, and shall comply to one of the following specifications: SB-42, Seamless Copper Pipe, Standard Sizes; SB-43, Seamless Red Brass Pipe, Standard Sizes; SB-75, Seamless Copper Tube; or SB-111, Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock.

PG-9.4 Bimetallic tubes, having a core of an acceptable boiler and superheater material, and having an external cladding of another metal alloy, may be used provided the requirements of PG-27.2.1.5 are met for establishing minimum thickness of the core. The permissible variation in wall thickness tolerance of SA-450 or SB-163, as applicable, shall apply to the total wall thickness. The thickness and over and undertolerances of the cladding shall be included in the ordering information. Marking of the bimetallic tubular product shall meet the specification requirements of the core material, but shall also suitably identify the cladding alloy.

PG-10 MATERIAL IDENTIFIED WITH OR PRODUCED TO A SPECIFICATION NOT PERMITTED BY THIS SECTION, AND MATERIAL NOT FULLY IDENTIFIED

PG-10.1 Identified With Complete Certification From the Material Manufacturer. Material identified with a specification not permitted by this Section, or material procured to chemical composition requirements and identified to a single production lot as required by a permitted specification may be accepted as satisfying the requirements of a specification permitted by this Section provided the conditions set forth in PG-10.1.1 or PG-10.1.2 are satisfied.

PG-10.1.1 Recertification by an organization other than the boiler or part manufacturer:

PG-10.1.1.1 All requirements, including but not limited to, melting method, melting practice, deoxidation, quality, and heat treatment, of the specification

permitted by this Section, to which the material is to be recertified, have been demonstrated to have been met.

PG-10.1.1.2 A copy of the certification by the material manufacturer of the chemical analysis required by the permitted specification, with documentation showing the requirements to which the material was produced and purchased, and which demonstrates that there is no conflict with the requirements of the permitted specification, has been furnished to the boiler or part manufacturer.

PG-10.1.1.3 A certification that the material was manufactured and tested in accordance with the requirements of the specification to which the material is recertified, excluding the specific marking requirements, has been furnished to the boiler or part manufacturer, together with copies of all documents and test reports pertinent to the demonstration of conformance to the requirements of the permitted specification.

PG-10.1.1.4 The material, and the Certificate of Compliance or the Material Test Report have been identified with the designation of the specification to which the material is recertified and with the notation "Certified per PG-10."

PG-10.1.2 Recertification by the boiler or part manufacturer:

PG-10.1.2.1 A copy of the certification by the material manufacturer of the chemical analysis required by the permitted specification, with documentation showing the requirements to which the material was produced and purchased, which demonstrates that there is no conflict with the requirements of the permitted specification, is available to the Inspector.

PG-10.1.2.2 For applications in which the maximum allowable stresses are subject to a note of Table 1A of Section II, Part D, requiring the use of killed steel, documentation is available to the Inspector which establishes that the material is a killed steel.

PG-10.1.2.3 Documentation is available to the Inspector which demonstrates that the metallurgical structure, mechanical property, and hardness requirements of the permitted specification have been met.

PG-10.1.2.4 For material recertified to a permitted specification which requires a fine austenitic grain size or which requires that a fine grain practice be used during melting, documentation is available to the Inspector which demonstrates that the heat treatment requirements of the permitted specification have been met, or will be met during fabrication.

PG-10.1.2.5 The material has marking, acceptable to the Inspector, for identification to the documentation.

PG-10.1.2.6 When the conformance of the material with the permitted specification has been established, the material has been marked as required by the permitted specification.

PG-10.2 Material Identified to a Particular Production Lot as Required by a Specification Permitted by This Section but Which Cannot Be Qualified Under PG-10.1. Any material identified to a particular production lot as required by a specification permitted by this Section, but for which the documentation required in PG-10.1 is not available, may be accepted as satisfying the requirements of the specification permitted by this Section provided that the conditions set forth below are satisfied.

PG-10.2.1 Recertification by an organization other than the boiler or part manufacturer — not permitted.

PG-10.2.2 Recertification by the boiler or part manufacturer.

PG-10.2.2.1 Chemical analyses are made on different pieces from the lot to establish a mean analysis which is to be accepted as representative of the lot. The pieces chosen for analyses shall be selected at random from the lot. The number of pieces selected shall be at least 10% of the number of pieces in the lot, but not less than three. For lots of three pieces or less, each piece shall be analyzed. Each individual analysis in the permitted specification and the mean for each element shall conform to the heat analysis limits of that specification. Analyses need to be made for only those elements required by the permitted specification. However, consideration should be given to making analyses for elements not specified in the specification but which would be deleterious if present in excessive amounts.

PG-10.2.2.2 Mechanical property tests are made in accordance with the requirements of the permitted specification and the results of the tests conform to the specified requirements.

PG-10.2.2.3 For applications in which the maximum allowable stresses are subject to a note of Table 1A of Section II, Part D, requiring the use of killed steel, documentation is available to the Inspector which establishes that the material is a killed steel.

PG-10.2.2.4 When the requirements of the permitted specification include metallurgical structure re-

quirements (i.e., fine austenitic grain size), tests are made and the results are sufficient to establish that those requirements of the specification have been met.

PG-10.2.2.5 When the requirements of the permitted specification include heat treatment, the material is heat treated in accordance with those requirements, either prior to or during fabrication.

PG-10.2.2.6 When the conformance of the material with the permitted specification has been established, the material has been marked as required by the permitted specification.

PG-10.3 Material Not Fully Identified. Material which cannot be qualified under the provisions of either PG-10.1 or PG-10.2, such as material not fully identified as required by the permitted specification or as unidentified material, may be accepted as satisfying the requirements of a specification permitted by this Section provided that the conditions set forth below are satisfied.

PG-10.3.1 Qualification by an organization other than the boiler or part manufacturer — not permitted.

PG-10.3.2 Qualification by the boiler or part manufacturer:

PG-10.3.2.1 Each piece is tested to show that it meets the chemical composition for product analysis and the mechanical properties requirements of the permitted specification. Chemical analyses need only be made for those elements required by the permitted specification. However, consideration shall be given to making analyses for elements not specified in the specification but which would be deleterious if present in excessive amounts. For plates, when the direction of final rolling is not known, both a transverse and a longitudinal tension test specimen shall be taken from each sampling location designated in the permitted specification. The results of both tests shall conform to the minimum requirements of the specification, but the tensile strength of only one of the two specimens need conform to the maximum requirement.

PG-10.3.2.2 The provisions of PG-10.2.2.3, PG-10.2.2.4, and PG-10.2.2.5 are met.

PG-10.3.2.3 When the identity of the material with the permitted specification has been established in accordance with PG-10.3.2.1 and PG-10.3.2.2, each piece (or bundle, etc., if permitted in the specification) is marked with a marking giving the permitted specification number and grade, type, or class as applicable and a serial number identifying the particular lot of material. A suitable report, clearly marked as being a "Report on

Tests of Nonidentified Material," shall be completed and certified by the boiler or part manufacturer. This report, when accepted by the Inspector, shall constitute authority to use the material in lieu of material procured to the requirements of the permitted specification.

PG-11 MISCELLANEOUS PRESSURE PARTS

Prefabricated or preformed pressure parts for boilers which are subject to allowable working stresses due to internal or external pressure in the boiler and which are furnished by other than the shop of the Manufacturer responsible for the completed boiler shall conform to all applicable requirements of the Code for the completed boiler, including inspection in the shop of the parts manufacturer and the furnishing of Manufacturer's Partial Data Reports as provided for in PG-112.2.4 except as permitted in PG-11.1, PG-11.2, and PG-11.3.

PG-11.1 Cast, Forged, Rolled, or Die Formed Standard Pressure Parts

PG-11.1.1 Pressure parts such as pipe fittings, valves, flanges, nozzles, welding necks, welding caps, manhole frames and covers, and casings of pumps that are part of a boiler circulating system that are wholly formed by casting, forging, rolling, or die forming shall not require inspection, mill test reports, or Partial Data Reports. Standard pressure parts which comply with some American National Standard³ shall be made of materials permitted by this Section or of materials specifically listed in an American National Standard product standard listed elsewhere in this Section but not of materials specifically prohibited or beyond use limitations listed in this Section. Standard pressure parts which comply with a manufacturer's standard^{4,5} shall be made of materials permitted by this Section. Such parts shall be marked with the name or trademark of the parts manufacturer and such other markings as are required by the standard. Such markings shall be considered as the parts manufacturer's certification that

³ These are pressure parts which comply with some American National Standard product standard accepted by reference in PG-42. The American National Standard product standard establishes the basis for the pressure-temperature rating and marking.

⁴ These are pressure parts which comply with a parts manufacturer's standard which defines the pressure-temperature rating marked on the part and described in the parts manufacturer's literature. The Manufacturer of the completed vessel shall satisfy himself that the part is suitable for the design conditions of the completed vessel.

⁵ Pressure parts may be in accordance with an American National Standard product standard not covered by footnote 3, but such parts shall satisfy the requirements applicable to a parts manufacturer's standard and footnote 4.

the product complies with the material specifications and standards indicated and is suitable for service at the rating indicated. The intent of the paragraph will have been met if, in lieu of the detailed marking on the part itself, the parts described herein have been marked in any permanent or temporary manner that will serve to identify the part with the parts manufacturer's written listing of the particular items and such listings are available for examination by the Inspector.

PG-11.1.2 Parts of small size falling within this category for which it is difficult or impossible to obtain identified material or which may be stocked and for which mill test reports or certificates cannot be economically obtained and are not customarily furnished, and which do not appreciably affect the safety of the vessel, may be used for relatively unimportant part or parts stressed to not more than 50% of the stress value permitted by this Section, and listed in Tables 1A and 1B of Section II, Part D, provided they are suitable for the purpose intended and meet the approval of the Inspector. The Manufacturer of the completed vessel shall satisfy himself that the part is suitable for the design conditions specified for the completed vessel.

PG-11.2 Cast, Forged, Rolled, or Die Formed Nonstandard Pressure Parts. Pressure parts such as shells, heads, removable and access opening cover plates, that are wholly formed by casting, forging, rolling, or die forming, may be supplied basically as materials. All such parts shall be made of materials permitted under this Section, and the manufacturer of the part shall furnish mill test reports or other acceptable evidence to that effect. Such parts shall be marked with the name or trademark of the parts manufacturer and with such other markings as will serve to identify the particular parts with accompanying material identification. The Manufacturer of the completed boiler shall satisfy himself that the part is suitable for the design conditions specified for the completed boiler.

PG-11.3 Welded Standard Pressure Parts for Use Other Than the Shell of a Vessel.⁶ Pressure parts such as welded standard pipe fittings, caps, valves, and flanges that are fabricated by one of the welding processes recognized by this Section shall not require inspection, mill test reports, or Manufacturers' Partial Data Reports provided.⁷

⁶ Fusion welded pipe for use as the shell of the vessel shall be subject to the same requirements as a shell fabricated from plate, including inspection at the point of manufacture and Manufacturers' Partial Data Reports.

⁷ For requirements for welded water columns, see PW-42.

PG-11.3.1 Standard pressure parts which comply with some American National Standard product standard³ shall be made of materials permitted by this Section or of materials specifically listed in an American National Standard product standard accepted and listed elsewhere in this Section but not of materials specifically prohibited or beyond use limitations listed in this Section. Standard pressure parts which comply with a manufacturer's standard^{4,5} shall be made of materials permitted by this Section.

PG-11.3.2 Welding for pressure parts which comply with a manufacturer's standard^{4,5} shall comply with the requirements of PW-26 through PW-39. Welding for pressure parts which comply with some American National Standard product standard³ shall comply with the requirements of PW-26 through PW-39 or, as a minimum, may comply with the welding requirements of ASTM A 234-75 which specifies "Fittings fabricated by welding shall be made by welders, welding operators, and welding procedures qualified under the provisions of ASME Section IX." Markings where applicable, or certification by the parts manufacturer where markings are not applicable shall be accepted as evidence of compliance with the above welding requirements. Such parts shall be marked as required by PG-11.1.1.

PG-11.3.3 If radiographic examination or heat treatment is required by the applicable rules of this Section, it may be performed either in the plant of the parts manufacturer or in the plant of the Manufacturer of the completed vessel.

If the radiographic examination is done under the control of the parts manufacturer, the completed radiographs, properly identified, with a radiographic inspection report, shall be forwarded to the vessel manufacturer and shall be available to the Authorized Inspector.

PG-11.3.4 If heat treatment is performed at the plant of the parts manufacturer, certification by the parts manufacturer that such treatment was performed shall be accepted as evidence of compliance with applicable Code paragraphs. This certification shall be available to the Authorized Inspector. The Manufacturer of the completed vessel shall satisfy himself that the part is suitable for the design conditions specified for the completed vessel.

PG-12 GAGE GLASS BODY AND CONNECTOR MATERIALS

Gage glass body and connector materials shall comply with a Manufacturer's standard which defines the pres-

sure-temperature rating marked on the unit. The materials used may include austenitic stainless steel.

PG-13 STAYS

Threaded stays shall be of steel complying with SA-36 or SA-675.

Seamless steel tubes for threaded stays shall comply with SA-192 or SA-210.

Staybolts, stays, through-rods, or stays with ends for attachment by fusion welding shall comply with SA-36 or SA-675.

DESIGN

PG-16 GENERAL

PG-16.1 The design of power boilers, high-temperature water boilers, and other pressure parts included within the scope of these rules shall conform to the general design requirements in the following paragraphs and in addition to the specific requirements for design given in the applicable Parts of this Section that pertain to the methods of construction used.

PG-16.2 When the pressure parts of a forced-flow steam generator with no fixed steam and waterline are designed for different pressure levels as permitted in PG-21.2, the owner shall provide or cause to be provided a boiler pressure system design diagram, certified by a Professional Engineer experienced in the mechanical design of power plants, which supplies the following information.

PG-16.2.1 The relative location of the various pressure parts within the scope of Section I, with respect to the path of water-steam flow.

PG-16.2.2 A line showing the expected maximum sustained pressure as described in PG-21.2, indicating the expected variation in pressure along the path of water-steam flow.

PG-16.2.3 The maximum allowable working pressure of the various pressure parts.

PG-16.2.4 The location and set pressure of the overpressure protection devices.

Copy of this diagram shall be attached to the Master Data Report per PG-113.

PG-16.3 Minimum Thicknesses. The minimum thickness of any boiler plate under pressure shall be $\frac{1}{4}$ in. except for electric boilers constructed under the rules of Part PEB. The minimum thickness of plates

A96

to which stays may be applied in other than cylindrical outer shell plates shall be $\frac{3}{16}$ in. When pipe over NPS 5 is used in lieu of plate for the shell of cylindrical components under pressure, its minimum wall shall be $\frac{1}{4}$ in.

PG-16.4 Undertolerance on Plates. Plate material that is not more than 0.01 in. thinner than that calculated from the formula may be used in Code constructions provided the material specification permits such plate to be furnished not more than 0.01 in. thinner than ordered.

PG-16.5 Undertolerance on Pipe and Tubes. Pipe or tube material shall not be ordered thinner than that calculated from the applicable formula of this Section. The ordered material shall include provision for the allowed manufacturing undertolerance as given in Section II in the applicable pipe or tube specification.

PG-17 FABRICATION BY A COMBINATION OF METHODS

A boiler and parts thereof may be designed and fabricated by a combination of the methods of fabrication given in this Section, provided the rules applying to the respective methods of fabrication are followed and the boiler is limited to the service permitted by the method of fabrication having the most restrictive requirements.

PG-18 HYDROSTATIC DEFORMATION TEST

Where no rules are given and it is impossible to calculate with a reasonable degree of accuracy the strength of a boiler structure or any part thereof, a full-sized sample shall be built by the Manufacturer and tested in accordance with the Standard Practice for Making a Hydrostatic Test on a Boiler Pressure Part to Determine the Maximum Allowable Working Pressure, given in A-22 or in such other manner as the Committee may prescribe.

PG-21 MAXIMUM ALLOWABLE WORKING PRESSURE

The maximum allowable working pressure is the pressure determined by employing the allowable stress values, design rules, and dimensions designated in this Section.

Whenever the term maximum allowable working pressure is used in this Section of the Code, it refers to gage pressure, or the pressure above atmosphere in pounds per square inch.

PG-21.1 No boiler, except a forced-flow steam generator with no fixed steam and water line that meets the special provisions of PG-67, shall be operated at a pressure higher than the maximum allowable working pressure except when the safety valve or safety relief valve or valves are discharging, at which time the maximum allowable working pressure shall not be exceeded by more than 6%.

PG-21.2 In a forced-flow steam generator with no fixed steam and waterline it is permissible to design the pressure parts for different pressure levels along the path of water-steam flow. The maximum allowable working pressure of any part shall be not less than that required by the rules of Part PG for the expected maximum sustained conditions⁸ of pressure and temperature to which that part is subjected except when one or more of the overpressure protection devices covered by PG-67.4 is in operation.

PG-22 LOADINGS

PG-22.1 Stresses due to hydrostatic head shall be taken into account in determining the minimum thickness required unless noted otherwise. Additional stresses imposed by effects other than working pressure or static head which increase the average stress by more than 10% of the allowable working stress shall also be taken into account. These effects include the weight of the component and its contents, and the method of support.

PG-22.2 Loading on structural attachments — refer to PW-43.

PG-23 STRESS VALUES FOR CALCULATION FORMULAS

PG-23.1 The maximum allowable stress values in Tables 1A and 1B of Section II, Part D, are the unit stresses to be used in the formulas of this Section to calculate the minimum required thickness or the maximum allowable working pressure of the pressure part (see Appendix 7 of Section II, Part D).

⁸ "Expected maximum sustained conditions of pressure and temperature" are intended to be selected sufficiently in excess of any expected operating conditions (not necessarily continuous) to permit satisfactory boiler operation without operation of the overpressure protection devices.